Hunter Ecology

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BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT

for the

Paling Yards Wind Farm

9 August 2023

CERTIFICATION

I, Lizzie Bowman of Hunter Ecology, hereby state that this Biodiversity Development Assessment Report (BDAR) for the Paling Yards Wind Farm, has been prepared in accordance with the Biodiversity Assessment Method (BAM) 2020 established under the NSW *Biodiversity Conservation Act 2016.* Fieldwork for this project was undertaken by Lizzie Bowman, Bart Schiebaan and Lorena Boyle. Report writing was undertaken by Lizzie Bowman and Lucinda Casey. Qualifications are provided below.

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Conflicts of Interest

The Accredited Assessors have signed an agreement to abide by the Accredited BAM Assessor Code of Conduct. The authors declare in accordance with the Assessors Code of Conduct that no actual, perceived, or potential conflicts of interest exist.

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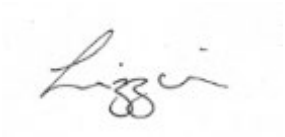

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TERMS & ABBREVIATIONS

Assessment area – the area that includes the subject site and a 1.5 km buffer surrounding the subject site.

BAM – Biodiversity Assessment Method 2020

BAM-C – BAM Calculator

BC Act – NSW *Biodiversity Conservation Act 2016*

BC Regulation – *Biodiversity Conservation Regulation 2017*

BDAR – Biodiversity Development Assessment Report

BioNet – NSW Atlas of NSW Wildlife.

BioNet VIS – NSW BioNet Vegetation Information System

BOS – Biodiversity Offset Scheme

Canopy – The tallest woody stratum present.

CEEC – Critically endangered ecological community

Connectivity – The measure of the degree to which an area of native vegetation is linked with other areas of native vegetation.

Cumulative impacts – the combined incremental effects of past, present and anticipated future actions within a regional setting.

DAWE – Commonwealth Department of Agriculture, Water and the Environment.

DEC – NSW Department of Environment and Conservation

DECC – Department of Environment & Climate Change

DCP – Development Control Plan

Direct impacts – Impacts that directly affect the habitat of species and ecological communities and of individuals using the study area.

DoE – Commonwealth Department of Environment

EES – NSW Energy, Environment & Science

EP&A Act – NSW *Environmental Planning and Assessment Act 1979*

EPBC Act – Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

Ground Cover – Vegetation generally below 1 m in height.

Ha – Hectare.

Habitat – An area or areas occupied, or periodically or occasionally occupied, by a species or ecological community, including any biotic or abiotic component.

HBT – Hollow-bearing tree

IBRA – Interim Biogeographic Regionalisation for Australia.

Indirect impacts – Impacts which occur when project-related activities affect species or ecological communities in a manner other than direct loss within the study area. Indirect impacts may sterilise or reduce the habitability of adjacent or connected habitats. Indirect impacts can include loss of individuals through starvation, exposure, predation by domestic and/or feral animals, loss of breeding opportunities, loss of shade/shelter, reduction in viability of adjacent habitat due to edge effects, deleterious hydrological changes, increased soil salinity, erosion, inhibition of nitrogen fixation, weed invasion, noise, light spill, fertiliser drift, or increased human activity within or directly adjacent to sensitive habitat areas.

Intact vegetation – Vegetation where all tree, shrub, grass and/or forb structural growth form groups expected for a plant community type are present.

LEP – Local Environment Plan

Locality – the database search area encompassing a 10 km radius from the study area.

Mid-storey – All vegetation between the over-storey stratum and a height of 1 m (typically tall shrubs, under-storey trees and tree regeneration).

Mitchell Landscape – Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000.

MU – Map unit

NPWS – National Parks & Wildlife Service

OEH – Office of Environment & Heritage

PCT – Plant community type, identified using the PCT classification system described in the BioNet Vegetation Classification.

Prescribed Impacts - Impacts on biodiversity values which are not related to, or are in addition to, native vegetation clearing and habitat loss. Prescribed impacts are specified in Section 6.1 of the *Biodiversity Conservation Regulation 2017*.

SEPP – State Environmental Planning Policy

Study area – the surveyed area of the site.

Subject Site – the area directly affected by the proposal, as shown in Figure 1-1 of this report. The Subject Site includes the footprint of the development and any ancillary works, facilities, accesses, or hazard reduction zones that support the construction or operation of the development or activity.

TEC – Threatened ecological community, listed as critically endangered, endangered or vulnerable in Schedule 2 of the BC Act, or any such listed communities under the EPBC Act.

Threatened species – Critically endangered, endangered or vulnerable species as defined by Schedule 1 of the BC Act, or any such listed species under the EPBC Act.

VZ – Vegetation Zone

WM Act – NSW *Water Management Act 2000*

EXECUTIVE SUMMARY

Hunter Ecology has been contracted by ERM to prepare a Biodiversity Development Assessment Report (BDAR) for the Paling Yards Wind Farm ('the Project'), south of Oberon, NSW Central Tablelands, in the Oberon local government area (LGA). The Project is to be assessed under Part 5 of the EP&A Act and this BDAR is required as part of the Environmental Impact Statement (EIS). The wind farm infrastructure would be located across several properties in the Paling Yards area. This assessment focuses on the portion of these properties on which the wind farm infrastructure would be aligned, as well as a 50 m buffer around the proposed alignment. These areas are collectively referred to as 'the Subject Site' or the 'Survey Area'. This BDAR has been prepared in accordance with the Office of Environment and Heritage (OEH) (2020) Biodiversity Assessment Method (BAM).

The Project would involve:

- Up to forty-seven wind turbine generator (WTG) locations, with an estimated capacity of 6.1 megawatts (MW) each. The maximum tip height would be 240 m.
- Corresponding individual kiosks (which would be contained with the WTGs) for the housing of transformers, switch gear and associated control systems.
- Three meteorological monitoring masts, fitted with anemometers, wind vanes, temperature gauges and other electrical equipment.
- Wind farm and substation control room and facilities building.
- Obstacle lighting to selected turbines (if deemed necessary).
- Onsite electrical substations and ancillary infrastructure, including approximately 9 km of overhead transmission line (with total easement measuring 70m in width) of up to 500 kV (including control room and other associated grid connection facilities).
- Underground electrical and communication cable network, linking turbines to each other and the proposed onsite electrical substation.
- Removal of native vegetation and additional vegetation planting to provide screening.
- Upgrades to existing local road infrastructure, including several access points from Abercrombie Road, and establishment of internal unsealed tracks for access to turbines and infrastructure.
- Temporary batching plant to supply concrete during the construction phase.

Activities to be undertaken during construction works include:

- Bulk earthworks, including vegetation removal, earthworks and site regrading.
- Construction of the infrastructure listed above.

Six Plant Community Types (PCTs) were identified within Survey Area (which included the construction footprint and a 50 m buffer around that), as summarised in the following table.

PCTs and VZs

Plant Community Type	Vegetation Zone	TEC – BC Act	TEC – EPBC Act	Area within Survey Area	Area within Construction Footprint
PCT 85 River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion	**85_1**	No	No	4.69 ha	1.73 ha
PCT 649 Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion	**649_1**	No	No	15.3 ha	5.57 ha
PCT 654 Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion	**654_1**	Yes	No	2.39 ha	1.95 ha
PCT 727 Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion	**727_1**	No	No	10.2 ha	7.53 ha
	727_2	No	No	2.79 ha	1.25 ha
	727_3	No	No	12.99 ha	7.38 ha
PCT 951 Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion	**951_1**	Yes	No	0.5 ha	0.5 ha
	951_2	Yes	No	7.61 ha	2.34 ha
PCT 1093 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion	**1093_1**	No	No	9.19 ha	3.45 ha

The Subject Site was found to contain suitable habitat for several ecosystem credit species. Targeted surveys were undertaken for confirmed candidate species credit species. One species credit species were confirmed present, being breeding *Callocephalon fimbriatum* (Gang-gang Cockatoo).

Effort has been undertaken to ensure that the Project complies with the avoidance and minimisation requirements under the BOS. Considerations of landscape features, ecological values and social factors were all involved in early consultation activities. This was used to inform the design of the preliminary Project layout and since then, the layout has had several modifications to reduce the area of vegetation clearing and to avoid, where possible, important habitat features such as hollow-bearing trees (as documented in the BDAR). Impacts will be further avoided and minimised through several measures, designed to protect retained vegetation and habitat during both the construction and operational stages of the Project.

The principal of adaptive management has also been addressed. A key component of the Project's adaptive management measures includes the development and implementation of a Bird and Bat Adaptive Management Plan (BBAMP) to address uncertainties around the ongoing impact of collision and barotrauma related mortalities. The BBAMP will outline monitoring measures, key thresholds for determining permissible impacts and corrective actions that are required to achieve the BBMP objectives (which are essentially to minimise impacts on birds and bats during the operational phase).

Two potential Serious And Irreversible Impact (SAII) entities are identified as being associated with the Project. These include the following TECs:

- 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.
- Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions.

Information has been provided in the BDAR to support the decision maker to determine if the impacts constitute a SAII, although it was found that SAII on these entities would be unlikely.

An assessment of direct, indirect and prescribed impacts was undertaken, and several mitigation measures have been proposed to address any unavoidable impacts.

The following biodiversity credits are required to offset the Project.

Ecosystem Credits Required to Offset the Project

PCT	VZ	Area	No. of Ecosystem Credits Required
PCT 85 River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion	**85_1**	1.73 ha	41
PCT 649 Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion	**649_1**	5.57 ha	100
PCT 654 Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion	**654_1**	1.95 ha	24
PCT 727 Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion	**727_1**	7.53 ha	206
	727_2	1.25 ha	19
	727_3	7.38 ha	0
PCT 951 Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion	**951_1**	0.5 ha	14
	951_2	2.34 ha	49
PCT 1093 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion	**1093_1**	3.45 ha	78

Species Credits Required to Offset the Project

Species	VZ	Area	No. of Species Credits Required
Callocephalon fimbriatum Gang-gang Cockatoo	727_1	4.2 ha	131
	951_1	0.4 ha	12

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1. INTRODUCTION

1.1 Purpose

Hunter Ecology has been contracted by ERM to prepare a Biodiversity Development Assessment Report (BDAR) for the Paling Yards Wind Farm ('the Project'), south of Oberon, NSW Central Tablelands, in the Oberon local government area (LGA). The Project is to be assessed under Part 5 of the EP&A Act and this BDAR is required as part of the Environmental Impact Statement (EIS). The wind farm infrastructure would be located across several properties in the Paling Yards area. This assessment focuses on the portion of these properties on which the wind farm infrastructure would be aligned, as well as a 50 m buffer around the proposed alignment. These areas are collectively referred to as 'the Subject Site' or the 'Survey Area'. This BDAR has been prepared in accordance with the Office of Environment and Heritage (OEH) (2020) Biodiversity Assessment Method (BAM).

1.2 Scope

Section 1 of this BDAR identifies and describes the Subject Site and Project (including the construction and operational footprint) and lists the sources of information used for the assessment.

Sections 2, 3, 4 & 5 of this BSSAR address Stage 1 of the BAM and provide an assessment of the biodiversity values of the site by identifying:

- Landscape features and site context of the Subject Site in accordance with Chapter 4 of the BAM;
- Presence of threatened ecological communities (TECs), plant community types (PCTs), and the condition (vegetation integrity) of native vegetation in the Subject Site in accordance with Chapter 5 of the BAM;
- Habitat suitability for threatened species on the Subject Site in accordance with Chapter 6 of the BAM; and
- Potential prescribed biodiversity impacts on threatened entities.

Sections 6, 7, 8 & 9 of this BDAR address Stage 2 of the BAM and provide an assessment of the impacts on biodiversity values, as follows:

- Demonstration of efforts to avoid and minimise impacts on biodiversity values (including prescribed impacts) associated with the project location in accordance with Chapter 7 of the BAM;
- Determination of the impacts on native vegetation and threatened species habitat, including a description of direct, indirect and prescribed impacts on native vegetation, threatened ecological communities, threatened species and threatened species habitat;
- Identification of measures to mitigate or manage impacts in accordance with the recommendations in BAM Sections 8.4 and 8.5;
- Details of the adaptive management strategy proposed to monitor and respond to impacts on biodiversity values that are uncertain (BAM Section 8.5);

- Identification and assessment of impacts on TECs and threatened species that are at risk of a serious and irreversible impacts (SAII, in accordance with BAM Section 9.1);
- Identification of impacts requiring offset in accordance with BAM Section 9.2;
- Identification of impacts not requiring offset in accordance with BAM Subsection 9.2.1(3.);
- Identification of areas not requiring assessment in accordance with BAM Section 9.3;
- Identification on the ecosystem credits and species credits that measure the impact of the development on biodiversity values; and
- Description of credit classes for ecosystem credits and species credits at the development or clearing site.

1.3 Project Background

The objectives of the Project are to provide up to 900,000 megawatt hours (MWh) of renewable energy and to displace up to 900,000 tonnes of greenhouse gases per annum. The scope of the Project includes the following:

- Up to forty-seven wind turbine generator (WTG) locations, with an estimated capacity of 6.1 megawatts (MW) each. The maximum tip height would be 240 m. See **Table 1-1** for WTG specifications.
- Corresponding individual kiosks (which would be contained with the WTGs) for the housing of transformers, switch gear and associated control systems.
- Three meteorological monitoring masts, fitted with anemometers, wind vanes, temperature gauges and other electrical equipment.
- Wind farm and substation control room and facilities building.
- Obstacle lighting to selected turbines (if deemed necessary).
- Onsite electrical substations and ancillary infrastructure, including approximately 9 km of overhead transmission line (with total easement measuring 70m in width) of up to 500 kV (including control room and other associated grid connection facilities). See **Table 1-2** for transmission line specifications.
- Underground electrical and communication cable network, linking turbines to each other and the proposed onsite electrical substation.
- Removal of native vegetation and additional vegetation planting to provide screening.
- Upgrades to existing local road infrastructure, including several access points from Abercrombie Road, and establishment of internal unsealed tracks for access to turbines and infrastructure.
- Temporary batching plant to supply concrete during the construction phase.

The construction timeframe would be twenty-two months. Activities to be undertaken during construction works include:

- Bulk earthworks, including vegetation removal, earthworks and site regrading.
- Construction of the infrastructure listed above.

Figure 1-1 indicates the Project layout.

Table 1-1: Wind Turbine Specifications

Selected turbine model	General Electric Cypress 158-6.1 MW turbine (50/60 Hz) (tubular steel tower).
Output	Estimated at 6.1 MW per turbine, with a total generation capacity estimated at 287 MW.
Number of turbines	Up to 47.
Maximum blade tip height	Maximum of up to 240 m (above NGL).
Hub height	151 m (above NGL).
Maximum blade length	Three blades 77.4 m each.
Rotor diameter	158 m
Maximum cord	4 m
Swept area	19,607 m²
Operational life	30 years. Hours of operation will be 24/7.

Table 1-2: Transmission Line Specifications

Corridor	Approximately 9 km long with a 70 m wide easement.
Poles	200-250 m apart. Not to be located closer than 40 m to any watercourse, except where first-order minor streams are identified as per the *Water Management Act 2000*.
Connection Point	Mt Piper / Bannaby 500 kV transmission line, to the north-east of the site.

1.4 Subject Site Overview

The wind farm infrastructure would be located across three separate land holdings over approximately 4,600 hectares (ha) referred to as 'Mingary Park', 'Paling Yards' and 'Middle Station' and 'Hilltop'. This assessment focuses on the portion of these properties on which the wind farm infrastructure would be aligned, as well as a 50 m buffer around the proposed alignment. These areas are collectively referred to as 'the Subject Site' or the 'Survey Area'. See **Table 1-3** for a Subject Site overview.

Table 1-3: Overview of the Subject Site

Involved Lots – Lot/DP and Site Address	- Lot 1-4 / DP 753019 (7056 Abercrombie Road Paling Yards 2580) - Lot 30-32 / DP 753019 (7056 Abercrombie Road Paling Yards 2580) - Lot 1 / DP 753037 (7056 Abercrombie Road Paling Yards 2580) - Lot 2 / DP 753037 (6466 Abercrombie Road Paling Yards 2580) - Lot 5 / DP 753037 (7056 Abercrombie Road Paling Yards 2580) - Lot 6 / DP 753037 (6335 Abercrombie Road Paling Yards 2580) - Lot 7 / DP 753037 (6055 Abercrombie Road, Paling Yards 2580) - Lot 11 / DP 753037 (7056 Abercrombie Road Paling Yards 2580) - Lot 13 / DP 753037 (7056 Abercrombie Road Paling Yards 2580) - Lot 14 / DP 753037 (7056 Abercrombie Road Paling Yards 2580) - Lot 15 / DP 753037 (6055 Abercrombie Road, Paling Yards 2580) - Lot 16 / DP 753037 (6335 Abercrombie Road Paling Yards 2580) - Lot 17 / DP 753037 (7056 Abercrombie Road Paling Yards 2580) - Lot 18 / DP 753037 (7056 Abercrombie Road Paling Yards 2580) - Lot 19 / DP 753037 (6055 Abercrombie Road, Paling Yards 2580) - Lot 20 / DP 753037 (7056 Abercrombie Road Paling Yards 2580) - Lot 21 / DP 753037 (6335 Abercrombie Road Paling Yards 2580) - Lot 22 / DP 753037 (7056 Abercrombie Road Paling Yards 2580) - Lot 23 / DP 753037 (7056 Abercrombie Road Paling Yards 2580) - Lot 26 / DP 753037 (6335 Abercrombie Road Paling Yards 2580) - Lot 27 / DP 753037 (7056 Abercrombie Road Paling Yards 2580) - Lot 28 / DP 753037 (6335 Abercrombie Road Paling Yards 2580) - Lot 34 / DP 753037 (6055 Abercrombie Road, Paling yards 2580) - Lot 39/ DP 753037 (6790 Abercrombie Road Paling Yards 2580) - Lot 40 / DP 753037 (6335 Abercrombie Road Paling Yards 2580) - Lot 41 / DP 753037 (6466 Abercrombie Road Paling Yards 2580) - Lot 42 / DP 753037 (6466 Abercrombie Road Paling Yards 2580) - Lot 43 / DP 753037 (6790 Abercrombie Road Paling Yards 2580) - Lot 44 / DP 753037 (6335 Abercrombie Road Paling Yards 2580) - Lot 45 / DP 753037 (7056 Abercrombie Road Paling Yards 2580) - Lot 48 / DP 753037 (6055 Abercrombie Road, Paling yards 2580) - Lot 49 / DP 753037 (7056 Abercrombie Road Paling Yards 2580) - Lot 53 / DP 753037 (6650 Abercrombie Road Paling Yards 2580) - Lot 61 / DP 753037 (6650 Abercrombie Road Paling Yards 2580) - Lot 2 / DP 753064 (6057 Abercrombie Road, Paling yards 2580)

	- Lot 41 / DP 753064 (6055 Abercrombie Road, Paling Yards 2580) - Lot 56 / DP 753064 (6055 Abercrombie Road, Paling Yards 2580) - Lot 67 / DP 753064 (6057 Abercrombie Road, Paling Yards 2580) - Lot 2 / DP 1025920 (7056 Abercrombie Road Paling Yards 2580) - Lot 41 / DP 1025920 (7056 Abercrombie Road Paling Yards 2580) - Lot 13 / DP 257010 (Abercrombie Road Paling Yards 2580) - Lot 51 / DP 621232 (6790 Abercrombie Road Paling Yards 2580) - Lot 7005 / DP 1068141 (Abercrombie Road Paling Yards 2580) - Lot 7002 / DP 1068142 (Abercrombie Road Paling Yards 2580
Transmission Line, including proposed Terminal Stations – Lot/DP and Site Address	- Lot 2 / DP 753037 (6466 Abercrombie Road Paling Yards 2580) - Lot 5 / DP 753037 (7056 Abercrombie Road Paling Yards 2580) - Lot 16 / DP 753037 (6335 Abercrombie Road Paling Yards 2580) - Lot 40 / DP 753037 (6335 Abercrombie Road Paling Yards 2580) - Lot 56 / DP 753064 (6055 Abercrombie Road Paling Yards 2580) - Lot 67 / DP 753064 (6057 Abercrombie Road Paling Yards 2580)
Site size	The total area of the involved land holdings ('Mingary Park', 'Paling Yards' and 'Middle Station' and 'Hilltop') is 4,600 ha. However, the Subject Site/Survey Area covers an area of approx. 515 ha and the actual footprint of the wind farm infrastructure would cover an area of 235.8 ha.
LGA	Oberon
Site zoning	RU1 Primary Production
Topography	Undulating hills.
Vegetation	Cleared agricultural land with exotic derived grassland and patches of open forest or woodland vegetation.
Existing development/ land uses	Livestock grazing and breeding (mainly sheep) and cropping.
Historical development/ land uses	Agriculture and remnant vegetation.

1.5 Development Footprint

1.5.1 Construction Footprint

The construction footprint (**Figure 1-1**) encompasses the footprint of the proposed turbines and associated infrastructure (which are listed in previous Section 1.3). It is estimated that an overall area of approximately 235.8 ha of land would be directly impacted by the construction footprint. Within this area, 31.6 ha of native vegetation would be directly impacted.

1.5.2 Operational Footprint

The operational footprint includes the construction footprint indicated in **Figure 1-1** and also the operational measures of the WTGs, which are provided in **Table 1-4**.

Table 1-4: Operational Measures of the Wind Turbine Generators

Rotor sweep area	72-240 m
Maximum chord width of rotor	4 m
Pitch angle of rotor	90°
Rotor diameter	158 m
Rotation period	6.18 m/s

1.6 Information Sources

The Bibliography in Section 11 contains a full list of information sources referred to for this report. Digital shapefiles for all maps and spatial data have been submitted with this report. Information sources included (but were not limited to) the following:

- Databases searches included:
    - Review of the threatened species ecological data contained in NSW BioNet.
    - Review of NSW BioNet Vegetation Classification database.
    - Review of threatened fauna and flora records within a 10 km radius of the site, contained in the NSW Energy and Science (EES) Atlas of NSW Wildlife (BioNet).
    - Review of the Matters of National Environmental Significance (MNES) records within a 10 km radius of the site, using the Commonwealth Department of Agriculture, Water and the Environment (DAWE), EPBC Act Protected Matters Search Tool.
    - Review of the NSW EES Threatened Species website https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-

species.

  - Review of the Commonwealth DAWE Species Profile and Threats Database < http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl.
  - Review of regional vegetation mapping data contained within the NSW government's SEED website.

- Aerial Photograph Interpretation (API) included use of the following:
  - SIX maps.
- The following guidelines were reviewed and referred to in the development of biodiversity assessment and field survey methods:
  - Biodiversity Assessment Method (BAM) 2020
  - Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment Method (EES, 2016).
  - *'Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method* (OEH, 2018).
  - *NSW Survey Guide for Threatened Frogs: A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method* (Department of Primary Industries and Environment (DPIE), 2020).
  - *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (Department of Environment and Conservation (DEC), 2004).
  - *Survey Guidelines for Australia's Threatened Mammals* (Department of Sustainability, Environment, Water, Population & Communities (DSWP&C), 2011).
- The following environmental reports relevant to the Project were reviewed:
  - *Paling Yards Wind Farm Supplementary Ecological Report* (ERM, 2014).
  - *Preferred Project and Response to Submissions Report, Paling Yards Wind Farm* (Global Power Generation Australia Pty Ltd, 2020).
  - *Preliminary Biodiversity Values Report, Paling Yards Wind Farm* (ERM, 2021).
  - *Wind Farm Collision Risk for Birds: Cumulative risks for threatened and migratory species* (Smales, 2006).
  - *Bird and bat species' global vulnerability to collision mortality at wind farms revealed through a trait-based assessment* (Thaxter, et. al., 2017).
- Several other information sources were reviewed, such as regional vegetation mapping reports, threatened species recovery plans and approved conservation advice, and Threatened Species Scientific Committee final determinations. These are listed in the Bibliography in Section 11.

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Figure 1.1 Project Layout

- Survey Area
- Development Footprint 12/2022
- Dwelling Location
- PYWF_WTG_Layout_v2_01_20210727
- PYWF_TL_v2_03_20221115
- PYWF_AccessRoad_v2_02_20221115
- PYWF_Existing_TL_v1_01_20210115
- PYWF_Site_Boundary_v2_01_20210727
- PYWF_Substation_v2_04_20221115

DATE : 05/12/2022
Map Version: 1.3

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:42,000

Dwelling locations digitised from geo-referenced image.
For illustration purposes only

0 800 1,600 2,400 3,200 4,000 8,000 Meters

2. LANDSCAPE FEATURES

2.1 Site and Landscape Context

This section details the site and landscape features occurring on the Subject Site and within the assessment area (i.e., a 1.5 km buffer surrounding the Subject Site). See **Figure 2-1** for a Site and Location Map.

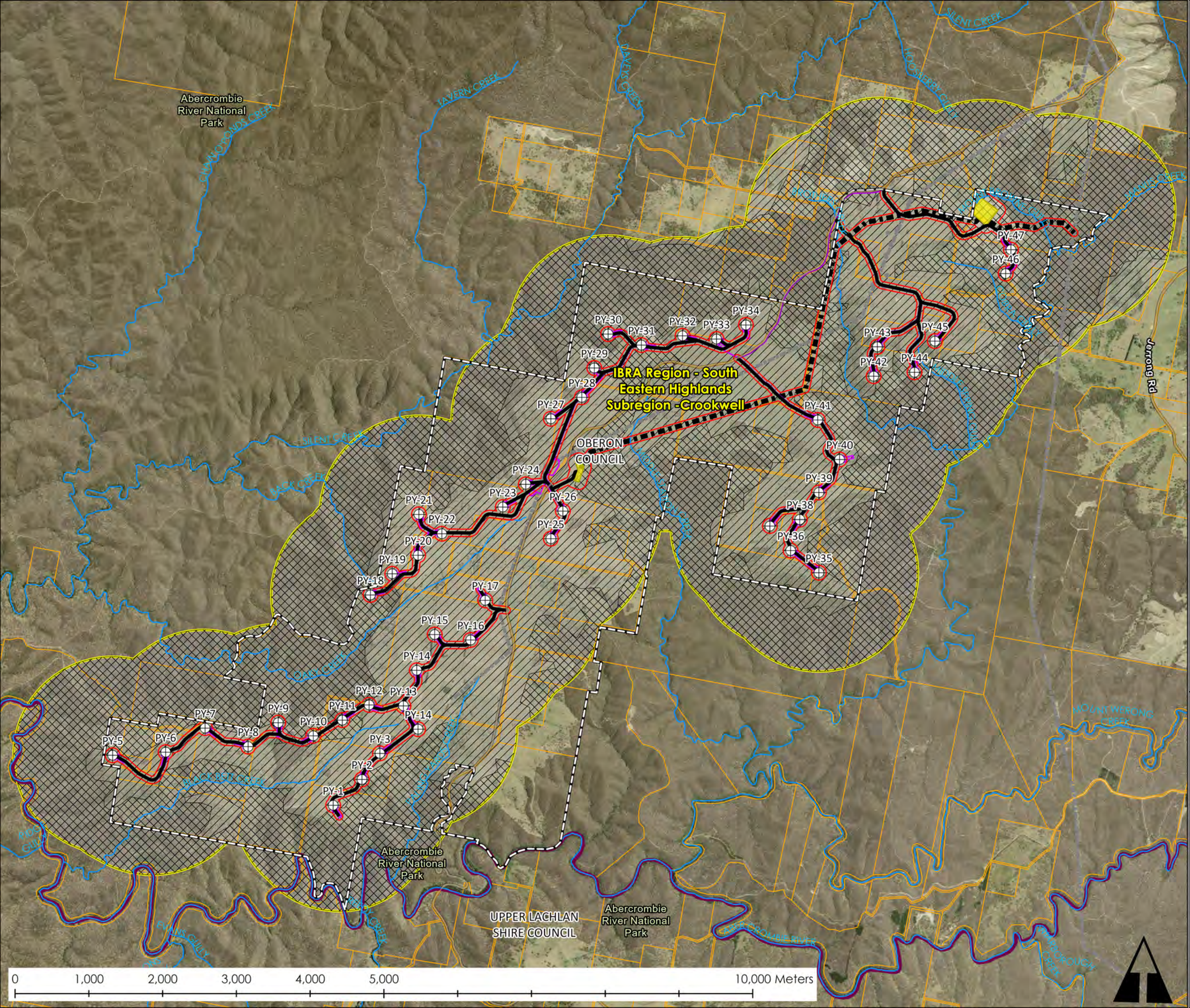
Table 2.1: Site and Landscape Features

IBRA Bioregions and Subregions	The Subject Site is within both the South Eastern Highlands IBRA bioregion and the Crookwell IBRA subregion. No other regions/subregions occur within the assessment area. See **Figure 2-1**.
NSW Landscape Regions (Mitchell Landscapes)	The Subject Site occurs across both the Rockley Plains and Mount David Basalts Mitchell Landscapes. The Mount David Basalts landscape (which has an estimated cleated percentage of 65%) covers most of the Subject Site though. No other Mitchell Landscapes occur within the assessment area. See **Figure 2-1.**
Native Vegetation Extent	Native vegetation extent is calculated as a percentage cover on the Subject Site and the surrounding assessment area. Cover estimates are based on the cover of native woody and non-woody vegetation relative to the approximate benchmarks for the PCT, considering vegetation condition and extent. The native vegetation cover within the assessment area is estimated at 50%. See **Figure 2-1**.
Patch Size	Patch size is used to describe an area of intact native vegetation, that includes native vegetation with a gap of less than 100 m from the next area of moderate to good condition native vegetation. This gap is less than or equal to 30 m for non-woody ecosystems. The patch size of the native vegetation on the subject site has been calculated as >100 ha.
Watercourses	The proposed wind turbines do not occur on any watercourses or wetlands, although some are in close proximity to watercourses and several farm dams (<100 m). There are various locations along the proposed access tracks that intercept minor drainage features and in the north-eastern portion of the Subject Site, a transmission line would cross Mount Brown Gully. All watercourses in the vicinity of the project (including Oaky Creek, Black Bett Creek and Paling Yard Creek) are 1st order (Strahler stream order). Abercrombie River occurs south of the Subject Site and is approximately 1 km from the nearest portion of the construction footprint. See **Figure 2-1**.
Important Wetlands	Abercrombie River occurs south of the Subject Site and is approximately 1 km from the nearest portion of the construction footprint. There are no Wetlands of International Importance within 10 km of the Subject Site. See **Figure 2-1**.
Habitat Connectivity	The Subject Site is situated between large tracks of forested land, including Abercrombie River National Park (NP) to the west and north and a combination of state forest, private land and various nature reserves (including Blue Mountains National Park (NP) and Kanangra-Boyd NP) to the east and south.

	There are no specific corridors within the Subject Site; rather, all areas of native vegetation the Subject Site would provide connectivity in the form of 'stepping stones'.
Karst, caves, crevices, cliffs and areas of geological significance	The Subject Site and assessment area do not contain karst, caves, crevices, cliffs and areas of geological significance.
Areas of Outstanding Biodiversity Value (AOBV)	No AOBV declared by the BC Act occur within the Subject Site or assessment area.
Flight pathways for migratory and nomadic species	There are several migratory and nomadic bird and bat species that may fly through the Subject Site and assessment area (as detailed in Section 5.2); however, there are no predictable / habitual flight paths able to be mapped within the Subject Site and assessment area.

Hunter Ecology

Figure 2.1 Site and Location



PYWF_Site_Boundary_v2_01_20210727

Survey Area

PYWF_Substation_v2_04_20221115

PYWF_WTG_Layout_v2_01_20210727

PYWF_TL_v2_03_20221115

PYWF_AccessRoad_v2_02_20221115

PYWF_Existing_TL_v1_01_20210115

Development Footprint 12/2022

Waterways

LGA Boundary

Mitchell Landscapes 3_1

Mount David Basalts

Rockley Plains

1.5km Buffer Assessment Area

NSW Cadastre Lots (DCDB)

DATE : 05/12/2022
Map Version: 1.3

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:46,000

3. NATIVE VEGETATION

3.1 Methodology

A review of existing regional vegetation mapping (i.e., *State Vegetation Type Map: Central Tablelands Region Version 1.0. VIS_ID 4778*) was undertaken to determine the types of vegetation communities previously mapped in the Subject Site and surrounding areas. A previous Supplementary Ecological Report by ERM (2014) (which documents the flora and fauna field surveys undertaken in 2013, over the original footprint of the Project) was also reviewed.

The overall native vegetation extent within the Subject Site was assessed and groundtruthed during site visits in February and October 2021. See **Figure 3-1** for the native vegetation extent within the Survey Area. Vegetation mapping was initially undertaken in 2013 by ERM (2014). This mapping was reviewed, adjusted and groundtruthed during both the February and October 2021 surveys, to accommodate changes to the original proposed wind farm layout.

Vegetation communities were matched with their 'best-fit' equivalent Plant Community Types (PCTs) according to the NSW PCT classification described in the NSW BioNet Vegetation Information System (BioNet VIS), and with reference to other relevant plant community classification documents, such as OEH's (2011) classification of plant communities in the South Eastern Highlands and Australian Alps. PCTs were further divided into vegetation zones (VZs). For the purposes of the BAM, a VZ is an area of native vegetation on the Subject Site that is the same PCT and has a similar broad condition state.

Plot-based floristic surveys and a vegetation integrity (VI) assessment were conducted for each VZ, in accordance with the BAM. The data collection methods used for assessment of VI are specified in Section 5 of the BAM (DPIE 2020a). Values relating to the composition, structure and function of native vegetation at the Subject Site are assessed using standardised plots and transects prescribed by the BAM (DPIE 2020a). This consists of a 20 x 20 m quadrat, within a 20 x 50 m plot and five 1 x 1 m sub-plots, arranged along a central 50 m transect. **Table 3-1** lists the attributes recorded within each of the plot scales.

The BAM plot surveys were undertaken over several dates (between 2-10 February 2021 and between 1-7 October 2021). Survey conditions were optimal during both survey periods. Approximately 59 mm and 38 mm of rainfall had occurred within the 2-week periods prior to the February 2021 and October 2021 surveys respectively.

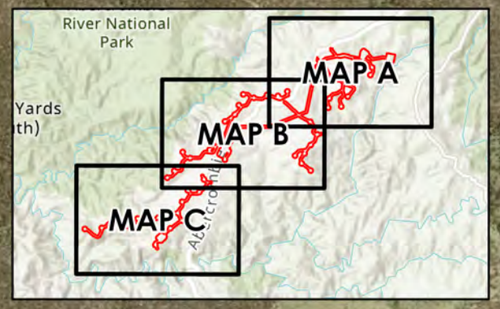
The locations of plots were representative of the vegetation condition for all VZs and the plots were well distributed across the Subject Site to capture any variability within VZs. The BAM specifies the number of plots required within a VZ, depending on its area. In total, data from 18 BAM plots was collected. See **Table 3-2** for a summary of plots and **Figure 3-1** for the plot locations. **Note**, some plots occur outside the Survey Area depicted in Figure 3-1. This is because since they were undertaken, the Project layout has been modified to reduce native vegetation clearing (as discussed in Section 5-1). These Plots are still representative of the relevant VZs within the Survey Area. Raw plot data is provided in **Appendix A**. Plot photos are provided in **Appendix B**. A full recorded flora species list is provided in **Appendix C**.

Table 3-1: Attributes Recorded in the BAM Plot

Dataset	Attribute
20 x 20 m quadrat	Flora species common and scientific name, stratum, growth form, cover, abundance and native/exotic/high threat weed status.
20 x 50 m plot	The number of large trees, tree stem size class, tree regeneration, total length of fallen logs and number of trees with hollows.
1 x 1 m plot	Percent litter cover

Table 3-2: Summary of BAM Plots

VZ	Condition	No. of Plots Surveyed
85_1	Disturbed riparian open forest	2
649_1	Open woodland, exotic groundcover	3
654_1	Open woodland, exotic groundcover	1
727_1	Open forest	4
727_2	Regrowth >5 years	1
727_3	Regrowth <5 years	3
951_1	Open forest	1
951_2	Open woodland, exotic groundcover	2
1093_1	Open forest	3



Hunter Ecology

MAP A

Figure 3.1 Native Vegetation Extent and BAM Plot Locations

PYWF_Site_Boundary_v2_01_20210727
Survey Area
Development Footprint 202212
BAM_PLOTS
PYWF_AccessRoad_v2_02_20221115
PYWF_Substation_v2_04_20221115
PYWF_WTG_Layout_v2_01_20210727
PYWF_TL_v2_03_20221115
PYWF_Existing_TL_v1_01_20210115

PCT_Vegetation_202212
Native Vegetation
DAM

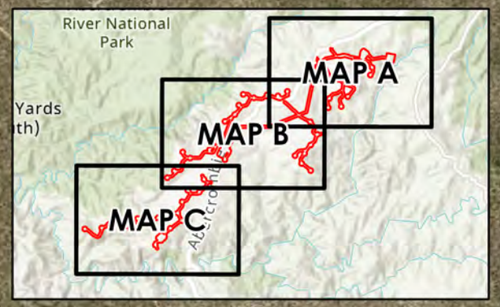
DATE : 05/12/2022
Map Version: 1.3

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:18,000

0 200 400 600 800 1,000 2,000 Meters



Hunter Ecology

MAP B

Figure 3.1 Native Vegetation Extent and BAM Plot Locations

PY-30
PY-31
PY-32
PY-33
PY-34
PY-29
PY-28
PY-27
PY-24
PY-23
PY-26
PY-25
PY-21
PY-22
PY-20
PY-19
PY-17
PY-15
PY-16
PY-41
PY-39
PY-38
PY-37
PY-36
PY-35
2
3
4
5
6
11
Abercrombie Rd

0 200 400 600 800 1,000 2,000 Meters

PYWF_Site_Boundary_v2_01_20210727
Survey Area
Development Footprint 202212
BAM_PLOTS
PYWF_AccessRoad_v2_02_20221115
PYWF_Substation_v2_04_20221115
PYWF_WTG_Layout_v2_01_20210727
PYWF_TL_v2_03_20221115
PYWF_Existing_TL_v1_01_20210115

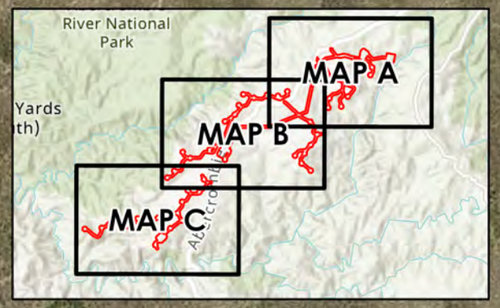
PCT_Vegetation_202212
Native Vegetation
DAM

DATE : 05/12/2022
Map Version: 1.3

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:18,000



Hunter Ecology

MAP C

Figure 3.1 Native Vegetation Extent and BAM Plot Locations

PYWF_Site_Boundary_v2_01_20210727
Survey Area
Development Footprint 202212
BAM_PLOTS
PYWF_AccessRoad_v2_02_20221115
PYWF_Substation_v2_04_20221115
PYWF_WTG_Layout_v2_01_20210727
PYWF_TL_v2_03_20221115
PYWF_Existing_TL_v1_01_20210115

PCT_Vegetation_202212
Native Vegetation
DAM

DATE : 05/12/2022
Map Version: 1.3

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:18,000

0 200 400 600 800 1,000 2,000 Meters

3.2 Review of Existing Regional Vegetation Mapping

See **Table 3-3** for an indication of the vegetation communities / PCTs previously mapped in and near the Subject Site (from a review of regional vegetation mapping data contained within the NSW government's SEED website).

Table 3-3: Review of Existing Regional Vegetation Mapping

Dataset	Vegetation Communities / PCTs Mapped within a 10 km Radius of the Survey Area
State Vegetation Type Map: Central Tablelands Region Version 1.0. VIS_ID 4778	• PCT 649 Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion • PCT 731 Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills; South Eastern Highlands Bioregion • PCT 1093 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands; South Eastern Highlands Bioregion • PCT 85 River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion • PCT 951 Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion • PCT 963 Narrow-leaved Peppermint - Mountain Gum - Brown Barrel moist open forest on high altitude ranges; northern South Eastern Highlands Bioregion • PCT 1197 Snow Gum - Mountain Gum tussock grass-herb forest of the South Eastern Highlands Bioregion • PCT 732 Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion
Vegetation Map – Southern Forests – VIS 3858	• Widespread Tablelands Dry Shrub-Tussock Grass Forest • Eastern Tablelands Acacia/Herb/Grass Forest • Riparian Acacia/Shrub/Grass/Herb Forest • Tablelands Shrub/Grass/Moist Forest • Northern Plateau Moist Fern/Herb/Grass Forest • North East Tablelands Shrub/Herb/Grass Forest • Eastern Tablelands Acacia/Herb/Grass Forest • Northern Tablelands Acacia/Herb/Grass Dry Forest • Tableland Tussock Grass/Herb Forest • Tablelands Dry Shrub/Tussock Grass Forest • Eastern Tablelands Dry Shrub Forest • North East Tablelands Dry Shrub/Grass Forest • Tablelands Dry Shrub/Tussock Grass Forest • Western Slopes Grass/Herb Dry Forest • Northern Tablelands Shrub/Tussock Grass Forest • Northern Slopes Dry Grass Woodland • Northern Tablelands Grass Forest on Basalt

3.3 Plant Community Types and Vegetation Zones

Six PCTs were identified in the Survey Area and as presented in **Table 3-4**, these were further divided into a total of nine VZs. **Tables 3-5** provides more detailed summaries of the identified PCTs, including justifications for PCT selection and descriptions of conditions classes and VZs. The distribution of the PCTs and VZs across the Survey Area are depicted in **Figure 3-2**.

Table 3-4: PCTs and VZs

PCT	VZ	Area within Survey Area	Area Impacted
PCT 85 River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion	**85_1**	4.69 ha	1.73 ha
PCT 649 Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion	**649_1**	15.3 ha	5.57 ha
PCT 654 Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion	**654_1**	2.39 ha	1.95 ha
PCT 727 Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion	**727_1**	10.2 ha	7.53 ha
	727_2	2.79 ha	1.25 ha
	727_3	12.99 ha	7.38 ha
PCT 951 Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion	**951_1**	0.5 ha	0.5 ha
	951_2	7.61 ha	2.34 ha
PCT 1093 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion	**1093_1**	9.19 ha	3.45 ha

Table 3-5: PCT Summary

Attribute	Description
	PCT 85 River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion
Photos – VZ 85_1	 
Formation	Forested Wetlands
Vegetation Class	Eastern Riverine Forests
TEC status	No associated TEC
PCT Percent Cleared	73
Description	This is a mature riparian open forest/woodland community, occurring along the ephemeral drainage lines, semi-permanent creeks and gullies of the Survey Area. Disturbance level varies slightly, but all areas contain large old growth trees with hollows. Upper Stratum – 10 m to 25 m high with a projected foliage cover (PFC) of 20% to 50%. Dominated by *Eucalyptus viminalis* and *E. blakelyi*. Willow (*Salix* sp.) occurs in some areas. Mid Stratum – 1 m to 4 m high with a PFC of 10% to 60%. The shrub layer is variable and. There is often dense *Rubus fruticosus* (Blackberry) and scattered *Rosa canina* (Dog Rose). Native species include *Acacia melanoxylon*, *A. dealbata*, *A. implex*a and *Cassinia longifolia*. Lower Stratum – <1 m high with a PFC of 20% to 90%. The groundlayer is often dominated by *Pteridium esculentum* but can be variable with some areas containing abundant grasses, grass-like species and sedges (such as *Themeda triandra*, *Rytidosperma* sp., *Lomandra* sp. and *Carex* sp.) and some containing exotics (such as *Holcus lanatus*, *Taraxacum officinale* and *Modiola caroliniana*). Native forbs also occur, such as *Aceana ovina*, *Dichondra repens*, *Oxalis perennans*, *Euchiton sphaericus*, *Rumex brownie* and *Geranium solandri*.

Vegetation Zones / Condition States	PCT 85 was found to be in one broad condition state across the Survey Area and was concluded to have one VZ (85_1). This VZ is fairly disturbed, with an often high abundance of weeds and evidence of livestock impacts; however all areas contain large old growth trees with hollows.
Justification for PCT Selection	Assigning this community to a particular PCT was difficult as it did not fit confidently with any one PCT in BioNet VIS. The community is very much like 'p520: Ribbon Gum very tall woodland on sandy alluvial soils along drainage lines of the eastern South Eastern Highlands Bioregion' described by OEH (2011), however it does not align with any suitable PCTs in BioNet VIS for the community. Problematically, a key PCT 85 species, *Casuarina cunninghamiana*, was not observed in the Survey Area; however, the community was dominated by one other key species, being *Eucalyptus viminalis*. Further, it was determined that the community would fit within the Eastern Riverine Forests vegetation class (of which PCT 85 is in). It is also worth noting that PCT 85 has been mapped within the Survey Area by *SVTM: Central Tablelands Region Version 1.0. VIS_ID 4778* and thus it is considered the best fit for the Survey Area's riparian community. The following other riparian PCTs containing *E. viminalis* were also considered: • PCT 951 Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion – this PCT is in the Wet Sclerophyll Forests (Grassy sub-formation) / Southern Tableland Wet Sclerophyll Forests vegetation formation / class. It is considered that the Survey Area's community is a riparian community specifically and the Forested Wetlands / Eastern Riverine Forests formation / class (of which PCT 85 is in) would be a better fit. • PCT 299 Riparian Ribbon Gum - Robertsons Peppermint - Apple Box riverine very tall open forest of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion – This PCT is perhaps more floristically aligned with the community, however the PCT profile states that is does not occur within the Crookwell subregion.
PCT 649 Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion	
Photos – VZ 649_1	
Formation	Dry Sclerophyll Forests (Shrubby sub-formation)
Vegetation Class	Southern Tableland Dry Sclerophyll Forests

TEC status	PCT 649 is associated with the BC Act listed TEC, Mt Canobolas Xanthoparmelia Lichen Community. This TEC however is confined to Mt Canobolas and thus the site's community is not commensurate with it.
PCT Percent Cleared	45
Description	The community has a patchy distribution across the site and occurs on the slopes and hills. It is highly disturbed, with the understorey and groundcover being largely cleared and dominated heavily by pasture grasses, clover and weedy exotic species. All areas on the site were observed to be heavily grazed by sheep and cattle. Upper Stratum – 10 m to 20 m high with a projected foliage cover (PFC) of <5 to 30%. Dominated by *Eucalyptus bridgesiana*, *E. dives* and *E. goniocalyx*, with occasional *E. macrorhyncha*. Mid Stratum – 1 m to 4 m high with a PFC of <5%. The shrub layer is almost entirely absent. There are occasional *Acacia falciformis* and the exotic *Lycium ferocissimum*. Lower Stratum – <1 m high with a PFC of 90% to 100%. The exotic species, *Lolium perenne* and *Hordeum leporinum* and *Trifolium repens* are often very dominant. There is also a mix of native grasses and forbs, such as *Rytidosperma setaceum*, *R. pallidum*, *Microlaena stipoides*, *Geranium solandri*, *Rumex brownie* and *Dichondra repens*. Exotic annuals, such as *Carthamus lanatus*, *Cirsium vulgare*, *Silybum marianum* are abundant in some areas.
Vegetation Zones / Condition States	PCT 649 was found to be in one broad condition state across the Survey Area and was concluded to have one VZ (649_1). As mentioned above, the condition of VZ 649_1 is highly disturbed, with the understorey/groundcover being cleared, pasture improved and heavily grazed. There are however a high number of large, senescent trees with abundant hollows.
Justification for PCT Selection	The community's highly disturbed state made it difficult to determine its original floristics and structure. PCT 649 was chosen however as the IBRA subregion, vegetation formation / class and key canopy species identified in its PCT profile are well aligned with the community. One other PCT was considered, as summarised below: • PCT 305 Apple Box - Broad-leaved Peppermint - Red Stringybark shrubby hill open forest in the upper NSW South Western Slopes Bioregion and adjacent South Eastern Highlands Bioregion – this PCT contains similar key canopy species however according to its PCT profile, it does not occur in the Crookwell subregion.

PCT 654 Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion	
Photos – VZ 654_1	
Formation	Grassy Woodlands
Vegetation Class	Southern Tableland Grassy Woodlands
TEC status	Listed under the BC Act as a Critically Endangered Ecological Community (CEEC): 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. The community does not meet the condition threshold (in Appendix 2 of DECCW (2010)) for the EPBC Act listing as it contains a heavily exotic-dominant groundlayer (see BAM data sheets in **Appendix A**).
PCT Percent Cleared	95
Description	Highly disturbed, with the understorey/groundcover being cleared, exotic and heavily grazed. There are however a high number of large, senescent trees with abundant hollows. Upper Stratum – 10 m to 20 m high with a projected foliage cover (PFC) of <5 to 30%. Dominated by *Eucalyptus melliodora* and occasional *E. bridgesiana*. Mid Stratum – 1 m to 4 m high with a PFC of <5%. The shrub layer is almost entirely absent. There are occasional exotic *Lycium ferocissimum*. Lower Stratum – <1 m high with a PFC of 90% to 100%. Exotic pasture grasses and annual weeds dominate the ground cover; such species include *Lolium perenne*, *Hordeum leporinum*, *Trifolium repens*, *Poa annua*, *Carthamus lanatus*, *Cirsium vulgare*, *Silybum marianum* and *Urtica dioica*. Native groundcover species were rare; occasional *Microlaena stipoides*, *Geranium solandri*, *Rumex brownie* and *Dichondra repens* were observed.

Vegetation Zones / Condition States	PCT 654 was found to be in one broad condition state across the Survey Area and was concluded to have one VZ (654_1). As mentioned above, the condition of VZ 654_1 is highly disturbed, with the understorey/groundcover being cleared, exotic and heavily grazed. There are however a high number of large, senescent trees with abundant hollows.
Justification for PCT Selection	The community's highly disturbed state made it difficult to determine its original floristics and structure. PCT 654 was chosen however as the IBRA subregion, vegetation formation / class and key canopy species identified in its PCT profile are well aligned with the community. Two other PCTs were considered, as summarised below: PCT 277 Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion – this PCT shares characteristics with the community, although according to its PCT profile, whilst it occurs within the Crookwell subregion, it does not occur within the Oberon LGA. PCT 276 Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion – this PCT shares characteristics with the community, although according to its PCT profile, it does not occur within the Crookwell subregion. PCT 352 Red Stringybark - Blakely's Red Gum hillslope open forest on meta-sediments in the Yass - Boorowa - Crookwell region of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion – This PCT was considered as its PCT profile states that it often contains *Eucalyptus melliodora* and it occurs in the Crookwell subregion. PCT 352 however is within the Dry Sclerophyll Forests (Shrubby sub-formation) / Southern Tableland Dry Sclerophyll Forests vegetation formation / class. The community is better aligned with the Grassy Woodlands / Southern Tableland Grassy Woodlands vegetation formation / class (of which PCT 654 is in).
PCT 727 Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion	
Photos – VZ 727_1	

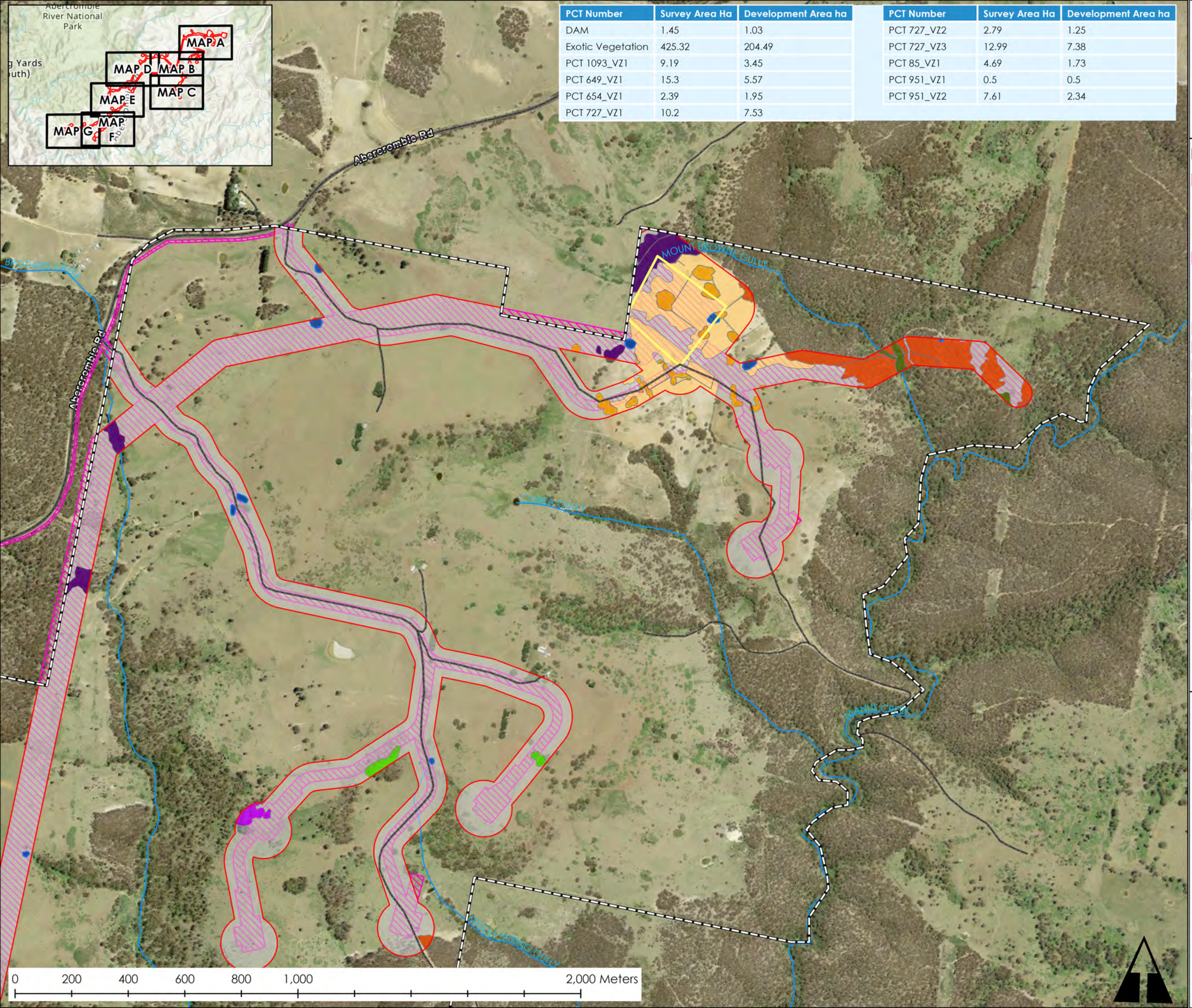
Photos – VZ 727_2	
Photos – VZ 727_3	 
Formation	Dry Sclerophyll Forests (Shrubby sub-formation)
Vegetation Class	Southern Tableland Dry Sclerophyll Forests
TEC status	Associated with the BC Act listed TEC, Mt Canobolas Xanthoparmelia Lichen Community. This TEC however is confined to Mt Canobolas and thus the site's community is not commensurate with it.
PCT Percent Cleared	50
Description	The majority of this PCT mapped on the Survey Area is characterised as fairly intact low open forest, with a native but very sparse shrub and ground layer. There are some recently cleared patches in the northern portion of the Subject Site, that are in varying stages of regrowth. Upper Stratum – 8 m to 15 m high with a projected foliage cover (PFC) of <5% to 50%. Dominated by *Eucalyptus dives*, *E. macrorhyncha*, *E. goniocalyx* and occasional *E. mannifera* and *E. rossi*.

	Mid Stratum – 1 m to 4 m high with a PFC of <5% to 10%. The shrub layer is very sparse and is generally dominated by emergent canopy species as well as occasional *Acacia brownii*, *Cassinia longifolia*, and *Bursaria spinosa*. Lower Stratum – <1 m high with a PFC of <5% to 30%. The groundlayer is very sparse and dominated by native grasses such as *Rytidosperma setaceum*, *R. pallidum*, *Microlaena stipoides* and *Poa sieberiana.* There is also a mix of forbs, climbers and small shrubs, such as *Hardenbergia violaceae*, *Einadia nutans*, *Gonocarpus tetragynus*, *Goodenia hederacea*, *Lomandra filiformis* and *Poranthera microphylla*.
Vegetation Zones / Condition States	PCT 727 was split into three vegetation zones, based on the varying conditions states, as summarised below. 727_1: this VZ is characterised as fairly intact open forest, with a native but very sparse shrub and ground layer. Livestock do have access to these areas and there was evidence of grazing and trampling impacts. There are occasional hollow-bearing trees scattered throughout this VZ. 727_2: this VZ has recently been cleared and consists of dense regrowth of the canopy (trees <5 years old), with little to no shrubs and a very sparse ground layer. The soil here appears to be very compacted with little organic matter. 727_3: this VZ has also recently been cleared, however the regrowth is dominated heavily by *Cassinia arcuata* shrubs with only occasional regrowth canopy species <5 years old. The soil here also appears to be very compacted with little organic matter. There is also an abundance of the High Threat Weed, *Nassella trichotoma* (Serrated Tussock) in this VZ.
Justification for PCT Selection	The community contains all key canopy species for PCT 727 (including *Eucalyptus dives*, *E. mannifera* and *E. macrorhyncha*) and aligns well with the vegetation formation / class for PCT 727. Three other PCTs were considered and ruled out, as summarised below: • PCT 731 Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands Bioregion – The community contains affinities with this PCT, however PCT 731 is within the Grassy Woodlands / Southern Tableland Grassy Woodlands vegetation formation / class. The community is better aligned with the Dry Sclerophyll Forests (Shrubby sub-formation) / Southern Tableland Dry Sclerophyll Forests vegetation formation / class (of which PCT 727 is in). • PCT 287 Long-leaved Box - Red Box - Red Stringybark mixed open forest on hills and hillslopes in the NSW South Western Slopes Bioregion – this PCT was considered as *Eucalyptus goniocalyx* was often observed in the community. Other key species for PCT 287 however, were absent from the community (including *Eucalyptus polyanthemos, Eucalyptus melliodora, Callitris endlicheri* and *Eucalyptus sideroxylon*). Further, PCT 287 is described in its PCT profile as 'mid-high to tall open forest or woodland to 25 m high'. The community in the Survey Area is a low open forest, with the mature canopy not reaching more than about 15 m high. • PCT 305 Apple Box - Broad-leaved Peppermint - Red Stringybark shrubby hill open forest in the upper NSW South Western Slopes Bioregion and adjacent South Eastern Highlands Bioregion – according to its PCT profile, this PCT does not occur in the Crookwell subregion. It is also described as a 'tall open forest', which is not consistent with the low open forest in the Survey Area.

PCT 951 Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion	
Photos – VZ 951_1	
Photos – VZ 951_2	 
Formation	Wet Sclerophyll Forests (Grassy sub-formation)
Vegetation Class	Southern Tableland Wet Sclerophyll Forests
TEC status	Listed under the BC Act as an Endangered Ecological Community (EEC): Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions. Note listed under the EPBC Act.
PCT Percent Cleared	80
Description	Tall open forest / woodland, occurring on the slopes and hills. Upper Stratum – 10 m to 15 m high with a projected foliage cover (PFC) of <5% to 50%. Dominated mostly by *Eucalyptus viminalis*, with some areas containing *E. macrorhyncha* and *Acacia melanoxylon.*

	Mid Stratum – 1 m to 4 m high with a PFC of <5% to 20%. The more intact areas of the community are dominated by *Acacia melanoxylon, A. falcata* and *Pittosporum multiflorum*. The more disturbed areas are cleared entirely of an understorey. The High Threat Weed, *Rubus fruticosus* was observed in the community. Lower Stratum – <1 m high with a PFC of <5% to 30%. The more intact areas are dominated heavily by *Pteridium esculentum* and L*omandra longifolia*, with scattered forbs, such as *Acaena ovina, Dichondra repens* and *Oxalis perennans.* In the more disturbed areas, exotic pasture grasses and annual weeds are abundant (species include *Phalaris canariensis, Trifolium repens,* thistles (*Carthamus lanatus, Cirsium vulgare, Carduus nutans*, *Silybum marianum*). Native species observed in these areas included *Microlaena stipoides, Rytidosperma setaceum, Einadia nutans, Geranium solandri and Oxalis perennans*.
Vegetation Zones / Condition States	PCT 951 was split into two vegetation zones, based on the varying conditions states, as summarised below. 951_1 is characterised as fairly intact open forest / woodland with a shrubby understorey. 951_2 is characterised is heavily disturbed, with the understorey and groundcover being largely cleared and pasture improved.
Justification for PCT Selection	The community contains key canopy species for PCT 951 (including *Eucalyptus viminalis* and *Acacia melanoxylon*). It also aligns well with the Wet Sclerophyll Forests (Grassy sub-formation) / Southern Tableland Wet Sclerophyll Forests formation / class (of which PCT 951 is in) and has been mapped in the Survey Area by *SVTM: Central Tablelands Region Version 1.0. VIS_ID 4778.* One other PCT was considered and ruled out, as summarised below: • PCT 732 Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion – This PCT was considered, however it is in the Grassy Woodlands / Southern Tableland Grassy Woodlands vegetation formation / class. The community is much better aligned with the Wet Sclerophyll Forests (Grassy sub-formation) / Southern Tableland Wet Sclerophyll Forests formation / class (of which PCT 951 is in).
PCT 1093 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion	
Photos – VZ 1093_1	
Formation	Dry Sclerophyll Forests (Shrubby sub-formation)

Vegetation Class	Southern Tableland Dry Sclerophyll Forests
TEC status	No TECs are associated with this PCT.
PCT Percent Cleared	61%
Description	This community occurs in areas of lower soil fertility. It is characterised as a fairly intact, low open forest with a sparse shrub and groundlayer. Upper Stratum – 8 m to 15 m high with a projected foliage cover (PFC) of <5% to 50%. Dominated by *Eucalyptus rossi*, *E. macrorhyncha* and *E. dives*, with occasional *E. mannifera* and *E. goniocalyx*. Mid Stratum – 1 m to 4 m high with a PFC of <5% to 20%. The shrub layer is very sparse and is generally dominated by emergent canopy species as well as occasional *Acacia brownii*, *Cassinia longifolia*, and *Bursaria spinosa*. Lower Stratum – <1 m high with a PFC of <5% to 30%. The groundlayer is very sparse and dominated by native grasses such as *Rytidosperma setaceum*, *R. pallidum*, *R. monticola*, *Microlaena stipoides* and *Poa sieberiana.* There is also a mix of forbs, climbers and small shrubs, such as *Hardenbergia violaceae*, *Acacia gunnii*, *Hibbertia obtusifolia*, *Einadia nutans*, *Gonocarpus tetragynus*, *Goodenia hederacea*, *Lomandra filiformis* and *Poranthera microphylla*.
Vegetation Zones / Condition States	PCT 1093 was found to be in one broad condition state across the Survey Area and was concluded to have one VZ (1093_1). VZ 1093_1 is characterised as fairly intact low open forest, with a native but very sparse shrub and ground layer. Livestock do have access to these areas and there was evidence of grazing and trampling impacts. There are hollow-bearing trees scattered throughout.
Justification for PCT Selection	The community contains all key canopy species for PCT 1093 (including *Eucalyptus rossi, E. macrorhyncha, E. mannifera, E. dives* and *Eucalyptus goniocalyx*) and fits the PCT profile description which states that it is 'a low open forest or woodland with an open understorey'. It also aligns well with the Dry Sclerophyll Forests (Shrubby sub-formation) / Southern Tableland Dry Sclerophyll Forests vegetation formation / class (of which PCT 1093 is in) and has been mapped in the Survey Area by *SVTM: Central Tablelands Region Version 1.0. VIS_ID 4778.* Two other PCTs were considered, as summarised below: • PCT 731 Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands Bioregion – This PCT was considered as it also may contain E. rossi, however PCT 731 is within the Grassy Woodlands / Southern Tableland Grassy Woodlands vegetation formation / class. The community is better aligned with the Dry Sclerophyll Forests (Shrubby sub-formation) / Southern Tableland Dry Sclerophyll Forests vegetation formation / class (of which PCT 727 is in). • PCT 888 Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion – this PCT shares close affinities with the community and is very similar to PCT 1093. The presence of *E. goniocalyx* in the community though leans it more towards PCT 1093.



PCT Number	Survey Area Ha	Development Area ha
DAM	1.45	1.03
Exotic Vegetation	425.32	204.49
PCT 1093_VZ1	9.19	3.45
PCT 649_VZ1	15.3	5.57
PCT 654_VZ1	2.39	1.95
PCT 727_VZ1	10.2	7.53
PCT 727_VZ2	2.79	1.25
PCT 727_VZ3	12.99	7.38
PCT 85_VZ1	4.69	1.73
PCT 951_VZ1	0.5	0.5
PCT 951_VZ2	7.61	2.34

Hunter Ecology

MAP A

Figure 3.2 Plant Community Types and Vegetation Zones

- PYWF_Site_Boundary_v2_01_20210727
- Survey Area
- Existing Roads
- PYWF_Substation_v2_04_20221115
- Development Footprint
- Drainage Lines

PCT_Vegetation_202212
- PCT 951_VZ1
- PCT 951_VZ2
- PCT 727_VZ1
- PCT 727_VZ2
- PCT 727_VZ3
- PCT 1093_VZ1
- PCT 649_VZ1
- PCT 654_VZ1
- PCT 85_VZ1
- Exotic Vegetation
- DAM

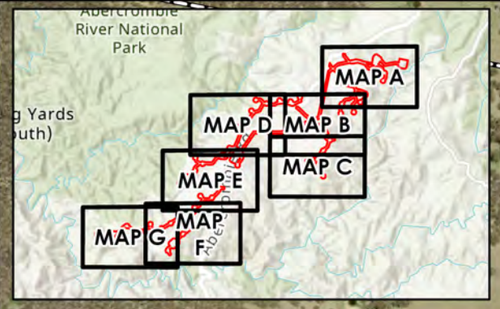
DATE : 05/12/2022
Map Version: 1.3

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:12,000

Although all care has been taken WiZarDTech accepts no responsibility from the use or inaccuracies of this map and spatial data.



PCT Number	Survey Area Ha	Development Area ha
DAM	1.45	1.03
Exotic Vegetation	425.32	204.49
PCT 1093_VZ1	9.19	3.45
PCT 649_VZ1	15.3	5.57
PCT 654_VZ1	2.39	1.95
PCT 727_VZ1	10.2	7.53

PCT Number	Survey Area Ha	Development Area ha
PCT 727_VZ2	2.79	1.25
PCT 727_VZ3	12.99	7.38
PCT 85_VZ1	4.69	1.73
PCT 951_VZ1	0.5	0.5
PCT 951_VZ2	7.61	2.34

Hunter Ecology

MAP B

Figure 3.2 Plant Community Types and Vegetation Zones

- PYWF_Site_Boundary_v2_01_20210727
- Survey Area
- Existing Roads
- PYWF_Substation_v2_04_20221115
- Development Footprint
- Drainage Lines

PCT_Vegetation_202212

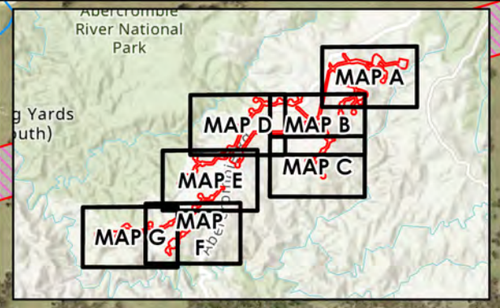
- PCT 951_VZ1
- PCT 951_VZ2
- PCT 727_VZ1
- PCT 727_VZ2
- PCT 727_VZ3
- PCT 1093_VZ1
- PCT 649_VZ1
- PCT 654_VZ1
- PCT 85_VZ1
- Exotic Vegetation
- DAM

DATE : 05/12/2022
Map Version: 1.3

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:12,000



PCT Number	Survey Area Ha	Development Area ha
DAM	1.45	1.03
Exotic Vegetation	425.32	204.49
PCT 1093_VZ1	9.19	3.45
PCT 649_VZ1	15.3	5.57
PCT 654_VZ1	2.39	1.95
PCT 727_VZ1	10.2	7.53

PCT Number	Survey Area Ha	Development Area ha
PCT 727_VZ2	2.79	1.25
PCT 727_VZ3	12.99	7.38
PCT 85_VZ1	4.69	1.73
PCT 951_VZ1	0.5	0.5
PCT 951_VZ2	7.61	2.34

Hunter Ecology

MAP C

Figure 3.2 Plant Community Types and Vegetation Zones

- PYWF_Site_Boundary_v2_01_20210727
- Survey Area
- Existing Roads
- PYWF_Substation_v2_04_20221115
- Development Footprint
- Drainage Lines

PCT_Vegetation_202212

- PCT 951_VZ1
- PCT 951_VZ2
- PCT 727_VZ1
- PCT 727_VZ2
- PCT 727_VZ3
- PCT 1093_VZ1
- PCT 649_VZ1
- PCT 654_VZ1
- PCT 85_VZ1
- Exotic Vegetation
- DAM

DATE : 05/12/2022
Map Version: 1.3

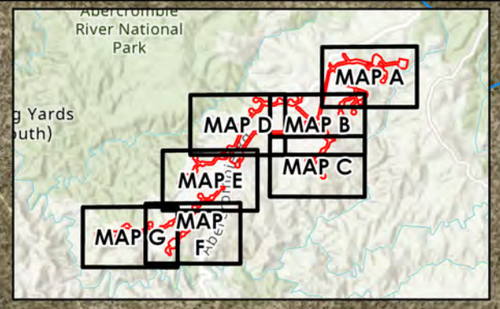
Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:12,000

PCT Number	Survey Area Ha	Development Area ha
DAM	1.45	1.03
Exotic Vegetation	425.32	204.49
PCT 1093_VZ1	9.19	3.45
PCT 649_VZ1	15.3	5.57
PCT 654_VZ1	2.39	1.95
PCT 727_VZ1	10.2	7.53

PCT Number	Survey Area Ha	Development Area ha
PCT 727_VZ2	2.79	1.25
PCT 727_VZ3	12.99	7.38
PCT 85_VZ1	4.69	1.73
PCT 951_VZ1	0.5	0.5
PCT 951_VZ2	7.61	2.34



Hunter Ecology

MAP D

Figure 3.2 Plant Community Types and Vegetation Zones

- PYWF_Site_Boundary_v2_01_20210727
- Survey Area
- Existing Roads
- PYWF_Substation_v2_04_20221115
- Development Footprint
- Drainage Lines

PCT_Vegetation_202212

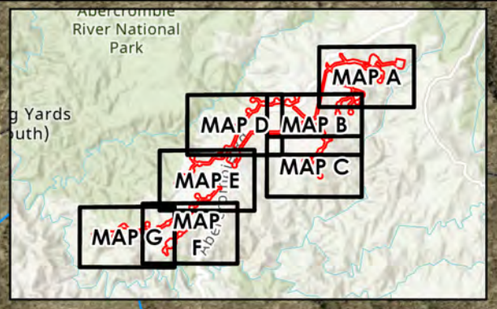
- PCT 951_VZ1
- PCT 951_VZ2
- PCT 727_VZ1
- PCT 727_VZ2
- PCT 727_VZ3
- PCT 1093_VZ1
- PCT 649_VZ1
- PCT 654_VZ1
- PCT 85_VZ1
- Exotic Vegetation
- DAM

DATE : 05/12/2022
Map Version: 1.3

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:12,000



PCT Number	Survey Area Ha	Development Area ha
DAM	1.45	1.03
Exotic Vegetation	425.32	204.49
PCT 1093_VZ1	9.19	3.45
PCT 649_VZ1	15.3	5.57
PCT 654_VZ1	2.39	1.95
PCT 727_VZ1	10.2	7.53

PCT Number	Survey Area Ha	Development Area ha
PCT 727_VZ2	2.79	1.25
PCT 727_VZ3	12.99	7.38
PCT 85_VZ1	4.69	1.73
PCT 951_VZ1	0.5	0.5
PCT 951_VZ2	7.61	2.34

Abercrombie Rd

BACK CREEK

OAKY CREEK

0 200 400 600 800 1,000 2,000 Meters

Hunter Ecology

MAP E

Figure 3.2 Plant Community Types and Vegetation Zones

- PYWF_Site_Boundary_v2_01_20210727
- Survey Area
- Existing Roads
- PYWF_Substation_v2_04_20221115
- Development Footprint
- Drainage Lines

PCT_Vegetation_202212

- PCT 951_VZ1
- PCT 951_VZ2
- PCT 727_VZ1
- PCT 727_VZ2
- PCT 727_VZ3
- PCT 1093_VZ1
- PCT 649_VZ1
- PCT 654_VZ1
- PCT 85_VZ1
- Exotic Vegetation
- DAM

DATE : 05/12/2022
Map Version: 1.3

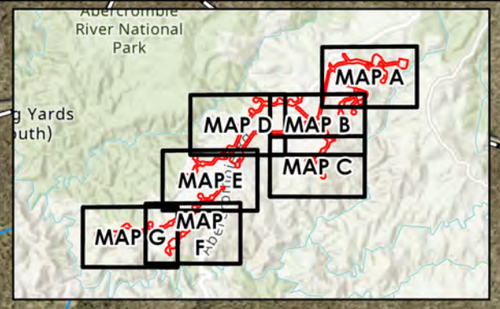
Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:12,000

PCT Number	Survey Area Ha	Development Area ha
DAM	1.45	1.03
Exotic Vegetation	425.32	204.49
PCT 1093_VZ1	9.19	3.45
PCT 649_VZ1	15.3	5.57
PCT 654_VZ1	2.39	1.95
PCT 727_VZ1	10.2	7.53

PCT Number	Survey Area Ha	Development Area ha
PCT 727_VZ2	2.79	1.25
PCT 727_VZ3	12.99	7.38
PCT 85_VZ1	4.69	1.73
PCT 951_VZ1	0.5	0.5
PCT 951_VZ2	7.61	2.34



Hunter Ecology

MAP F

Figure 3.2 Plant Community Types and Vegetation Zones

PYWF_Site_Boundary_v2_01_20210727
Survey Area
Existing Roads
PYWF_Substation_v2_04_20221115
Development Footprint
Drainage Lines

PCT_Vegetation_202212
PCT 951_VZ1
PCT 951_VZ2
PCT 727_VZ1
PCT 727_VZ2
PCT 727_VZ3
PCT 1093_VZ1
PCT 649_VZ1
PCT 654_VZ1
PCT 85_VZ1
Exotic Vegetation
DAM

DATE : 05/12/2022
Map Version: 1.3

Aerial Imagery: NSW LPI Six Imagery 2019

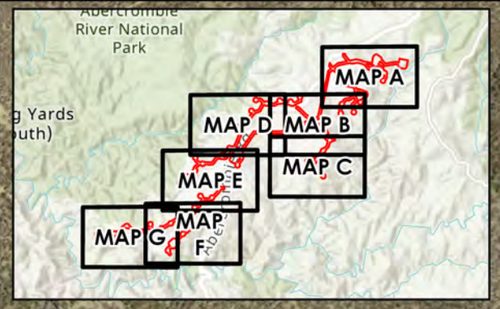
Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:12,000

0 200 400 600 800 1,000 2,000 Meters

PCT Number	Survey Area Ha	Development Area ha
DAM	1.45	1.03
Exotic Vegetation	425.32	204.49
PCT 1093_VZ1	9.19	3.45
PCT 649_VZ1	15.3	5.57
PCT 654_VZ1	2.39	1.95
PCT 727_VZ1	10.2	7.53

PCT Number	Survey Area Ha	Development Area ha
PCT 727_VZ2	2.79	1.25
PCT 727_VZ3	12.99	7.38
PCT 85_VZ1	4.69	1.73
PCT 951_VZ1	0.5	0.5
PCT 951_VZ2	7.61	2.34



Hunter Ecology

MAP G

Figure 3.2 Plant Community Types and Vegetation Zones

- PYWF_Site_Boundary_v2_01_20210727
- Survey Area
- Existing Roads
- PYWF_Substation_v2_04_20221115
- Development Footprint
- Drainage Lines

PCT_Vegetation_202212

- PCT 951_VZ1
- PCT 951_VZ2
- PCT 727_VZ1
- PCT 727_VZ2
- PCT 727_VZ3
- PCT 1093_VZ1
- PCT 649_VZ1
- PCT 654_VZ1
- PCT 85_VZ1
- Exotic Vegetation
- DAM

DATE : 05/12/2022
Map Version: 1.3

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:12,000

0 200 400 600 800 1,000 2,000 Meters

3.4 Vegetation Integrity Assessment

Table 3-6 details the vegetation integrity (VI) scores for each VZ.

Table 3-6: Vegetation Integrity Scores

VZ	Composition Score	Structure Condition Score	Function Condition Score	VI Score
85_1	32.6	35.6	89.8	**47.1**
649_1	34.8	63.4	49.7	**47.9**
654_1	4.5	36.2	45.3	**19.5**
727_1	41.4	59.5	99.1	**62.5**
727_2	18.9	49.9	41.8	**34**
727_3	12.9	18.1	5	**10.5**
951_1	34.6	73.8	76.3	**57.9**
951_2	23.3	75.3	42.4	**42.1**
1093_1	31.2	44.6	97.6	**51.4**

3.5 Exotic Vegetation

The cleared / grassland areas within the Survey Area were found to be overwhelmingly dominated by exotic species. Many of these areas had visibly been exposed to a long history of pasture improvement and contained cultivated pasture species, such as *Lolium perenne* (Rye Grass), *Hordeum sp.* (Barley Grass), *Poa annua* (Winter Grass), *Dactylis glomerata* (Cocksfoot), *Cenchrus clandestinus* (Kikuyu), *Paspalum dilatatum* (Paspalum), *Holcus lanatus* (Yorkshire Fog) and *Phalaris aquatica* (Phalaris). The north-eastern portion of the Survey Area (specifically 6055 Abercrombie Road, Lot 41 & 56 DP 753064, Lot 7, 15, 19, 34, 48 & 61 DP 753037) contained significant infestations of *Nassella trichotoma* (Serrated Tussock) and *Rubus fruticosus* (Blackberry). No native-dominant grasslands (derived or natural) were identified within the Survey Area. See the following photos of the exotic vegetation within the Survey Area.

Derived grassland dominated by exotic pasture grasses

Derived grassland dominated by *Nassella trichotoma* (Serrated Tussock) and *Rubus fruticosus* (Blackberry)

Derived grassland dominated by exotic pasture grasses and *Rubus fruticosus* (Blackberry)

4. THREATENED SPECIES

4.1 Habitat Assessment

A desktop review of previous reports and existing databases was undertaken. Databases searches included:

- Review of the threatened species ecological data contained in NSW BioNet.
- Review of threatened fauna and flora records within a 10 km radius of the subject site, contained in the NSW Energy and Science (EES) Atlas of NSW Wildlife (BioNet).
- Review of the Matters of National Environmental Significance (MNES) records within a 10 km radius of the subject site, using the Commonwealth Department of Agriculture, Water and the Environment (DAWE), EPBC Act Protected Matters Search Tool.
- Review of the NSW EES Threatened Species website https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species.
- Review of the Commonwealth DAWE Species Profile and Threats Database < http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl.

Field based assessments of the relative habitat values of the Survey Area were undertaken over several days (between 2-10 February 2021 and between 1-7 October 2021). The habitat assessment focused on the identification of habitat types and resources favoured by all major guilds of native flora and fauna, including threatened species known from the region. The assessment was based on specific habitat requirements regarding home range, feeding, roosting, breeding, movement patterns and corridor requirements. Consideration was given to contributing factors including topography, soil, light and hydrology. Any opportunistic observations of fauna utilising the Survey Area were recorded. This included sightings, calls or signs of fauna presence, such as scats, scratches, sap-feeding scars, diggings, nests, dreys, bones, hair, shed skins, tracks, burrows, chewed cones and feeding pellets. Signs were verified with reference to Triggs (2004).

Table 4-1 lists the threatened species (listed under the BC Act or EPBC Act) that have either been recorded within 10 km of the Survey Area (in the NSW BioNet Atlas) or are predicted to occur within 10 km of the site (in the EPBC Protected Matters Search Tool). **Table 4-2** provides details on the habitat features that were recorded in each VZ during field investigations. See **Figure 4-1** for locations of important habitat features.

Table 4-1: Threatened Species Recorded or Predicted to Occur within 10 km of the Site by a Search of the NSW BioNet Atlas and EPBC Protected Matters Search Tool

Threatened Species	BC Act Status*	EPBC Act Status*	Number of BioNet Records within 10 km of Site	Comments
PLANTS				
Acacia bynoeana Bynoe's wattle	E	V	No records	-
Diuris aequalis buttercup doubletail	E	E	No records	-
Dodonaea procumbens trailing hopbush	V	V	No records	-
Eucalyptus aggregata black gum	V	V	1	Record is approx. 8 km south of Subject Site (in Curraweela TSR, 19km North of Taralga on Oberon Road) and dates back to 1997.
Lepidium hyssopifolium basalt pepper-cress	E	E	No records	-
Leucochrysum albicans var. tricolor hoary sunray	-	E	1	Has been recorded approx. 10 km south-west of Subject Site, along Leighwood Road, north-east of Laggan, Upper Lachlan.
Rhizanthella slateri eastern underground orchid	V	E	No records	-
Senecio macrocarpus large-fruit fireweed	-	V	No records	-
Thesium australe austral toadflax	V	V	No records	-
Xerochrysum palustre swamp everlasting	-	V	No records	-
BIRDS				
Anthochaera phrygia regent honeyeater	E	CE	No records	-
Artamus cyanopterus cyanopterus dusky woodswallow	V	-	3	Records are within Wiarborough NR
Botaurus poiciloptilus Australasian bittern	E	E	No records	-
Calidris ferruginea curlew sandpiper	-	CE	No records	-

Threatened Species	BC Act Status*	EPBC Act Status*	Number of BioNet Records within 10 km of Site	Comments
Callocephalon fimbriatum gang-gang cockatoo	V	-	15	Several records in the area, mostly from Abercrombie NP and Wiarborough NP.
Climacteris picumnus victoriae brown treecreeper (eastern subspecies)	V	-	1	Record is within Abercrombie NP and dates back to 1998.
Daphoenositta chrysoptera varied sitella	V	-	7	Several records in the area, within Abercrombie NP and Wiarborough NR.
Falco hypoleucos grey falcon	E	V	No records	-
Glossopsitta pusilla little lorikeet	V	-	1	Record is in Abercrombie NP and dates back to 1998.
Grantiella picta painted honeyeater	V	V	No records	-
Hieraaetus morphnoides little eagle	V	-	1	Recorded in 2011, approx. 5 km east of Subject Site in open forest dominated by *Eucalyptus rossii*.
Hirundapus caudacutus white-throated needletail	-	V	4	Occasional records in the area, although the most recent is 2011.
Lathamus discolor swift parrot	E	CE	No records	-
Melithreptus gularis gularis black-chinned honeyeater (eastern subspecies)	V	-	1	Record is within Wiarborough NR, in scribbly gum open forest.
Ninox strenua powerful owl	V	-	17	Several records in the area, mostly from Abercrombie NP and Wiarborough NR.
Numenius madagascariensis eastern curlew	-	CE	No records	-
Petroica boodang scarlet robin	V	-	16	Several records in the area, mainly within Wiarborough NR and Abercrombie NP.
Petroica phoenicea flame robin	V	-	7	Several records in the area, mainly within Wiarborough NR and Abercrombie NP.
Polytelis swainsonii superb parrot	V	V	No records	-

Threatened Species	BC Act Status*	EPBC Act Status*	Number of BioNet Records within 10 km of Site	Comments
Stagonopleura guttata diamond firetail	V	-	1	Record dates back to 2009 and is approx. 10 km south-west of Subject Site.
MAMMALS				
Chalinolobus dwyeri large-eared pied bat	V	V	No records	-
Dasyurus maculatus spotted-tailed quoll	V	E	2	Was recorded in the Subject Site ('Paling Yards' property) in 1950. Was recorded more recently (2014) approx. 5 km south-west of Subject Site.
Falsistrellus tasmaniensis eastern false pipistrelle	V	-	9	Several records in the area, all of which are confined to Abercrombie NP and Wiarborough NR.
Miniopterus orianae oceanensis large bent-winged bat	V	-	4	Records are all confined to Abercrombie NP and Wiarborough NR.
Petauroides volans greater glider	-	V	40	High number of records in the area, although all are confined to deeply forested areas in Abercrombie NP and Wiarborough NR.
Petrogale penicillata brushtail rock wallaby	E	V	No records	-
Phascolarctos cinereus koala	V	V	4	There is one record from 1974 that is very close to the northern portion of the Subject Site. All other records are confined to Wiarborough NR.
Pseudomys novaehollandiae new holland mouse	-	V	No records	-
Pteropus poliocephalus grey-headed flying-fox	V	V	No records	-
Scoteanax rueppellii greater broad-nosed bat	V	-	1	Record is within Abercrombie NP.

Threatened Species	BC Act Status*	EPBC Act Status*	Number of BioNet Records within 10 km of Site	Comments
HERPETOFAUNA				
Aprasia parapulchella pink-tailed worm-lizard	V	V	No records	-
Heleioporus australiacus giant burrowing frog	V	V	No records	-
Litoria booroolongensis booroolong frog	E	E	2	Records are within Abercrombie River NP. Has not been recorded in the area since 1999.
Mixophyes balbus stuttering frog	E	V	6	Records are all from one location (near Mount Werong), 10 km north-east of Subject Site. Has not been recorded in the area since 2004.
Varanus rosenbergi Rosenberg's goanna	V	-	1	Record is 8 km south-east of Subject Site. Has not been recorded in the area since 1999.
INVERTEBRATES				
Paralucia spinifera Bathurst copper butterfly	E	V	No records	-
Synemon plana Golden Sun Moth	E	CE	No records	-

*** CE: Critically Endangered, E: Endangered, V: Vulnerable**

Table 4-2: Assessment of Habitat Features

Habitat Feature	Details
	VZ 649_1
Vegetation type, structure and condition	Open woodland with a grassy groundcover. Highly disturbed, with the understorey and groundcover being largely cleared and dominated heavily by pasture grasses, clover and weedy exotic species. High number of large, senescent trees with abundant hollows.
Presence of human disturbance, livestock or feral animals	Pasture improved and heavily grazed by sheep and cattle.
Nectar or fruit resources and perch sites	The canopy is sparse but mature and would provide nectar or fruit resources and perch sites for species that are adapted to open agricultural habitats.
Winter flowering eucalypt species	*Eucalyptus macrorhyncha* and *E. goniocalyx* may flower in winter.
Allocasuarina and Casuarina trees	No.
Proximity to water	Occurs near ephemeral drainage lines and farm dams.
Presence of sap feed trees for gliders	Yes - *Eucalyptus bridgesiana*. No glider incisions observed on any trees.
Presence of preferred Koala feed trees	*Eucalyptus bridgesiana, E. dives, E. goniocalyx* and *E. macrorhyncha* are listed as 'Koala use trees species' for the Central and Southern Tablelands Koala Management Area in the Koala SEPP 2021.
Hollow resources or other tree habitat features or large trees with basal cavities	Yes - high number of large, senescent trees with abundant hollows.
Wetlands, streams, rivers, dams or waterbodies with emergent vegetation	No.
Rocky outcrops, cliffs or caves, tunnels or disused mine shafts	No.

Bush rocks or logs	Occasional bush rocks and often abundant ground logs.
Humane made structures that may provide habitat	No.
	654_1
Vegetation type, structure and condition	Open woodland with a grassy groundcover. Highly disturbed, with the understorey and groundcover being largely cleared and dominated heavily by pasture grasses, clover and weedy exotic species. High number of large, senescent trees with abundant hollows.
Presence of human disturbance, livestock or feral animals	Pasture improved and heavily grazed by sheep and cattle.
Nectar or fruit resources and perch sites	The canopy is sparse but mature and would provide nectar or fruit resources and perch sites for species that are adapted to open agricultural habitats.
Winter flowering eucalypt species	*Eucalyptus melliodora* may flower at all times of the year.
Allocasuarina and Casuarina trees	No.
Proximity to water	Occurs along ephemeral drainage lines and near farm dams.
Presence of sap feed trees for glider species	Yes - *Eucalyptus bridgesiana*. No glider incisions observed on any trees.
Presence of preferred Koala feed trees	*Eucalyptus melliodora* and *E. bridgesiana* are listed as 'Koala use trees species' for the Central and Southern Tablelands Koala Management Area in the Koala SEPP 2021.
Hollow resources or other tree habitat features or large trees with basal cavities	Yes - high number of large, senescent trees with abundant hollows.
Wetlands, streams, rivers, dams or waterbodies with emergent vegetation	No.

Rocky outcrops, cliffs or caves, tunnels or disused mine shafts	No.
Bush rocks or logs	Occasional bush rocks and often abundant ground logs.
Humane made structures that may provide habitat	No.
	727_1
Vegetation type, structure and condition	Low open dry sclerophyll forest, with a sparse native shrub and ground layer.
Presence of human disturbance, livestock or feral animals	Livestock have access to this VZ and there is evidence of grazing and trampling impacts.
Nectar or fruit resources and perch sites	The canopy would provide nectar or fruit resources and perch sites for many species. Shrub layer is limited.
Winter flowering eucalypt species	*Eucalyptus macrorhyncha* and *E. goniocalyx* may flower in winter.
Allocasuarina and Casuarina trees	No.
Proximity to water	There are ephemeral drainage lines/creeks and farm dams nearby.
Presence of sap feed trees for glider species	There may be occasional *E. bridgesiana*. No glider incisions observed on any trees.
Presence of preferred Koala feed trees	*Eucalyptus bridgesiana, E. dives, E. goniocalyx*, *E. macrorhyncha* and *E. rossi* are listed as 'Koala use trees species' for the Central and Southern Tablelands Koala Management Area in the Koala SEPP 2021.
Hollow resources or other tree habitat features or large trees with basal cavities	Yes – the canopy contains mature trees with hollows; however, it is a low in height and hollows were observed to be relatively small in size.

Wetlands, streams, rivers, dams or waterbodies with emergent vegetation	No.
Rocky outcrops, cliffs or caves, tunnels or disused mine shafts	No.
Bush rocks or logs	Occasional bush rocks and often abundant ground logs.
Humane made structures that may provide habitat	No.
	727_2
Vegetation type, structure and condition	Consists of dense canopy regrowth (5-10 years old) of one species (*Eucalyptus macrorhyncha*). Shrub layer is absent and groundlayer is sparse. The soil is very compacted with little organic matter.
Presence of human disturbance, livestock or feral animals	Has been recently cleared. Livestock have access to this VZ.
Nectar or fruit resources and perch sites	Limited – the canopy is 5-10 years old, and the shrub layer is absent.
Winter flowering eucalypt species	*Eucalyptus macrorhyncha* may flower in winter.
Allocasuarina and Casuarina trees	No.
Proximity to water	There are ephemeral drainage lines/creeks and farm dams nearby.
Presence of sap feed trees for glider species	No.
Presence of preferred Koala feed trees	No – trees are too young.

Hollow resources or other tree habitat features or large trees with basal cavities	No.
Wetlands, streams, rivers, dams or waterbodies with emergent vegetation	No.
Rocky outcrops, cliffs or caves, tunnels or disused mine shafts	No.
Bush rocks or logs	No.
Humane made structures that may provide habitat	No.
	727_3
Vegetation type, structure and condition	Cleared canopy and a regrowth (<5 years old) shrub layer dominated almost by one native shrub species (Cassinia). The soil is very compacted with little organic matter. There is also an abundance of the High Threat Weed, *Nassella trichotoma*.
Presence of human disturbance, livestock or feral animals	Has been recently cleared. Livestock have access to this VZ.
Nectar or fruit resources and perch sites	Very limited – the canopy is <5 years old and the shrub layer is heavily dominated by only one shrub species (Cassinia).
Winter flowering eucalypt species	No.
Allocasuarina and Casuarina trees	No.
Proximity to water	There are ephemeral drainage lines/creeks and farm dams nearby.
Presence of sap feed trees for glider species	No.

Presence of preferred Koala feed trees	No – trees are too young.
Hollow resources or other tree habitat features or large trees with basal cavities	No.
Wetlands, streams, rivers, dams or waterbodies with emergent vegetation	No.
Rocky outcrops, cliffs or caves, tunnels or disused mine shafts	No.
Bush rocks or logs	No.
Humane made structures that may provide habitat	No.
951_1	
Vegetation type, structure and condition	Tall open wet sclerophyll forest, with a moderate to dense shrub layer.
Presence of human disturbance, livestock or feral animals	Livestock have access to this VZ and there is evidence of grazing and trampling impacts.
Nectar or fruit resources and perch sites	The canopy and shrub layer would provide nectar or fruit resources and perch sites for many species.
Winter flowering eucalypt species	*Acacia melanoxylon* and *Eucalyptus macrorhyncha* may flower in winter.
Allocasuarina and Casuarina trees	No.
Proximity to water	There are ephemeral drainage lines/creeks and farm dams nearby.

Presence of sap feed trees for glider species	Yes - *Eucalyptus viminalis*. No glider incisions observed on any trees.
Presence of preferred Koala feed trees	*Eucalyptus viminalis* and *E. macrorhyncha* are listed as 'Koala use trees species' for the Central and Southern Tablelands Koala Management Area in the Koala SEPP 2021.
Hollow resources or other tree habitat features or large trees with basal cavities	Yes – abundant large, hollow-bearing trees.
Wetlands, streams, rivers, dams or waterbodies with emergent vegetation	No.
Rocky outcrops, cliffs or caves, tunnels or disused mine shafts	No.
Bush rocks or logs	Occasional bush rocks and often abundant ground logs.
Humane made structures that may provide habitat	No.
	951_2
Vegetation type, structure and condition	Highly disturbed, with the understorey and groundcover being largely cleared and dominated heavily by pasture grasses, clover and weedy exotic species. High number of large, senescent trees with abundant hollows.
Presence of human disturbance, livestock or feral animals	Pasture improved and heavily grazed by sheep and cattle.
Nectar or fruit resources and perch sites	The canopy is sparse but mature and would provide nectar or fruit resources and perch sites for species that are adapted to open agricultural habitats.
Winter flowering eucalypt species	No.
Allocasuarina and Casuarina trees	No.

Proximity to water	There are ephemeral drainage lines/creeks and farm dams nearby.
Presence of sap feed trees for glider species	Yes - *Eucalyptus viminalis*. No glider incisions observed on any trees.
Presence of preferred Koala feed trees	*Eucalyptus viminalis* is listed as 'Koala use trees species' for the Central and Southern Tablelands Koala Management Area in the Koala SEPP 2021.
Hollow resources or other tree habitat features or large trees with basal cavities	Yes – abundant large, hollow-bearing trees.
Wetlands, streams, rivers, dams or waterbodies with emergent vegetation	No.
Rocky outcrops, cliffs or caves, tunnels or disused mine shafts	No.
Bush rocks or logs	Occasional bush rocks and often abundant ground logs.
Humane made structures that may provide habitat	No.
	1093_1
Vegetation type, structure and condition	Low open dry sclerophyll forest, with a sparse native shrub and ground layer.
Presence of human disturbance, livestock or feral animals	Livestock have access to this VZ and there is evidence of grazing and trampling impacts.
Nectar or fruit resources and perch sites	The canopy would provide nectar or fruit resources and perch sites for many species. Shrub layer is limited.
Winter flowering eucalypt species	*Eucalyptus macrorhyncha* and *E. goniocalyx* may flower in winter.

Allocasuarina and Casuarina trees	No.
Proximity to water	There are ephemeral drainage lines/creeks and farm dams nearby.
Presence of sap feed trees for glider species	There may be occasional *E. bridgesiana*. No glider incisions observed on any trees.
Presence of preferred Koala feed trees	*Eucalyptus rossi, E. dives, E. goniocalyx* and *E. macrorhyncha* are listed as 'Koala use trees species' for the Central and Southern Tablelands Koala Management Area in the Koala SEPP 2021.
Hollow resources or other tree habitat features or large trees with basal cavities	Yes – the canopy contains mature trees with hollows; however, it is a low in height and hollows were observed to be relatively small in size.
Wetlands, streams, rivers, dams or waterbodies with emergent vegetation	No.
Rocky outcrop, cliffs or caves, tunnels or disused mine shafts	No.
Bush rocks or logs	Occasional bush rocks and often abundant ground logs.
Humane made structures that may provide habitat	No.

Large hollow in *Eucalyptus viminalis* tree (951_1)

Exotic groundcover and absent shrub layer (649_1)

Open forest, shrubby understorey (951_1)

Blackberry and Willow infestation (85_1)

Ground timber (649_1)

Exotic groundcover and absent shrub layer (951_2)

Open forest with ground timber and sparse understorey (727_1)

Regrowth canopy (727_2)

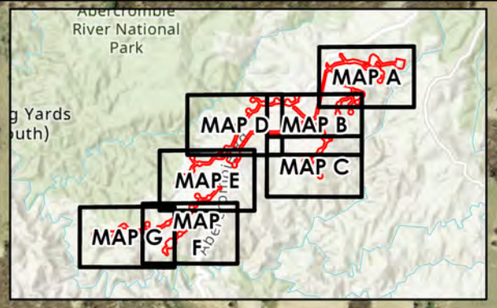
Farm dam (727_3)

Open forest with ground timber and sparse understorey (1093_1)

Medium-small hollow (1093_1)

Exotic groundcover and absent shrub layer (654_1)

Riparian habitat (85_1)



Habitat Type	Survey Area	Development Footprint
DAM (ha)	1.5	1
Exotic Vegetation (ha)	425.3	204.5
Native Vegetation (ha)	65.4	31.7
hollow bearing tree (no.)	409	189

Hunter Ecology

MAP A

Figure 4.1: Habitat Features

- PYWF_Site_Boundary_v2_01_20210727
- Survey Area
- Hollow-bearing tree
- Existing Roads
- Drainage Lines
- Development Footprint
- PYWF_Substation_v2_04_20221115

PCT_Vegetation_202212

- PCT 951_VZ1
- PCT 951_VZ2
- PCT 727_VZ1
- PCT 727_VZ2
- PCT 727_VZ3
- PCT 1093_VZ1
- PCT 649_VZ1
- PCT 654_VZ1
- PCT 85_VZ1
- Exotic Vegetation
- DAM

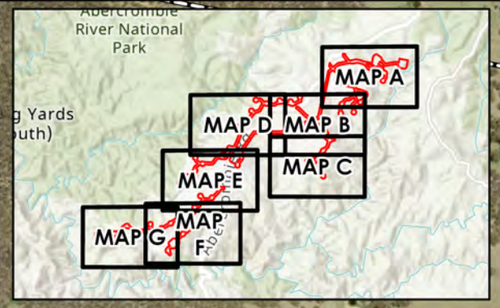
DATE : 05/12/2022
Map Version: 1.3

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:12,000

Habitat Type	Survey Area	Development Footprint
DAM (ha)	1.5	1
Exotic Vegetation (ha)	425.3	204.5
Native Vegetation (ha)	65.4	31.7
hollow bearing tree (no.)	409	189



Abercrombie Rd

0 200 400 600 800 1,000 2,000 Meters

Hunter Ecology

MAP B

Figure 4.1: Habitat Features

- PYWF_Site_Boundary_v2_01_20210727
- Survey Area
- Hollow-bearing tree
- Existing Roads
- Drainage Lines
- Development Footprint
- PYWF_Substation_v2_04_20221115

PCT_Vegetation_202212

- PCT 951_VZ1
- PCT 951_VZ2
- PCT 727_VZ1
- PCT 727_VZ2
- PCT 727_VZ3
- PCT 1093_VZ1
- PCT 649_VZ1
- PCT 654_VZ1
- PCT 85_VZ1
- Exotic Vegetation
- DAM

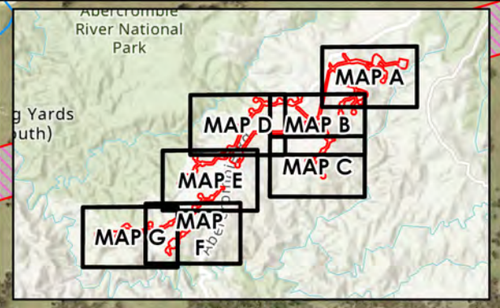
DATE : 05/12/2022
Map Version: 1.3

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:12,000

Habitat Type	Survey Area	Development Footprint
DAM (ha)	1.5	1
Exotic Vegetation (ha)	425.3	204.5
Native Vegetation (ha)	65.4	31.7
hollow bearing tree (no.)	409	189



Hunter Ecology

MAP C

Figure 4.1: Habitat Features

- PYWF_Site_Boundary_v2_01_20210727
- Survey Area
- Hollow-bearing tree
- Existing Roads
- Drainage Lines
- Development Footprint
- PYWF_Substation_v2_04_20221115

PCT_Vegetation_202212

- PCT 951_VZ1
- PCT 951_VZ2
- PCT 727_VZ1
- PCT 727_VZ2
- PCT 727_VZ3
- PCT 1093_VZ1
- PCT 649_VZ1
- PCT 654_VZ1
- PCT 85_VZ1
- Exotic Vegetation
- DAM

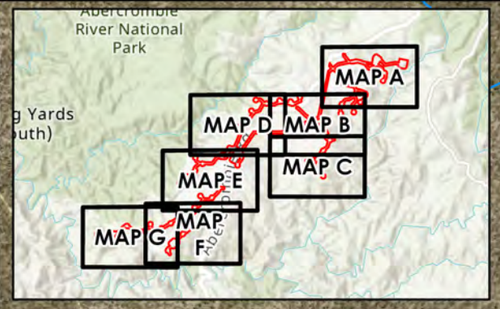
DATE : 05/12/2022
Map Version: 1.3

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:12,000

Habitat Type	Survey Area	Development Footprint
DAM (ha)	1.5	1
Exotic Vegetation (ha)	425.3	204.5
Native Vegetation (ha)	65.4	31.7
hollow bearing tree (no.)	409	189



Hunter Ecology

MAP D

Figure 4.1: Habitat Features

- PYWF_Site_Boundary_v2_01_20210727
- Survey Area
- Hollow-bearing tree
- Existing Roads
- Drainage Lines
- Development Footprint
- PYWF_Substation_v2_04_20221115

PCT_Vegetation_202212

- PCT 951_VZ1
- PCT 951_VZ2
- PCT 727_VZ1
- PCT 727_VZ2
- PCT 727_VZ3
- PCT 1093_VZ1
- PCT 649_VZ1
- PCT 654_VZ1
- PCT 85_VZ1
- Exotic Vegetation
- DAM

DATE : 05/12/2022
Map Version: 1.3

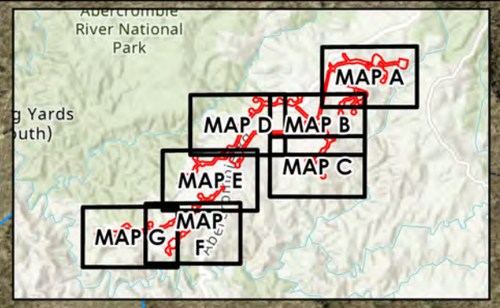
Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:12,000

0 200 400 600 800 1,000 2,000 Meters

Habitat Type	Survey Area	Development Footprint
DAM (ha)	1.5	1
Exotic Vegetation (ha)	425.3	204.5
Native Vegetation (ha)	65.4	31.7
hollow bearing tree (no.)	409	189



Abercrombie Rd

BACK CREEK

0 200 400 600 800 1,000 2,000 Meters

Hunter Ecology

MAP E

Figure 4.1: Habitat Features

- PYWF_Site_Boundary_v2_01_20210727
- Survey Area
- Hollow-bearing tree
- Existing Roads
- Drainage Lines
- Development Footprint
- PYWF_Substation_v2_04_20221115

PCT_Vegetation_202212

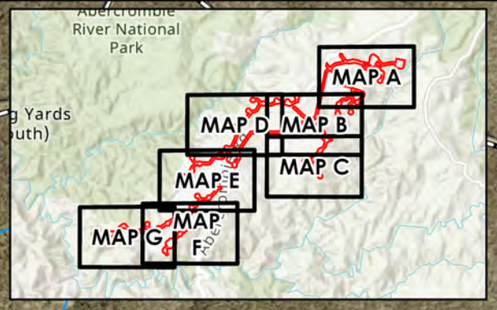
- PCT 951_VZ1
- PCT 951_VZ2
- PCT 727_VZ1
- PCT 727_VZ2
- PCT 727_VZ3
- PCT 1093_VZ1
- PCT 649_VZ1
- PCT 654_VZ1
- PCT 85_VZ1
- Exotic Vegetation
- DAM

DATE : 05/12/2022
Map Version: 1.3

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:12,000



Habitat Type	Survey Area	Development Footprint
DAM (ha)	1.5	1
Exotic Vegetation (ha)	425.3	204.5
Native Vegetation (ha)	65.4	31.7
hollow bearing tree (no.)	409	189

Hunter Ecology

MAP F

Figure 4.1: Habitat Features

- PYWF_Site_Boundary_v2_01_20210727
- Survey Area
- Hollow-bearing tree
- Existing Roads
- Drainage Lines
- Development Footprint
- PYWF_Substation_v2_04_20221115

PCT_Vegetation_202212

- PCT 951_VZ1
- PCT 951_VZ2
- PCT 727_VZ1
- PCT 727_VZ2
- PCT 727_VZ3
- PCT 1093_VZ1
- PCT 649_VZ1
- PCT 654_VZ1
- PCT 85_VZ1
- Exotic Vegetation
- DAM

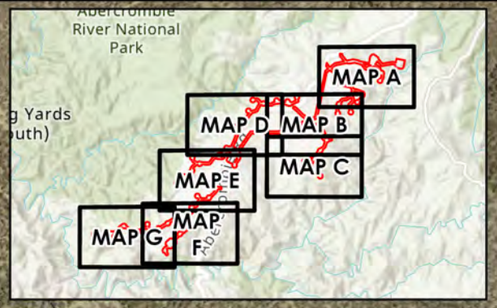
DATE : 05/12/2022
Map Version: 1.3

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:12,000

0 200 400 600 800 1,000 2,000 Meters



Habitat Type	Survey Area	Development Footprint
DAM (ha)	1.5	1
Exotic Vegetation (ha)	425.3	204.5
Native Vegetation (ha)	65.4	31.7
hollow bearing tree (no.)	409	189

Hunter Ecology

MAP G

Figure 4.1: Habitat Features

PYWF_Site_Boundary_v2_01_20210727
Survey Area
Hollow-bearing tree
Existing Roads
Drainage Lines
Development Footprint
PYWF_Substation_v2_04_20221115

PCT_Vegetation_202212
PCT 951_VZ1
PCT 951_VZ2
PCT 727_VZ1
PCT 727_VZ2
PCT 727_VZ3
PCT 1093_VZ1
PCT 649_VZ1
PCT 654_VZ1
PCT 85_VZ1
Exotic Vegetation
DAM

DATE : 05/12/2022
Map Version: 1.3

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:12,000

0 200 400 600 800 1,000 2,000 Meters

4.2 Ecosystem Credit Species

Ecosystem credit species are those where the likelihood of occurrence of the species or elements of the species' habitat, can be predicted by vegetation surrogates and landscape features, or for which targeted survey has a low probability of detection. Targeted survey is not required for ecosystem credit species. The Threatened Biodiversity Data Collection (TBCD) has identified several ecosystem credit species as requiring assessment, for the Project; these are listed in **Table 4-3**.

Table 4-3: Habitat Suitability for Ecosystem Credit Species

Ecosystem Credit Species	Habitat Constraints / Geographic Limitations	Confirmed predicted species
Anthochaera phrygia Regent Honeyeater (Foraging)	Nil	Yes – 85_1, 654_1, 1093_1, 649_1
Artamus cyanopterus cyanopterus Dusky Woodswallow	Nil	Yes – 85_1, 654_1, 727_1, 727_2, 727_3, 1093_1, 951_1, 951_2, 649_1
Callocephalon fimbriatum Gang-gang Cockatoo (Foraging)	Nil	Yes – 85_1, 654_1, 727_1, 727_2, 727_3, 1093_1, 951_1, 951_2, 649_1
Calyptorhynchus lathami Glossy Black-Cockatoo (Foraging)	Presence of Allocasuarina and casuarina species	Yes – 1093_1, 649_1
Chthonicola sagittata Speckled Warbler	Nil	Yes – 85_1, 654_1, 727_1, 727_2, 727_3, 1093_1, 649_1
Circus assimilis Spotted Harrier	Nil	Yes – 85_1
Climacteris picumnus victoriae Brown Treecreeper (eastern subspecies)	Nil	Yes – 85_1, 654_1, 727_1, 727_2, 727_3, 1093_1, 951_1, 951_2, 649_1
Daphoenositta chrysoptera Varied Sittella	Nil	Yes – 85_1, 654_1, 727_1, 727_2, 727_3, 1093_1, 951_1, 951_2, 649_1
Dasyurus maculatus Spotted-tailed Quoll	Nil	Yes – 85_1, 654_1, 727_1, 727_2, 727_3, 1093_1, 951_1, 951_2, 649_1
Falsistrellus tasmaniensis Eastern False Pipistrelle	Nil	Yes – 654_1, 1093_1, 951_1, 951_2, 649_1

Glossopsitta pusilla Little Lorikeet	Nil	Yes – 85_1, 654_1, 1093_1, 649_1
Grantiella picta Painted Honeyeater	Mistletoes present at a density of greater than five mistletoes per hectare	Yes – 85_1, 654_1, 727_1, 727_2, 727_3, 1093_1, 649_1
Haliaeetus leucogaster White-bellied Sea-Eagle (Foraging)	Waterbodies Within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines	Yes – 85_1
Hieraaetus morphnoides Little Eagle (Foraging)	Nil	Yes – 85_1, 654_1, 727_1, 727_2, 727_3, 1093_1, 951_1, 951_2, 649_1
Hirundapus caudacutus White-throated Needletail	Nil	Yes – 85_1, 654_1, 727_1, 727_2, 727_3, 1093_1, 951_1, 951_2, 649_1
Lathamus discolor Swift Parrot (foraging)	Nil	Yes – 85_1, 654_1, 727_1, 727_2, 727_3, 1093_1, 951_1, 951_2, 649_1
Melanodryas cucullata cucullata Hooded Robin (south-eastern form)	Nil	Yes – 85_1, 654_1, 1093_1, 649_1
Melithreptus gularis gularis Black-chinned Honeyeater (eastern subspecies)	Nil	Yes – 85_1, 654_1, 649_1
Miniopterus orianae oceanensis Large Bent-winged Bat (Foraging)	Nil	Yes – 85_1, 654_1, 727_1, 727_2, 727_3, 1093_1, 951_1, 951_2, 649_1
Ninox strenua Powerful Owl (Foraging)	Nil	Yes – 654_1, 727_1, 727_2, 727_3, 1093_1, 951_1, 951_2, 649_1
Petaurus australis Yellow-bellied Glider	Hollow bearing trees Hollows > 25cm diameter	Yes – 654_1, 1093_1, 951_1, 951_2, 649_1
Petroica boodang Scarlet Robin	Nil	Yes – 85_1, 654_1, 727_1, 727_2, 727_3, 1093_1, 951_1, 951_2, 649_1
Petroica phoenicea Flame Robin	Nil	Yes – 85_1, 654_1, 727_1, 727_2, 727_3, 1093_1, 951_1, 951_2, 649_1
Phascolarctos cinereus Koala (Foraging)	Nil	Yes – 85_1, 654_1, 727_1, 727_2, 727_3, 1093_1, 951_1, 951_2, 649_1

Polytelis swainsonii Superb Parrot (Foraging)	Nil	Yes – 85_1, 654_1
Pteropus poliocephalus Grey-headed Flying-fox (Foraging)	Nil	Yes – 654_1, 1093_1, 649_1
Scoteanax rueppellii Greater Broad-nosed Bat	Nil	Yes – 1093_1, 951_1, 951_2, 649_1
Stagonopleura guttata Diamond Firetail	Nil	Yes - 85_1, 654_1, 727_1, 727_2, 727_3, 1093_1, 649_1
Suta flagellum Little Whip Snake	Nil	Yes – 654_1
Varanus rosenbergi Rosenberg's Goanna	Nil	Yes – 654_1, 727_1, 727_2, 727_3, 1093_1, 649_1

4.3 Species Credit Species

Species credit species are threatened species for which vegetation surrogates and/or landscape features cannot reliably predict the likelihood of their occurrence or components of their habitat. These species are identified in the TBDC. A targeted survey or an expert report is required to confirm the presence of these species on the Subject Site. Alternatively, for a development activity, clearing or biodiversity certification proposal, the proponent may elect to assume the species is present. The assessor must identify the species assessed for species credits in conjunction with information about the site context of the subject land, information about PCTs and attributes and data from the TBDC. **Table 4-4** lists the species credit species identified as requiring assessment and also includes an assessment of the habitat suitability for each species credit species, in accordance with the BAM.

Table 4-4: Habitat Suitability for Species Credit Species

Species Credit Species	Habitat Constraints / Geographic Limitations	Confirmed Candidate Species	Justification
Acacia bynoeana Bynoe's Wattle	Nil	Yes	NA
Ammobium craspedioides Yass Daisy	Nil	Yes	NA
Anthochaera phrygia Regent Honeyeater (breeding)	As per mapped areas **X**	No	**Habitat constraints not present:** Subject Land does not occur within a 'mapped important area'.

Aprasia parapulchella Pink-tailed Legless Lizard	• Rocky areas • Or within 50m of rocky areas • South of Grabben Gullen	No	**Does not occur within geographic limitations:** The Subject Land is north of Grabben Gullen.
Callocephalon fimbriatum Gang-gang Cockatoo (breeding)	• Hollow bearing trees • Eucalypt tree species with hollows greater than 9 cm diameter	Yes	NA
Calyptorhynchus lathami Glossy Black-Cockatoo (breeding)	• Hollow bearing trees • Living or dead tree with hollows greater than 15cm diameter and greater than 8m above ground	Yes	NA
Cercartetus nanus Eastern Pygmy-possum	Nil	Yes	NA
Diuris aequalis Buttercup Doubletail	Nil	Yes	NA
Eucalyptus aggregata Black Gum	Nil	Yes	NA
Eucalyptus robertsonii subsp. hemisphaerica Robertson's Peppermint	Nil	Yes	NA
Haliaeetus leucogaster White-bellied Sea-Eagle (breeding)	• Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines	Yes	NA
Heleioporus australiacus Giant Burrowing Frog	Nil	Yes	NA
Hieraaetus morphnoides Little Eagle (breeding)	• Nest trees - live (occasionally dead) large old trees within vegetation	Yes	NA
Keyacris scurra Key's Matchstick Grasshopper	Nil	Yes	NA
Lathamus discolor Swift Parrot (breeding)	• As per mapped areas	No	**Habitat constraints not present:** The Subject Site is not within a 'mapped important area'.
Lepidium hyssopifolium Aromatic Peppercress	Nil	Yes	NA

Leucochrysum albicans var. tricolor Hoary Sunray	Nil	Yes	NA
Litoria aurea Green and Golden Bell Frog	• Semi-permanent/ephemeral wet areas • Within 1km of wet areas|Swamps • Within 1km of swamp|Waterbodies • Within 1km of waterbody	Yes	NA
Litoria booroolongensis Booroolong Frog	Nil	Yes	NA
Litoria castanea Yellow-spotted Tree Frog	Nil	Yes	NA
Miniopterus schreibersii oceanensis Large Bentwing-bat (breeding)	• Caves • 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	No	**Habitat constraints not present:** The study area does not contain the breeding habitat constraints for this species.
Mixophyes balbus Stuttering Frog	Nil	Yes	NA
Ninox strenua Powerful Owl (breeding)	• Hollow bearing trees • Living or dead trees with hollow greater than 20cm diameter	Yes	NA
Petauroides volans Greater Glider	• Hollow bearing trees	Yes	NA
Petaurus norfolcensis Squirrel Glider	Nil	Yes	NA
Phascolarctos cinereus Koala (breeding)	• Areas identified via survey as important habitat	Yes	NA
Polytelis swainsonii Superb Parrot (breeding)	• Hollow bearing trees • Living or dead E. blakelyi, E. melliodora, E. albens, E. camaldulensis, E. microcarpa,	Yes	NA

	E. polyanthemos, E. mannifera, E. intertexta with hollows greater than 5cm diameter • greater than 4m above ground or trees with a DBH of greater than 30cm		
Pteropus poliocephalus Grey-headed Flying-fox (breeding)	• Breeding camps	Yes	NA

4.3.1 Determining the Presence or Absence of Confirmed Candidate Species Credit Species

Targeted surveys have been undertaken for the confirmed candidate species credit species identified in previous **Table 4-4**. Requirements for targeted surveys include the survey months specified in the BAM Calculator, as well as the survey effort and methods described in the TBDC and relevant survey guidelines published by the Commonwealth and NSW governments. Where no relevant published guidelines exist, the species survey requirements are based on best practice methods that can be replicated for repeat surveys.

Targeted surveys for candidate species credit species were undertaken within any areas of suitable habitat in the Survey Area. **Note**, some survey locations occur outside the Survey Area depicted in **Figure 4-2**. This is because since they were undertaken, the Project layout has been modified to reduce native vegetation clearing (as discussed in Section 5-1). These survey locations are still representative of the relevant habitats within the Survey Area. **Table 4-5** provides the survey dates and weather conditions, and **Table 4-6** provides a summary of survey details, methods and results for each candidate species credit species. **Figure 4-2** depicts the survey effort. See **Appendix C** for the recorded species list and **Appendix D** for camera trapping images.

Table 4-5: Field Survey Dates and Weather Conditions

Date	Survey	Temp. Range	Wind	Cloud Cover	Rain
2/2/2021	Hollow / nest searches, Bird Utilisation Surveys (BUS), targeted flora surveys, arboreal camera trapping, nocturnal spotlighting and stag watching, call playback, frog surveys (nocturnal aural-visual surveys, call playback and tadpole searches), bat call detection (Anabat), flying fox colony/camp searches, Koala Spot Assessment Technique (SAT) surveys, opportunistic diurnal observations, habitat assessment.	12-24°C	Moderate-high	Cloudy	31 mm
3/2/2021	Hollow / nest searches, BUS, targeted flora surveys, arboreal camera trapping, nocturnal spotlighting and stag watching, call playback, frog surveys (nocturnal aural-visual surveys, call playback and tadpole searches), bat call detection (Anabat), flying fox colony/camp searches, Koala SAT surveys, opportunistic diurnal observations, habitat assessment.	11-23°C	Moderate-high	Moderate	0.2 mm
4/2/2021	Hollow / nest searches, BUS, targeted flora surveys, arboreal camera trapping, nocturnal spotlighting and stag watching, call playback, frog surveys (nocturnal aural-visual surveys, call playback and tadpole searches), bat call detection (Anabat), flying fox colony/camp searches, Koala SAT surveys, opportunistic diurnal observations, habitat assessment.	12-25.5°C	Calm	Clear	0 mm
5/2/2021	Hollow / nest searches, BUS, targeted flora surveys, arboreal camera trapping, nocturnal spotlighting and stag watching, call playback, frog surveys (nocturnal aural-visual surveys, call playback and tadpole searches), bat call detection (Anabat), flying fox colony/camp searches, Koala SAT surveys, opportunistic diurnal observations, habitat assessment.	16-25.5°C	Calm	Cloudy	3 mm
6/2/2021	Hollow / nest searches, BUS, targeted flora surveys, arboreal camera trapping, nocturnal spotlighting and stag watching, call playback, frog surveys (nocturnal aural-visual surveys, call playback and tadpole searches), bat call detection (Anabat), flying fox colony/camp searches, Koala SAT surveys, opportunistic diurnal observations, habitat assessment.	18-27°C	Moderate	Cloudy	0.2 mm
7/2/2021	Hollow / nest searches, BUS, targeted flora surveys, arboreal camera trapping, nocturnal spotlighting and stag watching, call playback, frog surveys (nocturnal aural-visual surveys, call playback and tadpole searches), bat call detection (Anabat), flying fox colony/camp searches, Koala SAT surveys, opportunistic diurnal observations, habitat assessment.	10-25.5°C	Moderate	Cloudy	21 mm
8/2/2021	Hollow / nest searches, BUS, targeted flora surveys, arboreal camera trapping, nocturnal spotlighting and stag watching, call playback, frog surveys (nocturnal aural-visual surveys, call playback and tadpole searches), bat call detection (Anabat), flying fox colony/camp searches, Koala SAT surveys, opportunistic diurnal observations, habitat assessment.	11.5-21.5°C	Moderate-high	Cloudy	0 mm
9/2/2021	Hollow / nest searches, BUS, targeted flora surveys, arboreal camera trapping, nocturnal spotlighting and stag watching, call playback, frog surveys (nocturnal aural-visual surveys, call playback and tadpole searches), bat call detection (Anabat), flying fox colony/camp searches, Koala SAT surveys, opportunistic diurnal observations, habitat assessment.	13.5-28.2°C	Moderate-high	Cloudy	0 mm

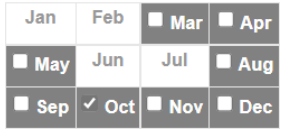
10/2/2021	Hollow / nest searches, BUS, targeted flora surveys, arboreal camera trapping, nocturnal spotlighting and stag watching, call playback, frog surveys (nocturnal aural-visual surveys, call playback and tadpole searches), flying fox colony/camp searches, Koala SAT surveys, opportunistic diurnal observations, habitat assessment.	8.5-22°C	Calm-moderate	Cloudy	0 mm
1/10/2021	Hollow / nest searches, BUS, targeted flora surveys, nocturnal spotlighting and stag watching, call playback, frog surveys (nocturnal aural-visual surveys, call playback and tadpole searches), flying fox colony/camp searches, Koala SAT surveys, opportunistic diurnal observations, habitat assessment.	5-22.5°C	Moderate	Cloudy	19 mm
2/10/2021	Hollow / nest searches, BUS, targeted flora surveys, nocturnal spotlighting and stag watching, call playback, frog surveys (nocturnal aural-visual surveys, call playback and tadpole searches), flying fox colony/camp searches, Koala SAT surveys, opportunistic diurnal observations, habitat assessment.	7-17.2°C	Moderate	Moderate	0.5 mm
3/10/2021	Hollow / nest searches, BUS, targeted flora surveys, nocturnal spotlighting and stag watching, call playback, frog surveys (nocturnal aural-visual surveys, call playback and tadpole searches), flying fox colony/camp searches, Koala SAT surveys, opportunistic diurnal observations, habitat assessment.	7-17°C	Moderate	Moderate	3 mm
4/10/2021	Hollow / nest searches, BUS, targeted flora surveys, nocturnal spotlighting and stag watching, call playback, frog surveys (nocturnal aural-visual surveys, call playback and tadpole searches), flying fox colony/camp searches, Koala SAT surveys, opportunistic diurnal observations, habitat assessment.	5-16°C	Calm	Clear	None
5/10/2021	Hollow / nest searches, BUS, targeted flora surveys, nocturnal spotlighting and stag watching, call playback, frog surveys (nocturnal aural-visual surveys, call playback and tadpole searches), flying fox colony/camp searches, Koala SAT surveys, opportunistic diurnal observations, habitat assessment.	4-12.5°C	Moderate-high	Cloudy	2 mm
6/10/2021	Hollow / nest searches, BUS, targeted flora surveys, nocturnal spotlighting and stag watching, call playback, frog surveys (nocturnal aural-visual surveys, call playback and tadpole searches), flying fox colony/camp searches, Koala SAT surveys, opportunistic diurnal observations, habitat assessment.	1-17.5°C	Moderate	Clear	None
7/10/2021	Hollow / nest searches, BUS, targeted flora surveys, nocturnal spotlighting and stag watching, call playback, frog surveys (nocturnal aural-visual surveys, call playback and tadpole searches), flying fox colony/camp searches, Koala SAT surveys, opportunistic diurnal observations, habitat assessment.	2.5-21°C	Moderate	Clear	None

Table 4-6: Survey Details and Results for Candidate Species Credit Species

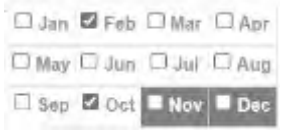
Species Credit Species	Survey Months Specified in the BAM Calculator	Survey Dates	Survey Methods and Effort	Relevant Survey Guidelines	Survey Result
Acacia bynoeana Bynoe's Wattle		2-10 February 2021 1-7 October 2021	Parallel field traverse (max. 10 m between transects) in all areas of suitable habitat.	*Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment Method* (EES, 2016). *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004).	Confirmed to be not present. **EXCLUDED**
Ammobium craspedioides Yass Daisy		1-7 October 2021	Parallel field traverse (max. 5-10 m between transects), in all areas of suitable habitat.	*Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment Method* (EES, 2016). *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004).	Confirmed to be not present. **EXCLUDED**
Callocephalon fimbriatum Gang-gang Cockatoo (breeding)		1-7 October 2021	Hollow / nest searches – all areas of suitable habitat were traversed to search for suitable hollows. Any suitable hollows were examined for evidence of use. BUS – 20-24 fixed observation points placed throughout development footprint. Each observation point monitored for 20 minutes, during this time any bird observations recorded, including	*Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004).	Breeding hollow recorded in VZ 951_1. **INCLUDED**

			species and abundance, as well as flight height and distance from the observation point. Opportunistic diurnal observations – Effort was made during all site visits to lookout for any evidence or sightings.		
Calyptorhynchus lathami Glossy Black-Cockatoo (breeding)		2-10 February 2021	Hollow / nest searches – all areas of suitable habitat were traversed to search for suitable hollows. Any suitable hollows were examined for evidence of use. BUS – 20-24 fixed observation points placed throughout development footprint. Each observation point monitored for 20 minutes, during this time any bird observations recorded, including species and abundance, as well as flight height and distance from the observation point. Opportunistic diurnal observations – Effort was made during all site visits to lookout for any evidence or sightings.	*Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004).	Confirmed to be not present. **EXCLUDED**
Cercartetus nanus Eastern Pygmy-possum		2-10 February 2021 1-7 October 2021	Arboreal camera trapping – A total of 8 Swift Enduro camera traps were installed within trees across the site (Feb 2021), to target arboreal fauna. Baits (using oats, honey and peanut butter) were installed to attract fauna. Camera traps were left onsite for 8 days/nights. Nocturnal spotlighting – 8 consecutive nights (Feb 2021) and 7 consecutive nights (Oct 2021), 2 hours and 2-3 ecologists each night. Portions of the site each night were traversed on foot via random meander and effort was made to cover all areas of	*Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004). *Survey Guidelines for Australia's Threatened Mammals* (DSWP&C, 2011).	Confirmed to be not present. **EXCLUDED**

			potential habitat on each night. Stag watching was also undertaken during spotlighting.		
Diuris aequalis Buttercup Doubletail		1-7 October 2021	Parallel field traverse (max. 5-10 m between transects), in all areas of suitable habitat.	*Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment Method* (EES, 2016). *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004).	Confirmed to be not present. **EXCLUDED**
Eucalyptus aggregata Black Gum		2-10 February 2021 1-7 October 2021	Parallel field traverse (max. 20 m between transects) in all areas of suitable habitat.	*Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004).	Confirmed to be not present. **EXCLUDED**
Eucalyptus robertsonii subsp. hemisphaerica Robertson's Peppermint		2-10 February 2021 1-7 October 2021	Parallel field traverse (max. 20 m between transects) in all areas of suitable habitat.	*Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004).	Confirmed to be not present. **EXCLUDED**
Haliaeetus leucogaster White-bellied Sea-Eagle (breeding)		1-7 October 2021	Nest searches – canopy trees across the site were searched for the presence of nests (binoculars were used where required). BUS – 20-24 fixed observation points placed throughout development footprint. Each observation point monitored for 20 minutes, during this time any bird observations recorded, including species and abundance, as well as flight height and distance from the observation point.	*Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004).	Confirmed to be not present. **EXCLUDED**

			Opportunistic diurnal observations – Effort was made during all site visits to lookout for any evidence or sightings.		
Heleioporus australiacus Giant Burrowing Frog		2-10 February 2021 1-7 October 2021	Nocturnal aural-visual surveys, call playback and tadpole searches – undertaken in all areas of suitable habitat and 7 consecutive nights (Oct 2021), 2 hours and 2-3 ecologists each night.	*NSW Survey Guide for Threatened Frogs: A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method* (DPIE, 2020). *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004).	Confirmed to be not present. **EXCLUDED**
Hieraaetus morphnoides Little Eagle (breeding)		1-7 October 2021	Nest searches – canopy trees across the site were searched for the presence of nests (binoculars were used where required). BUS – 20-24 fixed observation points placed throughout development footprint. Each observation point monitored for 20 minutes, during this time any bird observations recorded, including species and abundance, as well as flight height and distance from the observation point. Opportunistic diurnal observations – Effort was made during all site visits to lookout for any evidence or sightings.	*Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004).	Confirmed to be not present. **EXCLUDED**
Keyacris scurra Key's Matchstick Grasshopper		1-7 October 2021	Parallel field traverse (max. 20 m between transects) in all areas of suitable habitat.	*Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004).	Confirmed to be not present. **EXCLUDED**

			Opportunistic diurnal observations – Effort was made during all site visits to lookout for any evidence or sightings.		
Lepidium hyssopifolium Aromatic Peppercress		1-7 October 2021	Parallel field traverse (max. 5-10 m between transects), in all areas of suitable habitat.	*Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment Method* (EES, 2016). *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004).	Confirmed to be not present. **EXCLUDED**
Leucochrysum albicans var. tricolor Hoary Sunray		2-10 February 2021 1-7 October 2021	Parallel field traverse (max. 5-10 m between transects), in all areas of suitable habitat.	*Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment Method* (EES, 2016). *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004).	Confirmed to be not present. **EXCLUDED**
Litoria aurea Green and Golden Bell Frog		2-10 February 2021	Nocturnal aural-visual surveys, call playback and tadpole searches – undertaken in all areas of suitable habitat for 8 consecutive nights (Feb 2021) and 7 consecutive nights (Oct 2021), 2 hours and 2-3 ecologists each night.	*NSW Survey Guide for Threatened Frogs: A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method* (DPIE, 2020). *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004).	Confirmed to be not present. **EXCLUDED**

Litoria booroolongensis Booroolong Frog		1-7 October 2021	Nocturnal aural-visual surveys, call playback and tadpole searches – undertaken in all areas of suitable habitat for 8 consecutive nights (Feb 2021) and 7 consecutive nights (Oct 2021), 2 hours and 2-3 ecologists each night.	*NSW Survey Guide for Threatened Frogs: A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method* (DPIE, 2020). *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004).	Confirmed to be not present. **EXCLUDED**
Litoria castanea Yellow-spotted Tree Frog		2-10 February 2021 1-7 October 2021	Nocturnal aural-visual surveys, call playback and tadpole searches – undertaken in all areas of suitable habitat for 8 consecutive nights (Feb 2021) and 7 consecutive nights (Oct 2021), 2 hours and 2-3 ecologists each night. **Note:** Surveys undertaken outside of specified survey months. According to White & Ehmann (1996), the known calling period for *L. castanea* is Sept-Jan and thus the October survey should be sufficient.	*NSW Survey Guide for Threatened Frogs: A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method* (DPIE, 2020). *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004).	Confirmed to be not present. **EXCLUDED**
Mixophyes balbus Stuttering Frog		2-10 February 2021 1-7 October 2021	Nocturnal aural-visual surveys, call playback and tadpole searches – undertaken in all areas of suitable habitat for 8 consecutive nights (Feb 2021) and 7 consecutive nights (Oct 2021), 2 hours and 2-3 ecologists each night.	*NSW Survey Guide for Threatened Frogs: A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method* (DPIE, 2020). *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004).	Confirmed to be not present. **EXCLUDED**

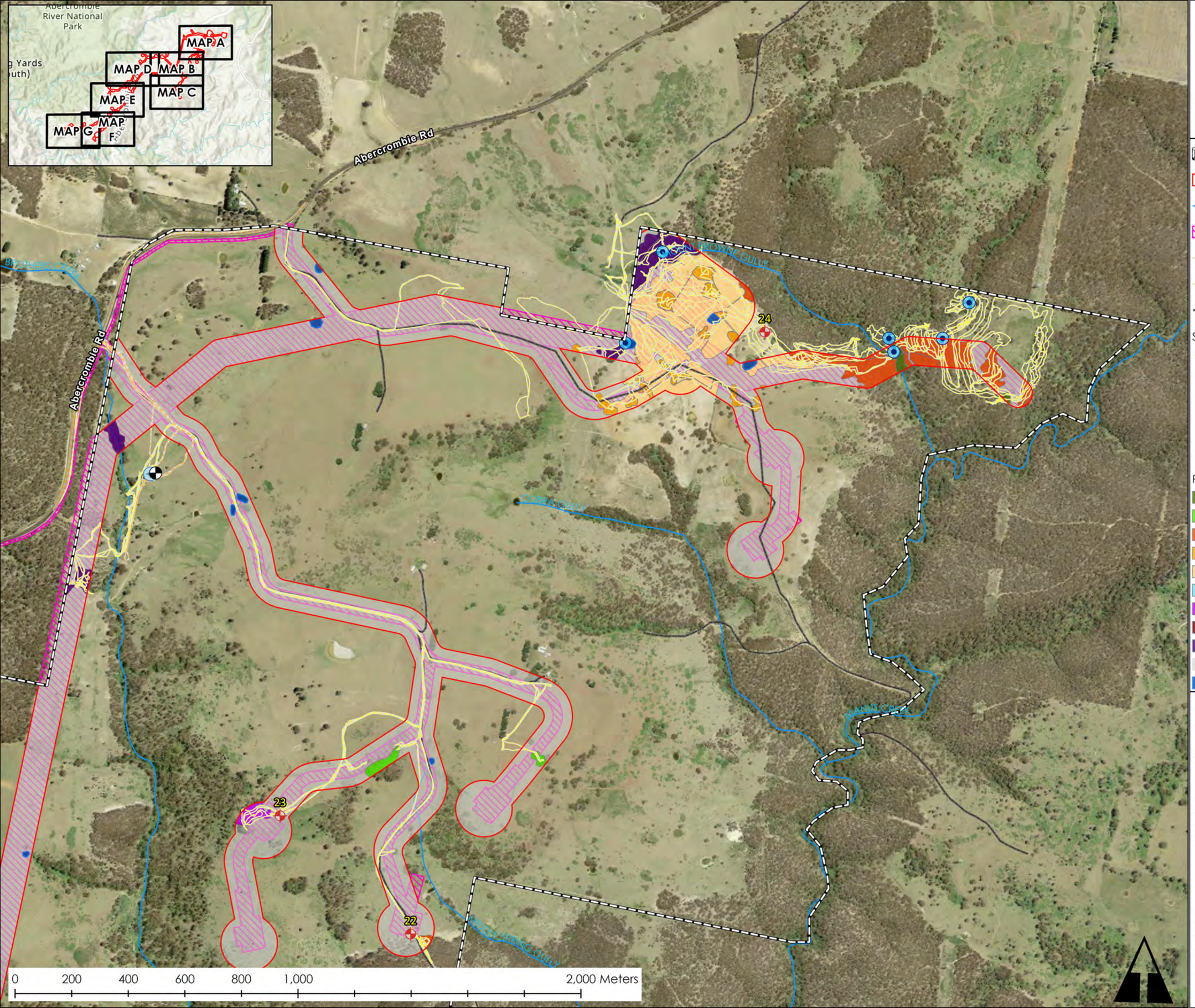
Ninox strenua Powerful Owl (breeding)		2-10 February 2021 1-7 October 2021	Hollow / nest searches – all areas of suitable habitat were traversed to search for suitable hollows. Any suitable hollows were examined for evidence of use. Nocturnal spotlighting – 8 consecutive nights (Feb 2021) and 7 consecutive nights (Oct 2021), 2 hours and 2-3 ecologists each night. Portions of the site each night were traversed on foot via random meander and effort was made to cover all areas of potential habitat on each night. Stag watching was also undertaken during spotlighting. Call playback – undertaken during nocturnal surveys. At each call playback site an initial listening period of 10 to 15 minutes was undertaken, followed by a spotlight search for 10 minutes to detect any fauna in the immediate vicinity. Calls where then played intermittently for 5 minutes each, followed by a 10-minute listening period. Following final broadcast and listening, the area was spotlighted on foot. Opportunistic diurnal observations – Effort was made during all site visits to lookout for any evidence or sightings. **Note:** Surveys undertaken outside of specified survey months. However, all hollows in the Survey Area were inspected for evidence of use (e.g., white-wash, owl regurgitation pellets), prior to and after the breeding period (Feb and Oct). Note that a recently fledged pare of young *N. boobook*	*Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004).	Confirmed to be not present. **EXCLUDED**

			(Southern Boobook) were observed roosting near the Survey Area in Feb but no hollows in the Survey Area showed any evidence of owl nesting. Survey effort is considered sufficient.		
Petauroides volans Greater Glider		2-10 February 2021 1-7 October 2021	Arboreal camera trapping – A total of 8 Swift Enduro camera traps were installed within trees across the site (Feb 2021), to target arboreal fauna. Baits (using oats, honey and peanut butter) were installed to attract fauna. Camera traps were left onsite for 8 days/nights. Nocturnal spotlighting – 8 consecutive nights (Feb 2021) and 7 consecutive nights (Oct 2021), 2 hours and 2-3 ecologists each night. Portions of the site each night were traversed on foot via random meander and effort was made to cover all areas of potential habitat on each night. Stag watching was also undertaken during spotlighting. Opportunistic diurnal searches – Effort was made during all site visits to search for any evidence (e.g., feed scars, scats, scratches).	*Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004). *Survey Guidelines for Australia's Threatened Mammals* (DSWP&C, 2011).	Confirmed to be not present. **EXCLUDED**
Petaurus norfolcensis Squirrel Glider		2-10 February 2021 1-7 October 2021	Arboreal camera trapping – A total of 8 Swift Enduro camera traps were installed within trees across the site (Feb 2021), to target arboreal fauna. Baits (using oats, honey and peanut butter) were installed to attract fauna. Camera traps were left onsite for 8 days/nights. Nocturnal spotlighting – 8 consecutive nights (Feb 2021) and 7 consecutive nights (Oct 2021), 2 hours and 2-3 ecologists each night. Portions of the site	*Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004). *Survey Guidelines for Australia's Threatened Mammals* (DSWP&C, 2011).	Confirmed to be not present. **EXCLUDED**

			each night were traversed on foot via random meander and effort was made to cover all areas of potential habitat on each night. Stag watching was also undertaken during spotlighting. Opportunistic diurnal searches – Effort was made during all site visits to search for any evidence (e.g., feed scars, scats, scratches).		
Phascolarctos cinereus Koala (breeding)		2-10 February 2021 1-7 October 2021	SAT Surveys – 15 SAT locations were selected and surveyed in the following manner: - One large 'centre' tree selected at each SAT location. - The 29 nearest trees to each centre tree were identified. - A search for *P. cinereus* faecal pellets was conducted beneath each of the 30 trees, based on a cursory inspection of the undisturbed ground surface within a distance of 100 cm around the base of each tree, followed by a more thorough inspection involving disturbance of the leaf litter and ground cover within the prescribed search area. Nocturnal spotlighting – 8 consecutive nights (Feb 2021) and 7 consecutive nights (Oct 2021), 2 hours and 2-3 ecologists each night. Portions of the site each night were traversed on foot via random meander and effort was made to cover all areas of potential habitat on each night. Call playback – undertaken during nocturnal surveys. At each call playback site an initial listening	*The Spot Assessment Technique: a tool for determining localised levels of habitat use by Koalas Phascolarctos cinereus* (Phillips and Callaghan, 2011). *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004).	Confirmed to be not present. **EXCLUDED**

			period of 10 to 15 minutes was undertaken, followed by a spotlight search for 10 minutes to detect any fauna in the immediate vicinity. Calls where then played intermittently for 5 minutes each, followed by a 10-minute listening period. Following final broadcast and listening, the area was spotlighted on foot. Opportunistic diurnal observations – Effort was made during all site visits to lookout for any evidence or sightings.		
Polytelis swainsonii Superb Parrot (breeding)		1-7 October 2021	Hollow / nest searches – all areas of suitable habitat were traversed to search for suitable hollows. Any suitable hollows were examined for evidence of use. BUS – 20-24 fixed observation points placed throughout development footprint. Each observation point monitored for 20 minutes, during this time any bird observations recorded, including species and abundance, as well as flight height and distance from the observation point. Opportunistic diurnal observations – Effort was made during all site visits to lookout for any evidence or sightings.	*Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004).	Confirmed to be not present. **EXCLUDED**
Pteropus poliocephalus Grey-headed Flying-fox (breeding)		1-7 October 2021	Colony camp searches – Effort was made during all site visits to lookout for any evidence of colony camp sites.	*Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004).	Confirmed to be not present. **EXCLUDED**

		Survey Guidelines for Australia's Threatened Mammals (DSWP&C, 2011).



Hunter Ecology

MAP A

Figure 4.2: Targeted Candidate Species Survey Effort

PYWF_Site_Boundary_v2_01_20210727

Survey Area

Drainage Lines

Development Footprint

GPS Tracks Feb 2021

GPS Tracks Oct 2021

Existing Roads

Survey Locations

- Anabat
- Bird Utilisation Survey
- Call Playback
- Camera Trap
- Frog Survey
- Koala SAT

PCT_Vegetation_202212

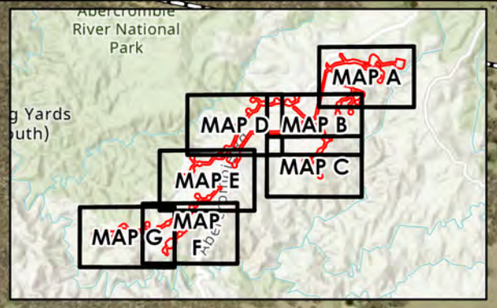
- PCT 951_VZ1
- PCT 951_VZ2
- PCT 727_VZ1
- PCT 727_VZ2
- PCT 727_VZ3
- PCT 1093_VZ1
- PCT 649_VZ1
- PCT 654_VZ1
- PCT 85_VZ1
- Exotic Vegetation
- DAM

DATE : 5/12/2022
Map Version: 1.2

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:12,000



Abercrombie Rd

Abercrombie Rd

12

23

22

9

19

8

6

BROTHERS CREEK

MANUS CREEK

MANUS CREEK

MANUS CREEK

MIDDLE STATION CREEK

0 200 400 600 800 1,000 2,000 Meters

Hunter Ecology

MAP B

Figure 4.2: Targeted Candidate Species Survey Effort

- PYWF_Site_Boundary_v2_01_20210727
- Survey Area
- Drainage Lines
- Development Footprint
- GPS Tracks Feb 2021
- GPS Tracks Oct 2021
- Existing Roads

Survey Locations

- Anabat
- Bird Utilisation Survey
- Call Playback
- Camera Trap
- Frog Survey
- Koala SAT

PCT_Vegetation_202212

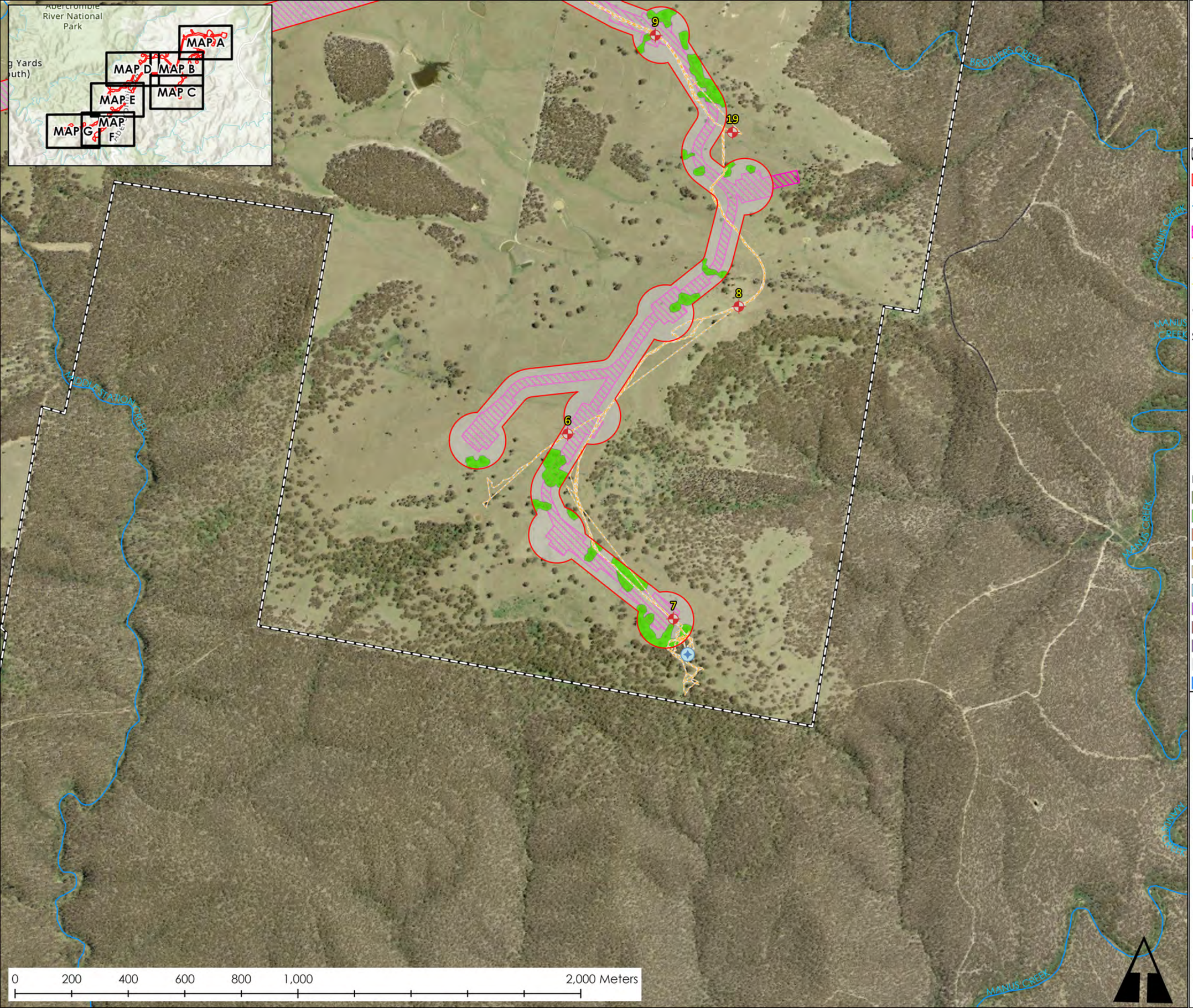
- PCT 951_VZ1
- PCT 951_VZ2
- PCT 727_VZ1
- PCT 727_VZ2
- PCT 727_VZ3
- PCT 1093_VZ1
- PCT 649_VZ1
- PCT 654_VZ1
- PCT 85_VZ1
- Exotic Vegetation
- DAM

DATE : 5/12/2022
Map Version: 1.2

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:12,000



Hunter Ecology

MAP C

Figure 4.2: Targeted Candidate Species Survey Effort

- PYWF_Site_Boundary_v2_01_20210727
- Survey Area
- Drainage Lines
- Development Footprint
- GPS Tracks Feb 2021
- GPS Tracks Oct 2021
- Existing Roads

Survey Locations

- Anabat
- Bird Utilisation Survey
- Call Playback
- Camera Trap
- Frog Survey
- Koala SAT

PCT_Vegetation_202212

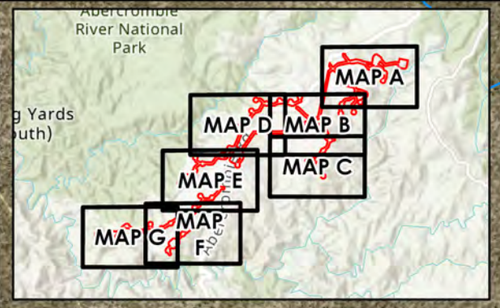
- PCT 951_VZ1
- PCT 951_VZ2
- PCT 727_VZ1
- PCT 727_VZ2
- PCT 727_VZ3
- PCT 1093_VZ1
- PCT 649_VZ1
- PCT 654_VZ1
- PCT 85_VZ1
- Exotic Vegetation
- DAM

DATE : 5/12/2022
Map Version: 1.2

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:12,000



Hunter Ecology

MAP D

Figure 4.2: Targeted Candidate Species Survey Effort

PYWF_Site_Boundary_v2_01_20210727

Survey Area

Drainage Lines

Development Footprint

GPS Tracks Feb 2021

GPS Tracks Oct 2021

Existing Roads

Survey Locations

Anabat

Bird Utilisation Survey

Call Playback

Camera Trap

Frog Survey

Koala SAT

PCT_Vegetation_202212

PCT 951_VZ1

PCT 951_VZ2

PCT 727_VZ1

PCT 727_VZ2

PCT 727_VZ3

PCT 1093_VZ1

PCT 649_VZ1

PCT 654_VZ1

PCT 85_VZ1

Exotic Vegetation

DAM

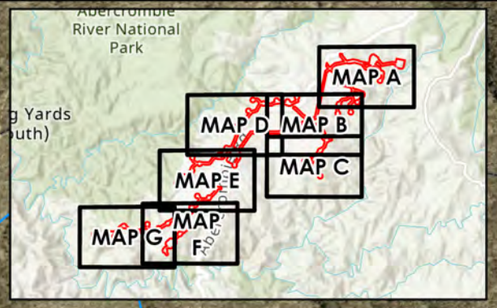
DATE : 5/12/2022
Map Version: 1.2

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:12,000

0 200 400 600 800 1,000 2,000 Meters



Hunter Ecology

MAP E

Figure 4.2: Targeted Candidate Species Survey Effort

PYWF_Site_Boundary_v2_01_20210727
Survey Area
Drainage Lines
Development Footprint
GPS Tracks Feb 2021
GPS Tracks Oct 2021
Existing Roads

Survey Locations
Anabat
Bird Utilisation Survey
Call Playback
Camera Trap
Frog Survey
Koala SAT

PCT_Vegetation_202212
PCT 951_VZ1
PCT 951_VZ2
PCT 727_VZ1
PCT 727_VZ2
PCT 727_VZ3
PCT 1093_VZ1
PCT 649_VZ1
PCT 654_VZ1
PCT 85_VZ1
Exotic Vegetation
DAM

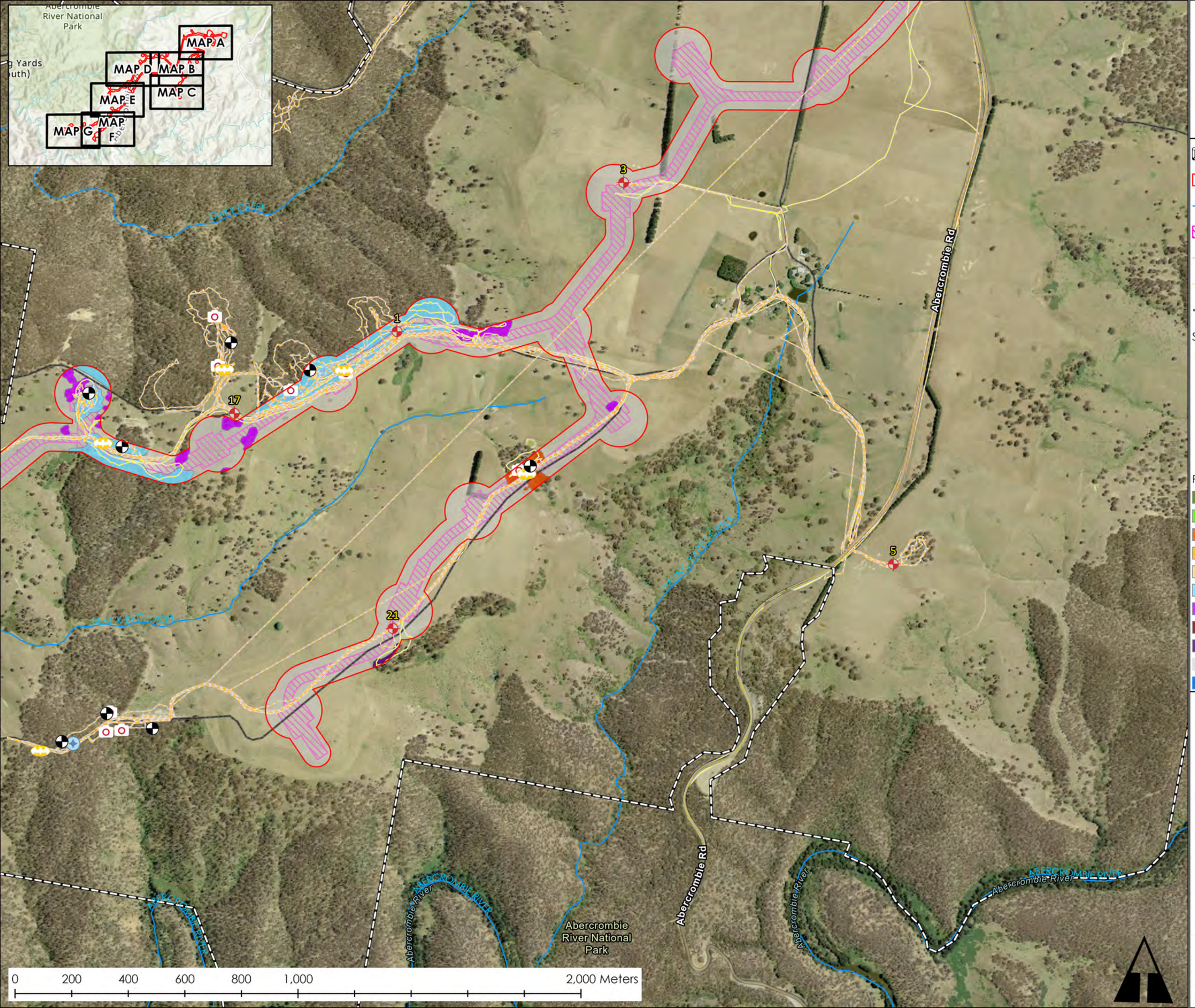
DATE : 5/12/2022
Map Version: 1.2

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:12,000

0 200 400 600 800 1,000 2,000 Meters



Hunter Ecology

MAP F

Figure 4.2: Targeted Candidate Species Survey Effort

PYWF_Site_Boundary_v2_01_20210727

Survey Area

Drainage Lines

Development Footprint

GPS Tracks Feb 2021

GPS Tracks Oct 2021

Existing Roads

Survey Locations

- Anabat
- Bird Utilisation Survey
- Call Playback
- Camera Trap
- Frog Survey
- Koala SAT

PCT_Vegetation_202212

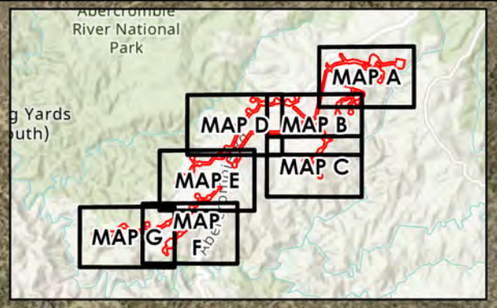
- PCT 951_VZ1
- PCT 951_VZ2
- PCT 727_VZ1
- PCT 727_VZ2
- PCT 727_VZ3
- PCT 1093_VZ1
- PCT 649_VZ1
- PCT 654_VZ1
- PCT 85_VZ1
- Exotic Vegetation
- DAM

DATE : 5/12/2022
Map Version: 1.2

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:12,000



Hunter Ecology

MAP G

Figure 4.2: Targeted Candidate Species Survey Effort

PYWF_Site_Boundary_v2_01_20210727
Survey Area
Drainage Lines
Development Footprint
GPS Tracks Feb 2021
GPS Tracks Oct 2021
Existing Roads

Survey Locations
Anabat
Bird Utilisation Survey
Call Playback
Camera Trap
Frog Survey
Koala SAT

PCT_Vegetation_202212
PCT 951_VZ1
PCT 951_VZ2
PCT 727_VZ1
PCT 727_VZ2
PCT 727_VZ3
PCT 1093_VZ1
PCT 649_VZ1
PCT 654_VZ1
PCT 85_VZ1
Exotic Vegetation
DAM

DATE : 5/12/2022
Map Version: 1.2

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:12,000

0 200 400 600 800 1,000 2,000 Meters

4.3.2 Survey Results

As previous **Table 4-6** indicates, one species credit species was confirmed to be present, being breeding *Callocephalon fimbriatum* (Gang-gang Cockatoo). Adult *C. fimbriatum* were observed and young could be heard calling in the vicinity of a large hollow-bearing tree external to the Survey Area, north of the proposed transmission line in the north-eastern portion of the Survey Area. In this same area, another large hollow-bearing tree of suitable size and height for breeding *C. fimbriatum* was observed just north of the Survey Area. A lone adult male/s was also observed close to this area and overall, there is ample evidence to suggest the second hollow would be utilised for breeding by *C. fimbriatum*.

C. fimbriatum nesting sites are often near water and breeding aggregations are reliant on stands of multiple suitable hollow-bearing trees, within a few hundred metres of each other. Breeding pairs utilise multiple nest trees over different years, which may be a way of minimising nest parasitism or predation (DAWE, 2022). It could therefore not be ruled out that the second hollow-bearing tree may be used by *C. fimbriatum* for breeding, despite it not being identified as an 'actual nest tree' at the time of the survey. In addition to the breeding observations, there were several sightings of *C. fimbriatum* in the wider Survey Area. See **Figure 4-3** for all *C. fimbriatum* observations.

Note that neither nest trees occur within the Project footprint; however to account for indirect impacts, the BioNet ecological data for *C. fimbriatum* requires that any native vegetation within a circular buffer radius of 200 m around a nest tree is include in a species polygon. The Project footprint occurs within 200 m of both nest trees.

Hunter Ecology

Figure 4.3: Locations of Callocephalon fimbriatum (Gang Gang) and Other Incidental Threatened Fauna Observations

PYWF_Site_Boundary_v2_01_202

Survey Area

Development Footprint

Existing Roads

Gang Gang actual breeding hollow

Gang Gang potential breeding hollow

Field Survey

Dusky Woodswallow

Gang Gang

Scarlet Robin

Abercrombie Rd

Abercrombie River National Park

Abercrombie River National Park

0 800 1,600 2,400 3,200 4,000 8,000 Meters

DATE : 05/12/2022
Map Version: 1.3

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:40,000

4.3.3 Species Polygon

A species polygon was used to identify the area and location of the suitable habitat within the Survey Area for breeding *Callocephalon fimbriatum* (Gang-gang Cockatoo). **Table 4-7** documents the information used to create the species polygon. **Table 4-8** details the biodiversity risk weighting and species polygon area. **Figure 4-4** depicts the species polygon.

Table 4-7: Information Used to Create the Species Polygon for *Callocephalon fimbriatum* (Gang-gang Cockatoo)

Species Description	*Callocephalon fimbriatum* Generally spends spring and summer in tall mountain forests and woodland, preferring heavily timbered, mature wet sclerophyll forest. During autumn and winter, it often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark associations. Breeding habitat requirements for *C. fimbriatum* are old growth forest or woodland with hollows in eucalyptus trees. Hollows chambers need to be approx. 20 cm in floor diameter, 22–90 cm deep and 5–9.4 m above the ground. Nesting sites are often near water and breeding aggregations are reliant on stands of multiple suitable hollow-bearing trees, within a few hundred metres of each other. Breeding pairs utilise multiple nest trees over different years, which may be a way of minimising nest parasitism or predation (DAWE, 2022).
Habitat Constraints or Microhabitats Associated with the Species	The following habitat constraint is listed in the BioNet ecological data for *C. fimbriatum*: • Hollow bearing trees – Eucalypt tree species with hollows greater than 9 cm diameter. The BioNet ecological data also notes that presence can be assumed in suitable breeding habitat for clearing or development assessments.
Unit of Measure	Area (extent of suitable habitat).
Method used to Derive Extent of Suitable Habitat	The extent of suitable habitat has been determined in accordance with the BioNet ecological data for *C. fimbriatum*, which require that it includes a circular buffer radius of 200 m around the nest tree. This buffer has been applied to the actual nest tree and the potential nest tree. The species polygon is provided in **Figure 4-4**.

Table 4-8: Biodiversity Risk Weighting and Species Polygon Area for *Callocephalon fimbriatum* (Gang-gang Cockatoo)

Vegetation Zone	Area / Count	Biodiversity Risk Weighting	Candidate SAII
727_1	4.2 ha	2	No
951_1	0.4 ha		

Hunter Ecology

Figure 4 4: Species Polygon for Callocephalon fimbriatum (Gang Gang)

- PYWF_Site_Boundary_v2_01_2
- Survey Area
- Development Footprint
- Gang Gang actual breeding hollow
- Gang Gang potential breeding hollow
- Species Polygon for Gang Gang Cockatoo (5.32ha)
- 200 m buffer around Gang Gang Cockatoo breeding hollow

0 50 100 150 200 250 500 Meters

DATE : 07/07/2022
Map Version: 1.1

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:2,400

5. PRESCRIBED IMPACTS

5.1 Identifying Prescribed Additional Biodiversity Impacts

Prescribed impacts are the impacts on biodiversity values that which are not related to, or are in addition to, native vegetation clearing and habitat loss. Prescribed additional biodiversity impacts (prescribed impacts) must be assessed as part of the BOS, as per clause 6.1 of the BC Regulation. Such prescribed impacts (including direct and indirect impacts) are impacts:

a. on the habitat of threatened entities including:
    i. karst, caves, crevices, cliffs, rocks and other geological features of significance, or
    ii. human-made structures, or
    iii. non-native vegetation
b. on areas connecting threatened species habitat, such as movement corridors
c. that affect water quality, water bodies and hydrological processes that sustain threatened entities (including from subsidence or upsidence from underground mining)
d. on threatened and protected animals from turbine strikes from a wind farm
e. on threatened species or fauna that are part of a TEC from vehicle strikes.

These types of impacts are used by the decision-maker to inform the determination and conditions of consent for developments. The BAM does not provide an approach to determine the number and class of biodiversity credits that are required for a prescribed impact. However, the additional prescribed impacts on biodiversity may be considered by a consent authority when they determine the biodiversity credits required to be retired (or other conservation measures required to be taken) under a planning approval.

Table 5-1 identifies the prescribed impacts and impacted threatened entities associated with the Subject Site / Project. An assessment of prescribed impacts associated with the Project is also undertaken in Section 7 of this BDAR.

Table 5-1: Prescribed Impacts

Impact	Present?	Potentially Impacted Threatened Entities	Characteristics, Location and Potential Impact
Impacts on karst, caves, crevices, cliffs, rocks and other geological features of significance.	✔	Ecosystem credits species potentially affected: *Suta flagellum* (Little Whip Snake), *Varanus rosenbergi* (Rosenberg's Goanna) No species credit species affected.	Occasional surface rocks (both loose and partially embedded) occur throughout the site, including within the vegetated areas that were not assigned to a PCT (i.e., exotic derived grassland). Loss of rocky habitat may impact on any threatened entities that use them for shelter; although in areas not assigned to a PCT, the surrounding habitat value would already be very marginal due to the dominance of exotic pasture and the heavy grazing pressure. Of the identified ecosystem credit species and confirmed species credit species in Section 4, only *S. flagellum* and *V. rosenbergi* are known to require surface rocks for habitat. *S. flagellum* tends to inhabit well drained hillsides with scattered loose or partially embedded rocks and studies have indicated that the majority of time is spent sheltering under these rocks (Turner, 2019). While *S. flagellum* is known to inhabit grassland or grassy woodland vegetation types, little is known as to whether an exotic-dominant groundcover is tolerated. It thus cannot be discounted that *S. flagellum* may occur in the exotic derived grassland areas not assigned to a PCT. *V. rosenbergi* is known to shelter in rock crevices (and also hollow logs, burrows, or termite mounds), but it is generally confined to heath, open forest or woodland vegetation types (EES, 2022), making it unlikely to occur within the exotic derived grassland areas not assigned to a PCT.
Impacts on human made structures	X	NA	NA
Impacts on-native vegetation	✔	Ecosystem credits species potentially affected: *Melanodryas cucullata* (Hooded Robin), *Petroica boodang* (Scarlet Robin), *Petroica phoenicea* (Flame Robin), *Stagonopleura guttata* (Diamond Firetail) No species credit species affected.	The cleared / grassland areas within the Survey Area were found to be overwhelmingly dominated by exotic species and were not able to be assigned to a PCT. These areas contained either cultivated pasture species, or in the case of the north-eastern portion of the Survey Area (specifically 6055 Abercrombie Road, Lot 41 & 56 DP 753064, Lot 7, 15, 19, 34, 48 & 61 DP 753037) significant infestations of *Nassella trichotoma* (Serrated Tussock) and *Rubus fruticosus* (Blackberry). The potentially impacted threatened entities include the small woodland birds, *M. cucullata*, *P. boodang*, *P. phoenicea* and *S. guttata.* These species are relatively tolerant of disturbed habitats and are known to shelter and even potentially nest in thickets of exotic species such as blackberry or African boxthorn. Their removal therefore may cause a reduction in habitat availability.

Impacts on areas connecting threatened species habitat, such as movement corridors.	✔	Ecosystem credits species potentially affected: All ecosystem credit fauna species listed in **Table 4-3**. Species credit species potentially affected: breeding *Callocephalon fimbriatum* (Gang-gang Cockatoo).	The Subject Site is situated between large tracks of forested land, including Abercrombie River NP to the west and north and a combination of state forest, private land and various nature reserves (including Blue Mountains National Park NP and Kanangra-Boyd NP) to the east and south. The areas of native vegetation within the Subject Site, whilst fragmented and highly disturbed by agriculture, contain some connectivity value. There are no specific corridors within the Subject Site; rather, all areas of native vegetation in the Subject Site would provide connectivity in the form of 'stepping stones'. Vegetation removal may cause isolation of suitable habitat patches or reduction in wildlife corridor width, not only from the loss in vegetation, but also from an increase in edge effects (such as light, and noise pollution). Fauna may avoid edge habitat, increasing competition for resources and disrupting home ranges. Gene flow may be restricted to sub-populations no longer connected by suitable habitat to facilitate dispersal. This impact may potentially impact on any of the identified ecosystem credit species and confirmed species credit species. It is important to note however, that the vegetation removal required for the Project is relatively minor and due to its linear nature, it would not result in the isolation of any habitat patches.
Impacts that affect water quality, water bodies and hydrological processes that sustain threatened entities (including from subsidence or upsidence from underground mining)	✔	Ecosystem credits species potentially affected: All ecosystem credit fauna species listed in **Table 4-3**. Species credit species potentially affected: breeding *Callocephalon fimbriatum* (Gang-gang Cockatoo).	Several ephemeral drainage lines, semi-permanent creeks and farm dams occur in the assessment area and Survey Area. Abercrombie River also occurs within the assessment area (see **Figure 2-1**). There is potential for impacts on water quality, water bodies and hydrological processes during both the construction phase and operational phase. Construction phase impacts can include erosion and sedimentation. Operational phase impacts can include an increased runoff from non-permeable surfaces. There are no confirmed ecosystem or species credit amphibian species confirmed for the Survey Area, but water quality may have generalised impacts on any threatened entity, not just pollution sensitive amphibians.
Impacts on threatened and protected animals from turbine strikes from a wind farm	✔	Ecosystem credits species potentially affected: *Callocephalon fimbriatum* (Gang-gang Cockatoo), *Calyptorhynchus lathami* (Glossy Black-Cockatoo), *Haliaeetus leucogaster* (White-bellied Sea-Eagle), *Hieraaetus morphnoides* (Little Eagle),	See **Figures 1.1, 2-1, 3-2** and **4-1** for the turbine locations. Turbine strike involves individual birds or bats being killed as a result of collision with moving rotors. In addition to fatalities caused directly by turbines rotor strikes, microchiropteran bats are known to be at risk of 'Barotrauma'. Barotrauma refers to tissue and lung damage caused by air pressure changes around turbine rotors. The project comprises up to 47 wind turbine generators, which would each have an overall maximum height of 240 m and maximum rotor sweep area of 30-240 m. Collision risk varies with species, number and

		Hirundapus caudacutus (White-throated Needletail), *Lathamus discolor* (Swift Parrot), *Ninox strenua* (Powerful Owl), *Polytelis swainsonii* (Superb Parrot), *Glossopsitta pusilla* (Little Lorikeet), *Circus assimilis* (Spotted Harrier), *Falsistrellus tasmaniensis* (Eastern False Pipistrelle), *Miniopterus orianae oceanensis* (Large Bent-winged Bat), *Scoteanax rueppellii* (Greater Broad-nosed Bat). Species credit species potentially affected: breeding *Callocephalon fimbriatum* (Gang-gang Cockatoo).	behaviour, site specific topography, weather conditions, turbine height/design and turbine layout (Smales, 2006). Particular bird groups, such as raptors and waterbirds are considered at greater risk of collision because of their flight heights, size and behaviour. Small woodland birds are generally not impacted. Discussed further in Section 5.2.
Impacts on threatened species or fauna that are part of a TEC from vehicle strikes.	✔	Ecosystem credits species potentially affected: *Dasyurus maculatus* (Spotted-tail Quoll), *Petaurus australis*, (Yellow-bellied Glider), *Phascolarctos cinereus* (Koala). No species credit species affected.	The proposal includes access roads through the wind farm layout. These would be low speed roads however and risk of vehicle strike of fauna is extremely low.

5.2 Impacts on Threatened and Protected Animals from Wind Turbine Strikes

In accordance with Section 6.1.5 of the BAM, a candidate list of protected animals that may use the development site as a flyway or migration route was generated for each of the three categories:

- Resident threatened aerial species
- Resident raptor species
- Nomadic and migratory species

The list of species in each category was identified from several sources, including a BioNet search of fauna records within 10 km of the site, an EPBC Act Protected Matters Search (for migratory species) and from available literature or general knowledge of species known to occur in the area. Species presence was confirmed via targeted survey or from the confirmed ecosystem credit species list. Effort was made to identify habitual flight paths for the confirmed species; however, maps of habitual flight paths were not generated, as the relevant species were deemed to potentially occur or move through anywhere in the Subject Site. See **Table 5-2**.

Note also that a Bird and Bat Utilisation Survey (BBUS) (see **Appendix E**) was undertaken in conjunction with this BDAR, to document the diversity and abundance of bird and bat species within the Subject Site and to identify 'at risk' species, susceptible to turbine collision or barotraumas. Section 7 of this BDAR summarises the BBUS and provides an assessment of the impacts of turbine collision and barotrauma.

Table 5-2: Prescribed Impacts Identified for Proposed Wind Farm Development

Protected animals that may live in, or fly over the development site (including migratory pathways, breeding, feeding and resting habitat)	Targeted survey		Result – habitual flight path or likely habitat for the species?	Predicted habitual flight paths and likely habitat
	Technique	Effort (date & time)		
Resident threatened aerial species Candidate species: the confirmed ecosystem credit species, *Hirundapus caudacutus* (White-throated Needletail).	Nest searches, Bird Utilisation Surveys (BUS), opportunistic diurnal observations, habitat assessment.	See previous **Table 4.5**.	**Yes:** *H. caudacutus* (White-throated Needletail) is a confirmed ecosystem credit species.	White-throated Needletail may potentially occur anywhere within the Subject Site, without any predictable habitual flight path. It prefers flying over wooded habitats but is also known to fly over partly cleared pasture, plantations or remnant vegetation at the edge of paddock and occurs from heights of <1 m up to >1000 m above the ground (Threatened Species Scientific Committee (TSSC), 2019).
Resident raptor species Candidate species: any common species of raptor (falcons, eagles, harriers etc) that potentially occur in the area and the confirmed ecosystem credit species, *Haliaeetus leucogaster* (White-bellied Sea-Eagle), *H. morphnoides* (Little Eagle) and *Circus assimilis* (Spotted Harrier).	Nest searches, BUS, opportunistic diurnal observations, habitat assessment.	See previous **Table 4.5**.	**Yes:** *Aquila audax* (Wedge-tailed Eagle), *Elanus axillaris* (Black-shouldered Kite), *Accipiter fasciatus* (Brown Goshawk), *Falco cenchroides* (Australian Kestrel), *F. longipennis* (Australian Hobby) and *F. berigor* (Brown Falcon) were recorded in the Survey Area. *H. leucogaster* (White-bellied Sea-Eagle), *H. morphnoides* (Little Eagle) and *C. assimilis* (Spotted Harrier) are confirmed ecosystem credit species.	Wedge-tailed Eagle, Black-shouldered Kite, Brown Goshawk, Australian Kestrel, Australian Hobby and Brown Falcon were all recorded during the BUS and the majority of birds were observed flying within Rotor Sweep Area (RSA) height (30-240 m). White-bellied Sea-Eagle, Little Eagle and Spotted Harrier would also be expected to fly at similar heights. These raptor species are all known to hunt in open areas and may occur anywhere in the Subject Site, without any predictable habitual flight paths.
Nomadic and migratory species Candidate species (nomadic): any common nomadic species (usually parrots, and some waterbirds and honeyeaters) that potentially occur in	Hollow / nest searches, BUS, opportunistic diurnal observations, habitat assessment.	See previous **Table 4.5**.	**Yes:** Nomadic: *Cacatua galerita* (Sulphur-crested Cockatoo), *Calyptorhynchus funereus* (Yellow-tailed Black Cockatoo), *Eolophus roseicapilla* (Galah), *Platycercus eximius*	Nomadic: Sulphur-crested Cockatoo, Galah, Yellow-tailed Black Cockatoo and Gang-gang Cockatoo were all recorded during the BUS and the majority of birds were observed flying within RSA height. Crimson Rosella, Eastern Rosella, Red Wattlebird,

the area as well as the confirmed ecosystem credit species *Polytelis swainsonii* (Superb Parrot), *Calyptorhynchus lathami* (Glossy Black-Cockatoo), *Glossopsitta pusilla* (Little Lorikeet), *Miniopterus orianae* (Large Bent-winged Bat), *Saccolaimus flaviventris* (Yellow-bellied Sheathtail Bat) and *Lathamus discolor* (Swift Parrot), and confirmed dual credit species, *Callocephalon fimbriatum* (Gang-gang Cockatoo)). *Pteropus poliocephalus* (Grey-headed Flying Fox) is also a confirmed ecosystem credits species. Candidate species (migratory): *Hirundapus caudacutus* (White-throated Needletail), *Monarcha melanopsis* (Black-faced Monarch), *Motacilla flava* (Yellow Wagtail), *Myiagra cyanoleuca* (Satin Flycatcher), *Rhipidura rufifrons* (Rufous Fantail), *Anthus novaeseelandiae* (Australasian Pipit) and *Apus pacificus* (Fork-tailed Swift).			(Eastern Rosella), *Platycercus elegans* (Crimson Rosella), *Anthochaera carunculata* (Red Wattlebird), *Caligavis chrysops* (Yellow-faced Honeyeater) and *Egretta novaehollandiae* (White-faced Heron) were recorded in the Survey Area. *Polytelis swainsonii* (Superb Parrot), *Calyptorhynchus lathami* (Glossy Black-Cockatoo), *Glossopsitta pusilla* (Little Lorikeet) and *Lathamus discolor* (Swift Parrot) are confirmed ecosystem credit species and *Callocephalon fimbriatum* (Gang-gang Cockatoo) is a confirmed dual credit species). *Pteropus poliocephalus* (Grey-headed Flying Fox) is also a confirmed ecosystem credits species. Migratory: *H. caudacutus* (White-throated Needletail) is a confirmed ecosystem credit species and *M. melanopsis* (Black-faced Monarch) and *A. pacificus* (Fork-tailed Swift) cannot be ruled out as potentially occurring in the Subject Site. Note: the EPBC Act referral guidelines for migratory birds (Commonwealth of Australia, 2015) state that the only migratory species likely to be affected by wind turbines are *Monarcha melanopsis* (Black-faced Monarch), *Apus pacificus* (Fork-tailed Swift) and *H. caudacutus* (White-throated Needletail). All other species listed here are not known to fly at RSA height, even during migration.	Yellow-faced Honeyeater and White-faced Heron were commonly recorded, but never within RSA height and are considered much less likely to be impacted. Sulphur-crested Cockatoo was by the far the most commonly recorded of these species and it, as well as Galah, are known to frequent open areas. Yellow-tailed Black Cockatoo, Swift Parrot and Gang-gang Cockatoo on the other hand would be more likely only travelling between forested habitat patches when flying through open areas. Overall though, these species could occur anywhere throughout the Subject Site, without any predictable habitual flight paths. Large Bent-winged Bat and Yellow-bellied Sheathtail Bat were recorded in the Subject Site. These species would be more at risk during movements rather than whilst foraging. Overall, they could fly anywhere within the Subject Site during movements, without any predictable habitual flight path. Grey-headed Flying Fox was not recorded in the Subject Site and there are no BioNet records within 10 km of the Subject Site. A review of the DAWE's *Interactive Flying-fox Web Viewer* indicates that the closest flying fox camp is at Thilmere, approx. 75 km east of the Subject Site. Overall, while its presence cannot be discounted, it is considered that this species would rarely occur in the Subject Site. Migratory: As mentioned above, White-throated Needletail may occur anywhere within the Subject Site (from heights of <1 m up to >1000 m), without any predictable habitual flight path. Black-faced Monarch prefers rainforest ecosystems

				and is unlikely to inhabit the Subject Site. It cannot be discounted though that it may fly through the Subject Site during migration, where it moves along the Australian east coast (as far inland as the eastern slopes and tablelands of the Great Divide) from breeding areas in North Qld to Papua New Guinea (DAWE, 2022). Overall, it could fly anywhere within the Subject Site, without any predictable habitual flight path. Australasian Pipit inhabits open habitats such as grassland, forest clearings and grassy woodland. It is a terrestrial species that feeds, roosts and nests on the ground, although it may fly within RSA height during migration. The species was recorded in the Subject Site and it is considered that during migration it could fly anywhere within the Subject Site, without any predictable habitual flight path. Fork-tailed Swift arrives in Australia (from breeding grounds in Siberia) around Sept-Oct and may occur in any region of NSW. It is almost exclusively aerial, flying from less <1 m to at least 300 m above ground (DAWE, 2022). The habitat types that this species flies over is very broad and it may occur anywhere within the Subject Site, without any predictable habitual flight path.

6. AVOID AND MINIMISE IMPACTS

6.1 Avoidance and Minimisation of Impacts through Location and Design

Investigations into suitable areas for the Project commenced prior to 2013. Considerations of landscape features, ecological values and social factors were all involved in early consultation activities. This was used to inform the design of the preliminary Project layout and since then, the layout has had several modifications to reduce the area of vegetation clearing and to avoid, where possible, important habitat features such as hollow-bearing trees. **Table 6-1** details the avoidance measures applied to the Project, including those that were documented in ERM (2014) and modifications since the most recent ecological surveys commenced in February 2021.

Table 6-1: Avoidance Measures Applied to the Project

Project Feature	Original Location	Adjusted Location	Reason for Adjustment
Adjustments Prior to 2013 (as documented in ERM (2014))			
Overhead transmission line.	South from PAA to the Crookwell 2 Wind Farm substation.	North-east of the PAA to the Mt Piper to Bannaby 500 kV transmission line.	To avoid removal or modification of remnant native vegetation.
WTGs: P2, P6 and P7 and their associated access tracks and crane pads.	Within a Box Gum Woodland (CEEC) environmental stewardship area.	Removed.	To avoid removal or modification of an area of Box Gum Woodland (CEEC) that is being managed under an environmental stewardship program.
WTG: P11 and its associated access tracks and crane pads.	Within remnant native woodland.	Removed.	To reduce removal or modification of remnant native vegetation.
WTGs: P10, P13 and P14 and their associated access tracks and crane pads.	Within remnant red stringybark woodland and broad-leaved peppermint woodland.	Closer to the edge of the remnant.	To reduce removal or modification of remnant native vegetation.
Adjustments Since 2021			
WTGs: P6, P7, P9, P10, P11, their associated access tracks and crane pads.	Within remnants of PCT 1093, PCT 727, PCT 654 and PCT 649.	Either removed or moved out of or closer to edges of remnants.	To reduce removal or modification of native vegetation and Box Gum Woodland CEEC (PCT 654). The adjustment was made after the February 2021 ecological surveys recorded high numbers of hollow-bearing trees within these areas.
Overhead transmission line.	North-eastern portion of site, in vicinity of Gang-gang Cockatoo nest tree.	Moved slightly south.	To avoid removal of Gang-gang Cockatoo nest tree.

6.2 Further Measures to Avoid and Minimise Impacts

Impacts will be further avoided and minimised through several measures, designed to protect retained vegetation and habitat during both the construction and operational stages of the Project. These measures are detailed in Section 7 of this BDAR.

7. ASSESSMENT OF IMPACT

7.1 Direct Impacts on Native Vegetation and Fauna Habitat

The Project has the potential to have the following direct impacts on native vegetation and fauna habitat:

- Clearing and modification of native vegetation communities and associated fauna habitat and the subsequent impacts to local populations of native species.
- Removal of hollow-bearing trees and the subsequent impacts to local populations of hollow-dependent native fauna.
- Removal of coarse woody debris and bush rocks and the subsequent impacts to local populations of native fauna.
- Mortality and injury of native fauna during vegetation clearing.

Table 7-1 details the change in vegetation integrity (VI) score for each VZ, as a result of direct impacts. **Table 7-2** provides information on the nature, extent, frequency, duration, timing and consequences of each direct impact and for the identification of affected threatened entities.

Table 7-1: Changes in Vegetation Integrity (VI) Scores as a Result of Direct Impacts

PCT	VZ	Area to be Removed (ha)	Current VI Score	Future VI Score	Change in VI Score
PCT 85 River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion	**85_1**	1.73 ha	47	0	-47
PCT 649 Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion	**649_1**	5.57 ha	47.9	0	-47.9
PCT 654 Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion	**654_1**	1.95 ha	19.5	0	-19.5
PCT 727 Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion	**727_1**	7.53 ha	62.5	0	-62.5
	727_2	1.25 ha	34	0	-34
	727_3	7.38 ha	10.5	0	-10.5
PCT 951 Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion	**951_1**	0.5 ha	57.9	0	-57.9
	951_2	2.34 ha	42.1	0	-42.1
PCT 1093 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion	**1093_1**	3.45 ha	51.4	0	-51.4

Table 7-2: Summary of Direct Impacts Native Vegetation and Fauna Habitat

Impact	Nature	Extent	Frequency, Timing & Duration	Associated Threatened Entities	Consequences
Clearing and modification of native vegetation communities and associated fauna habitat and the subsequent impacts to local populations of native species.	All strata and growth form groups, plus leaf litter.	31.6 ha of native vegetation in total. See **Table 7-1** for total areas of each PCT and VZ.	Once. Construction phase. Permanent.	Ecosystem credits species potentially affected: All ecosystem credit fauna species listed in previous **Table 4-3**. Species credit species potentially affected: *Callocephalon fimbriatum* (Gang-gang Cockatoo).	Loss of local vegetation, a disruption of established home ranges and a loss of potential sheltering, foraging and breeding habitat. Future VI assumed to be 0 for all VZs.
Removal of hollow-bearing trees and the subsequent impacts to local populations of hollow-dependent native fauna.	Removal of dead and living trees containing hollows.	A total of 185 hollow-bearing trees (out of total 405 recorded in the Survey Area) occur within the proposed footprint; see previous **Figure 4-1** for their locations.	Once. Construction phase. Permanent.	Ecosystem credits species potentially affected: *Climacteris picumnus victoriae* (Brown Treecreeper (eastern subspecies)), *Dasyurus maculatus* (Spotted-tailed Quoll), *Falsistrellus tasmaniensis* (Eastern False Pipistrelle), *Glossopsitta pusilla* (Little Lorikeet), *Petaurus australis* (Yellow-bellied Glider), *Scoteanax rueppellii* (Greater Broad-nosed Bat). Species credit species potentially affected: *C.*	Loss of potential breeding and refuge habitat. Hollows are a limited resource that take a long time to form. Some of the associated threatened entities are restricted to areas with hollows. There may be increased competition for hollows in the remaining bushland surrounding the Subject Site. Note, the identified *C. fimbriatum* (Gang-gang Cockatoo) nest trees would not be removed, but the Project footprint occurs within a 200 m buffer of the nest trees.

Impact	Nature	Extent	Frequency, Timing & Duration	Associated Threatened Entities	Consequences
				fimbriatum (Gang-gang Cockatoo).	
Removal of coarse woody debris and bush rocks and the subsequent impacts to local populations of native fauna.	Removal of hollow and non-hollow logs as well as surface bush rocks.	31.6 ha of habitat containing scattered coarse woody debris and bush rocks.	Once. Construction phase. Permanent.	Ecosystem credits species potentially affected: *Artamus cyanopterus cyanopterus* (Dusky Woodswallow), *Chthonicola sagittata* (Speckled Warbler), *Climacteris picumnus victoriae* (Brown Treecreeper (eastern subspecies)), *Daphoenositta chrysoptera* (Varied Sittella), *Dasyurus maculatus* (Spotted-tailed Quoll), *Melanodryas cucullata cucullata* (Hooded Robin (south-eastern form)), *Petroica boodang* (Scarlet Robin), *Petroica phoenicea* (Flame Robin), *Stagonopleura guttata* (Diamond Firetail), *Suta flagellum* (Little Whip Snake), *Varanus rosenbergi* (Rosenberg's Goanna) No species credit species potentially affected	Loss of potential breeding, foraging and refuge habitat, as well as biological processes associated with woody decay (e.g., nutrient cycling). Coarse woody debris and bush rocks are limited resources.

Impact	Nature	Extent	Frequency, Timing & Duration	Associated Threatened Entities	Consequences
Mortality and injury of native fauna during vegetation clearing.	Direct physical harm to fauna caused during clearing.	Uncertain.	Once. Construction phase. Permanent.	Ecosystem credits species potentially affected: All ecosystem credit fauna species listed in previous **Table 4-3**. Species credit species potentially affected: *Callocephalon fimbriatum* (Gang-gang Cockatoo).	Direct physical harm to undetected resident fauna, leading to reduced local populations and genetic diversity, as well as animal welfare issues.

7.2 Indirect Impacts on Native Vegetation and Fauna Habitat

The Project has the potential to have the following indirect impacts on native vegetation and fauna habitat:

- Inadvertent impacts on adjacent habitat or vegetation, during construction.
- Reduced viability of adjacent habitat due to edge effects.
- Reduced viability of adjacent habitat due to noise, dust or light spill.
- Transport of weeds and pathogens from the site to adjacent vegetation.

Table 7-3 provides information on the nature, extent, frequency, duration, timing and consequences of each direct impact and for the identification of affected threatened entities.

Table 7-3: Summary of Indirect Impacts on Native Vegetation and Fauna Habitat

Impact	Nature	Extent	Frequency, Timing & Duration	Associated Threatened Entities	Consequences
Inadvertent impacts on adjacent habitat or vegetation, during construction	Construction activities may result in inadvertent impacts on retained vegetation, such as increased sedimentation or accidental removal of vegetation external to the approved development footprint.	Uncertain, but generally in retained native vegetation adjacent to the approved development footprint.	Construction phase. Vegetation / habitat may or may not recover to its original state.	Ecosystem credits species potentially affected: All ecosystem credit fauna species listed in previous **Table 4-3**. Species credit species potentially affected: *Callocephalon fimbriatum* (Gang-gang Cockatoo).	Reduced condition of retained native vegetation adjacent to the approved development footprint. Note, the identified *C. fimbriatum* (Gang-gang Cockatoo) nest trees would not be removed, but the Project footprint occurs within a 200 m buffer of the nest trees.
Reduced viability of adjacent habitat due to edge effects	Increase in edge:core habitat ratio, resulting in edge effects such as light and noise pollution, weed invasion and altered moisture, wind and temperature.	Uncertain, but generally in retained native vegetation adjacent to the approved development footprint.	Ongoing and permanent during the operational phase.	Ecosystem credits species potentially affected: All ecosystem credit fauna species listed in previous **Table 4-3**.	Reduced condition of retained native vegetation adjacent to the approved development footprint. May reduce habitat quality or affect habitat use or movements of some species.

Impact	Nature	Extent	Frequency, Timing & Duration	Associated Threatened Entities	Consequences
				Species credit species potentially affected: *C. fimbriatum* (Gang-gang Cockatoo).	
Reduced viability of adjacent habitat due to noise, dust or light spill.	Construction and operational activities are likely to increase the noise, dust and light above current levels within the Subject Site	Uncertain, but generally in retained native vegetation adjacent to the approved development footprint.	Construction phase and potentially ongoing during the operational phase.	Ecosystem credits species potentially affected: All ecosystem credit fauna species listed in previous **Table 4-3**. Species credit species potentially affected: *C. fimbriatum* (Gang-gang Cockatoo).	Disruption of fauna habitat usage during construction and operation.
Transport of weeds and pathogens from the site to adjacent vegetation.	Several HTW occur within the Survey Area (e.g., *Rubus fruticosus, Nassella trichotoma, Lycium ferocissimum*). These may be inadvertently spread to other areas within the Subject Site.	Uncertain, but generally in retained native vegetation adjacent to the approved development footprint.	Construction phase and potentially ongoing during the operational phase.	Ecosystem credits species potentially affected: All ecosystem credit fauna species listed in previous **Table 4-3**. Species credit species potentially affected: *C. fimbriatum* (Gang-gang Cockatoo).	Reduced condition of retained native vegetation adjacent to the approved development footprint.

7.3 Prescribed Impacts

As identified in previous **Table 5-2**, the following prescribed impacts are relevant to the proposal:

- Impacts on the following habitat of threatened entities:
  - rocks
  - non-native vegetation.
- Impacts on areas connecting threatened species habitat, such as movement corridors.
- Impacts of development on movement of threatened species that maintains their lifecycle.
- Impacts that affect water quality, water bodies and hydrological processes that sustain threatened entities.
- Impacts on threatened and protected animals from turbine strikes from a wind farm.
- Impacts on threatened species or fauna that are part of a TEC from vehicle strikes.

See **Table 7-4** for the nature, extent, frequency, duration, timing and consequences of each impact and for identification of affected threatened entities. It is considered that the most important of these impacts involve mortality and injury of avian and microchiropteran bat species from turbine strike and barotrauma and these are assessed further in Section 7.3.1.

Table 7-4: Summary of Prescribed Impacts

Impact	Nature	Extent	Frequency, Timing & Duration	Associated Threatened Entities	Consequences
Removal of rocks	Removal of habitat containing surface rocks. Occasional surface rocks (both loose and partially embedded) occur throughout the Subject Site.	31.6 ha of native vegetation and 204.2 ha of exotic derived grassland containing scattered surface rocks impacted.	Once. Construction phase. Permanent.	Ecosystem credits species potentially affected: *Suta flagellum* (Little Whip Snake), *Varanus rosenbergi* (Rosenberg's Goanna) No species credit species affected.	Loss of potential refuge and basking habitat (although in non-native areas, habitat value would already be very marginal due to the dominance of exotic pasture and heavy grazing pressure).
Removal or disturbance of non-native vegetation	Removal of non-native vegetation which may provide habitat for native fauna. Non-native vegetation in the	204.2 ha of non-native vegetation impacted.	Once. Construction phase.	Ecosystem credits species potentially affected: *Melanodryas cucullata* (Hooded Robin),	Reduction in potential habitat (mainly in the case of blackberry removal).

Impact	Nature	Extent	Frequency, Timing & Duration	Associated Threatened Entities	Consequences
	Subject Site consists of exotic derived grassland containing pasture species or weeds such as serrated tussock and blackberry. Exotic shrubs like blackberry can provide habitat for some small woodland birds.		Permanent.	*Petroica boodang* (Scarlet Robin), *Petroica phoenicea* (Flame Robin), *Stagonopleura guttata* (Diamond Firetail). No species credit species affected.	
Increased habitat fragmentation / impacts on habitat connectivity	Reduction in habitat connectivity value, not only from the loss in vegetation, but also from an increase in edge effects (such as light, and noise pollution). The Subject Site is situated between large tracks of forested land, including several nature reserves and national parks. The areas of native vegetation within the Subject Site may contain some connectivity value (at least in the form of 'stepping stones' across open areas).	31.6 ha of native vegetation impacted.	Once. Construction phase. Permanent.	Ecosystem credits species potentially affected: All ecosystem credit fauna species listed in previous **Table 4-3**. Species credit species potentially affected: breeding *Callocephalon fimbriatum* (Gang-gang Cockatoo).	Some species may avoid edge habitat, increasing competition for resources and disrupting home ranges. Gene flow may be restricted to sub-populations no longer connected by suitable habitat to facilitate dispersal. It is important to note however, that the vegetation removal required for the Project is relatively minor and due to its linear nature, it would not result in the isolation of any habitat patches.
Impacts on water quality, water bodies and hydrological processes	Construction phase / direct impacts: Erosion and sedimentation (i.e., movement of soil to adjacent/downstream aquatic habitats, particularly during rain events). Operational phase / indirect impacts: increased runoff from non-	Uncertain, although likely to be minor – standard erosion control methods would be used during construction, and standard stormwater management measures would be implemented	During rainfall events in the construction phase. Ongoing and permanent during the operational phase.	There are no confirmed ecosystem or species credit amphibian species confirmed for the Survey Area. Water quality may have generalised impacts on any threatened entity though, not just pollution sensitive amphibians.	May decrease downstream water quality, which would affect mainly pollution-sensitive species, but potentially any threatened entity.

Impact	Nature	Extent	Frequency, Timing & Duration	Associated Threatened Entities	Consequences
	permeable surfaces (e.g., rooves and pavements).	during the operational phase.		Ecosystem credits species potentially affected: All ecosystem credit fauna species listed in previous **Table 4-3**. Species credit species potentially affected: breeding *C. fimbriatum* (Gang-gang Cockatoo).	
Impacts on threatened and protected animals from turbine strikes from a wind farm	Turbine strike involves individual birds or bats being killed as a result of collision with moving rotors. In addition to fatalities caused directly by turbines rotor strikes, microchiropteran bats are known to be at risk of 'Barotrauma'. Barotrauma refers to tissue and lung damage caused by air pressure changes around turbine rotors	Uncertain. The project comprises up to 47 wind turbine generators (WTG), which would each have an overall maximum height of 240 m and maximum rotor sweep area (RSA) of 30-240 m.	Ongoing and permanent during the operational phase.	Ecosystem credits species potentially affected: *Callocephalon fimbriatum* (Gang-gang Cockatoo), *Calyptorhynchus lathami* (Glossy Black-Cockatoo), *Haliaeetus leucogaster* (White-bellied Sea-Eagle), *Hieraaetus morphnoides* (Little Eagle), *Lathamus discolor* (Swift Parrot), *Ninox strenua* (Powerful Owl), *Polytelis swainsonii* (Superb Parrot), *Glossopsitta pusilla* (Little Lorikeet), *Circus assimilis* (Spotted Harrier), *Falsistrellus tasmaniensis* (Eastern False Pipistrelle), *Miniopterus orianae oceanensis* (Large Bent-winged Bat), *Scoteanax rueppellii* (Greater Broad-nosed Bat), *Pteropus*	Injury to or death of fauna. Collision risk varies with species, number and behaviour, site specific topography, weather conditions, turbine height/design and turbine layout. Particular bird groups, such as raptors and waterbirds are considered at greater risk of collision because of their flight heights, size and behaviour. Microchiropteran bats most at risk from barotrauma include relatively high-flying species that prefer to forage above canopy height. **Discussed further in Section 7.3.1.**

Impact	Nature	Extent	Frequency, Timing & Duration	Associated Threatened Entities	Consequences
				poliocephalus (Grey-headed Flying Fox). Species credit species potentially affected: breeding *C. fimbriatum* (Gang-gang Cockatoo). There are also several other associated protected fauna species, as identified in previous **Table 5-1**.	
Mortality and injury of native fauna from vehicle strikes	The proposal includes a series of access roads through the Project layout. These would be low speed roads however and risk of vehicle strike to fauna is very low.	Uncertain but likely to be very minor – The access roads would be low speed and risk of vehicle strike to fauna is very low.	Ongoing and permanent during the operational phase.	Ecosystem credits species potentially affected: *Dasyurus maculatus* (Spotted-tail Quoll), *Petaurus australis* (Yellow-bellied Glider), *Phascolarctos cinereus* (Koala). No species credit species affected.	Death or injury to fauna that may cross roads on the ground or low flying birds.

7.3.1 Impacts from Wind Turbine Strike and Barotrauma

Turbine strike involves individual birds or bats being killed as a result of collision with moving rotors. The project comprises up to 47 wind turbine generators (WTG), which would each have an overall maximum height of 240 m and maximum rotor sweep area (RSA) of 30-240 m. Collision risk varies with species, number and behaviour of birds, site specific topography, weather conditions, turbine height/design and turbine layout (Smales, 2006). Particular bird groups, such as raptors and waterbirds are considered at greater risk of collision because of their flight heights, size and behaviour.

In addition to fatalities caused directly by turbines rotor strikes, microchiropteran bats are known to be at risk of 'Barotrauma'. Barotrauma refers to tissue and lung damage caused by air pressure changes around turbine rotors (Baerwald, et al., 2008). Microchiropteran bats may experience barotrauma if they move through the low-pressure zones caused by air flowing over the rotors. Microchiropteran bats most at risk from barotrauma include relatively high-flying species that prefer to forage above canopy height.

A Bird and Bat Utilisation Survey (BBUS) was undertaken in conjunction with this BDAR, to document the diversity and abundance of bird and bat species within and directly adjacent to the Project location and to identify 'at risk' species, susceptible to turbine collision or barotraumas. The BBUS is provided in **Appendix E**.

7.3.1.1 Collision Risk – Birds

Surveys involved two separate bird utilisation survey (BUS) events representing the 2021 Summer (February 2021) and Spring (October 2021) survey events. Each survey event consisted of monitoring 20-24 fixed observation points strategically placed throughout development footprint. Each observation point was monitored for a period of 20 minutes and during this time any bird observations were recorded, including species and abundance, as well as flight height and distance from the observation point. Note that the results from a BUS undertaken by ERM (2014) in Autumn (May 2013) was also reviewed in the BBUS.

Tables 7-5, **7-6** and **7-7** summarise the main results of the 2021 BUS. **Table 7-5** shows the five most dominant species represented in each survey event and their relative abundance (i.e., percentage of total observations). *Cracticus tibicen* (Australian Magpie), *Cacatua galeritaand* (Sulphur-crested Cockatoo) and *Aquila audux* (Wedge-tailed Eagle) were well represented in both the Summer and Spring survey events. Other dominant species included *Platycercus eximius* (Eastern Rosella) and *Manorina melanocephala* (Noisy Miner) in Summer and *Corvus coronoides* (Australian Raven) and *Platycerus elegans* (Crimson Rosella) in Spring. Two threatened species were recorded, being *Callocephalon fimbriatum* (Gang-gang Cockatoo) and *Artamus cyanopterus* (Dusky Woodswallow).

The number of birds recorded at different flight heights is presented in **Table 7-6**, while **Table 7-7** details the four most highly represented species recorded flying at RSA height for both survey events. Of the species recorded utilising the wind farm site across the two surveys, a total of 13 species were recorded flying within RSA height (7 species in Spring and 10 species in Summer). Of the most highly represented species, three were consistent across the two survey events; these include Wedge-tailed Eagle, Australian Magpie and Sulphur-Crested Cockatoo.

An assessment of bird global vulnerability to collision mortality at windfarms undertaken by Thaxter et al. (2017) has estimated different fatality rates for bird groups/orders. Using the Thaxter et al. (2017) fatality rates and based on the proposal of 47 wind turbines, the annual fatality rates for each order of birds relevant to the Project has been calculated and presented in **Table 7-8**. Birds relevant to the Project included the protected and threatened species listed in previous **Table 5-1**, any species recorded by the BUS as flying at RSA height, and any confirmed ecosystem credit species.

As indicated in Table 7-8, the Accipitriformes species are at greatest risk and of these, Wedge-tailed Eagle was the most commonly recorded Accipitriformes species flying at RSA height. It is notable that during the spring survey, abundant lamb carcasses were observed to be attracting raptors. It would be expected that raptor mortalities from turbine strike would be much higher during the lambing season and a suitable mitigation measure that may significantly reduce raptor deaths (by decreasing the attraction of the area to feeding birds) would be the regular removal of lamb carcases.

Table 7-5: Five Most Dominant Species Recorded During Bird Utilisation Surveys

SUMMER (02/2021)		SPRING (10/2021)	
Species / Common Name	**Relative Abundance**	**Species / Common Name**	**Relative Abundance**
Cracticus tibicen Australian Magpie	26.7%	***Cracticus tibicen*** Australian Magpies	25%
Aquila audux Wedge-tailed Eagle	12.2%	***Cacatua galerita*** Sulphur-crested Cockatoo	20.6%
Cacatua galerita Sulphur-crested Cockatoo	11.4%	***Corvus coronoides*** Australian Raven	12.7%
Platycercus eximius Eastern Rosella	9.8%	***Aquila audux*** Wedge-tailed Eagle	10%
Manorina melanocephala Noisy Miner	8%	***Platycerus elegans*** Crimson Rosella	7.5%

Table 7-6: Percentage of Birds Recorded Flying within RSA

SUMMER (02/2021)						
Species	**Common Name**	**No. birds below RSA**	**No. birds within RSA**	**Grand total**	**% birds within RSA**	**% of all RSA birds**
Aquila audux	Wedge-tailed Eagle	1	14	15	93.3	28.6
Cacatua galerita	Sulphur-crested Cockatoo	0	14	14	100	28.6
Cracticus tibicen	Australian Magpie	28	5	33	15.2	10.2
Eolophus roseicapilla	Galah	0	4	4	100	8.2
Falco cenchroides	Australian Kestrel	0	6	6	100	12.2
Falco longipennis	Australian Hobby	0	2	2	100	4.1
Zanda funerea	Yellow-tailed Black Cockatoo	0	4	4	100	8.2
	Total	**29**	**49**	**78**	**62.8**	**100**

SPRING (10/2021)						
Species	**Common Name**	**No. birds below RSA**	**No. birds within RSA**	**Grand total**	**% birds within RSA**	**% of all RSA birds**
Accipiter fasciatus	Brown Goshawk	0	2	2	100	0.6
Aquila audux	Wedge-tailed Eagle	0	50	50	100	14.8
Cacatua galerita	Sulphur-crested Cockatoo	0	103	103	100	30.5
Callocephalon fimbriatum+	Gang-gang Cockatoo+	0	2	2	100	0.6
Corvus coronoides	Australian Raven	13	50	63	79.4	14.8
Cracticus tibicen	Australian Magpie	5	120	125	96	35.5
Elanus axillaris	Black-shouldered Kite	1	1	2	50	0.3
Falco berigora	Brown Falcon	0	1	1	100	0.3
Falco cenchroides	Australian Kestrel	4	6	10	60	1.8
Strepera graculina	Pied Currawong	0	3	3	100	0.9
Total		**23**	**338**	**361**	**93.6**	**100**

Notes: + denotes a threatened species. Below RSA = 0-30 m, Within RSA = 30-240 m. Note that no birds were recorded flying over RSA (>240 m).

Table 7-7: Four Most Dominant Bird Species Recorded Flying within RSA

SUMMER (02/2021)		SPRING (10/2021)	
Species / Common Name	**% of all RSA Birds**	**Species / Common Name**	**% of all RSA Birds**
Aquila audux Wedge-tailed Eagle	28.6 %	***Cracticus tibicen*** Australian Magpie	35.5 %
Cacatua galerita Sulphur-crested Cockatoo	28.6 %	***Cacatua galerita*** Sulphur-crested Cockatoo	30.5 %
Falco cenchroides Australian Kestrel	12.2 %	***Aquila audux*** Wedge-tailed Eagle	14.8 %
Cracticus tibicen Australian Magpie	10.2 %	***Corvus coronoides*** Australian Raven	14.8 %

Table 7-8: Estimated Annual Collision-related Fatality Rates for Confirmed Bird Species, by Order

Bird Order	Associated Protected or Threatened Species	Thaxter et al. (2017) Annual Fatality Rate	Estimated Annual Fatality Rate
Accipitriformes	*Aquila audax* (Wedge-tailed Eagle), *Elanus axillaris* (Black-shouldered Kite), *Haliaeetus leucogaster* (White-bellied Sea-Eagle), *H. morphnoides* (Little Eagle), *Circus assimilis* (Spotted Harrier)	0.07 birds per WTG.	3.29 birds.

Apodiformes	*Apus pacificus* (Fork-tailed Swift), *Hirundapus caudacutus* (White-throated Needletail)	0.021 birds per WTG.	0.99 birds.
Falconiformes	*Accipiter fasciatus* (Brown Goshawk), *Falco cenchroides* (Australian Kestrel), *F. longipennis* (Australian Hobby) and *F. berigor* (Brown Falcon)	No annual fatality rate for this order was provided in Thaxter et al. (2017).	
Passeriformes	*Anthochaera phrygia* (Regent Honeyeater), *Anthus novaeseelandiae* (Australasian Pipit), *Monarcha melanopsis* (Black-faced Monarch), *Cracticus tibicen* (Australian Magpie), *Grantiella picta* (Painted Honeyeater), *Strepera graculina* (Pied Currawong), *Corvus coronoides* (Australian Raven)	0.022 birds per WTG.	1.03 birds.
Pelecaniformes	*Egretta novaehollandiae* (White-faced Heron)	0.022 birds per WTG.	1.03 birds.
Psittaciformis	*Cacatua galerita* (Sulphur-crested Cockatoo), *Calyptorhynchus funereus* (Yellow-tailed Black Cockatoo), *Eolophus roseicapilla* (Galah), *Polytelis swainsonii* (Superb Parrot), *Calyptorhynchus lathami* (Glossy Black-Cockatoo), *Glossopsitta pusilla* (Little Lorikeet), *Callocephalon fimbriatum* (Gang-gang Cockatoo), *Lathamus discolor* (Swift Parrot)	0.03 birds per WTG.	1.41 birds.
Strigiformes	*Ninox strenua* (Powerful Owl)	0.022 birds per WTG.	1.03 birds.

7.3.1.2 Collision and Barotrauma Risk – Microchiropteran Bats

Bat echolocation detection surveys were undertaken across the Subject Site, over seven nights in Summer (February 2021). Several species were recorded across five families including Emballonuridae, Molossidae, Miniopteridae, Rhinolophidae and Vespertilionidae. Three threatened species were definitively recorded including *Falsistrellus tasmaniensis* (Eastern False Pipistrelle), *Scoteanax rueppellii* (Greater Broad-nosed Bat) and *Miniopterus orianae* (Large Bent-winged Bat) and one additional threatened species was potentially recorded (as an unresolved call), being *Saccolaimus flaviventris* (Yellow-bellied Sheathtail Bat). All confirmed ecosystem credit species were recorded. See **Appendix F** for the bat call analyses report.

The analysis of bat species' global vulnerability to collision mortality at wind farms, undertaken by Thaxter et al, (2017), has been used to estimate the collision risk for each of the represented families; see **Table 7-9**. It is unclear the role barotrauma has in contributing to fatality rates in wind farms as opposed to death directly attributed to collision alone. The Australian Bat Society has estimated the

fatality rates range from 1.6 bats per turbine per year to over 90 bats per turbine per year; however detailed studies have not confirmed this.

The Thaxter et al, (2017) models predict much higher collision rates for bats than birds. It should be noted though that this study utilised data from parts of Europe and North America. Species-specific traits for the species relevant to the Project should also be considered. In this instance, it is considered that migrating bats are the most likely microbat group to be potentially impacted by either collision or barotrauma. Of the four threatened species recorded, two are migratory, being *M. orianae* (Large Bent-winged Bat) and *S. flaviventris* (Yellow-bellied Sheathtail Bat).

Table 7-9: Estimated Annual Collision-related Fatality Rates for Recorded Microchiropteran Bat Species

Family	Species Recorded within Survey Area	Thaxter et al. (2017) Annual Fatality Rate	Estimated Annual Fatality Rate
Emballonuridae	*Saccolaimus flaviventris* (Yellow-bellied Sheathtail Bat)+	0.7 bats per WTG.	32.9 bats.
Miniopteridae	*Miniopterus orianae oceanensis* (Large Bent-winged Bat)+	0.68 bats per WTG.	32 bats.
Molossidae	*Tadarida australis* (White-striped Freetail Bat), *Ozimops planiceps* (Southern Free-tailed Bat), *O. ridei* (Ride's Free-Tailed Bat)	0.78 bats per WTG.	36.7 bats.
Rhinolophidae	*Rhinolophus megaphyllus* (Eastern Horseshoe Bat)	0.64 bats per WTG.	30.1 bats.
Vespertilionidae	*Chalinolobus gouldii* (Gould's Wattled Bat), *C. morio* (Chocolate Wattled bat), *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)+, *Nyctophilus* sp., *Scoteanax rueppellii* (Greater Broad-nosed Bat)+, *Scotorepens greyii* (Little Broad-nosed Bat), *S. orion* (Eastern Broad-nosed Bat), *Vespadelus darlingtoni* (Large Forest Bat), *V. regulus* (Southern Forest Bat), *V. vulturnus* (Little Forest Bat).	0.69 bats per WTG.	32.4 bats.

7.3.1.3 Collision Risk – Flying Foxes

Targeted surveys for *Pteropus poliocephalus* (Grey-headed Flying Fox) were undertaken in summer (3-10 February 2021) and spring (1-7 October 2022). These included nocturnal spotlighting and diurnal searches for colony camps. Grey-headed Flying Fox was not recorded in the Subject Site and there are no BioNet records within 10 km of the Subject Site. A review of DAWE's *Interactive Flying-fox Web Viewer* indicates that the closest flying fox camp is at Thilmere, approx. 75 km east of the Subject Site. Overall, while its presence cannot be discounted, it is considered that this species would rarely occur in the Subject Site and collision risk would be very low (although future monitoring would ensure that this was the case).

7.3.1.4 Bird and Bat Adaptive Management Program

As indicated in this assessment, there are uncertainties around the ongoing impact of collision and barotrauma related mortalities. The current literature is focused on Europe and North America and the statistics from these studies should be applied with caution to Australian conditions. In order to address these uncertainties, the Project proposes to develop a Bird and Bat Adaptive Management Program (BBAMP). The BBAP will outline monitoring measures, key thresholds for determining permissible impacts and corrective actions that are required to achieve the BBAMP objectives (which are essentially to minimise impacts on birds and bats during the operational phase). This is discussed further in Section 8.

8. MITIGATION AND MANAGEMENT OF IMPACTS

8.1 Mitigating and Managing Impacts

In accordance with the BAM, the proponent must identify measures to mitigate and manage impacts in accordance with the guidelines for mitigating and managing impacts on biodiversity values in Subsections 8.4.1 and 8.4.2 of the BAM. **Table 8-1** details the proposed measures to mitigate and manage impacts.

8.2 Adaptive Management for Uncertain Impacts

In accordance with Section 8.4 the BAM, adaptive management is to be used to address impacts that are infrequent or difficult to measure., such as indirect or prescribed impacts, or other remaining biodiversity impacts. A key component of the Project's adaptive management measures includes the development and implementation of a Bird and Bat Adaptive Management Plan (BBAMP) to address uncertainties around the ongoing impact of collision and barotrauma related mortalities. The BBAMP will outline monitoring measures, key thresholds for determining permissible impacts and corrective actions that are required to achieve the BBMP objectives (which are essentially to minimise impacts on birds and bats during the operational phase). Monitoring should include assessments of monthly mortality and periodic bird utilisation surveys (BUS) and appropriate mitigation measures will be identified (such as the regular removal of lamp carcasses during lambing season, to decrease the attraction of the area to feeding raptors). The frequency of report strike data and the adaptive management measures that could be implemented should strike thresholds be reached, will be negotiated with DPIE. Monitoring would also be undertaken with consideration of the monitoring guidelines provided by the Australian Wind Energy Association.

In addition to this, a Flora and Fauna Management Plan (FFMP) would be prepared and implemented as part of the Construction Environmental Management Plan. The FFMP will detail mitigation measures related specifically to the construction phase of the Project. There is scope to ensure that the principals of adaptive management are included in the FFMP (for instance through the monitoring of operational performance and by providing scope to adjust management measures where required). The **Table 8-1** further details the BBMP and FFMP, along with other measures to mitigate and manage impacts.

Table 8-1: Measures to Mitigate and Manage Impacts

Impact	Measure	Outcome	Timing	Responsibility
Impacts on threatened and protected animals from turbine strikes; **Mortality and injury of native fauna from barotrauma.**	A Bird and Bat Adaptive Management Plan (BBAMP) is to be developed, with the objective of minimising impacts on birds and bats during the wind farm's operational phase. • Will outline monitoring measures, key thresholds for determining permissible impacts and corrective actions that are required to achieve the objectives of the BBAMP. • Monitoring should include assessments of monthly mortality and periodic bird utilisation surveys (BUS). • Appropriate mitigation measures will be identified (such as the regular removal of lamb carcasses during lambing season, to decrease the attraction of the area to feeding raptors). • To be developed in consultation with DPIE. The frequency of report strike data and adaptive management measures that could be implemented should strike thresholds be reached, will be negotiated with DPIE. • Bird and bat strike monitoring will be undertaken with consideration of the monitoring guidelines provided by the Australian Wind Energy Association.	This will allow adaptive management of wind turbine collision and barotrauma risk to birds and bats.	BBAMP to be finalised prior to the issuing of the Construction Certificate and then implemented during the operational phase.	Project ecologist and site manager.
All impacts.	A Flora and Fauna Management Plan (FFMP) will be prepared and implemented as part of the Construction Environmental Management Plan. The FFMP should incorporate the design, construction and operational environmental management measures proposed. This should include (but not necessarily be limited to) issues relating to locations of threatened biodiversity, vegetation clearing procedures, wildlife connectivity, weed and pathogen control. Site personnel must be informed on procedures relating to the location of sensitive biodiversity issues. FFMP will include monitoring of operational performance and will provide scope to adjust management measures where required based on results of operational monitoring.	This will minimise any construction phase impacts on flora, fauna, their habitats and on downstream wetlands.	FFMP to be finalised prior to the issuing of the Construction Certificate and implemented during the construction phase.	Project ecologist and site manager.
Clearing of Native	The following vegetation clearing protocols will be implemented:	This will limit disturbance and impact on	Construction phase.	Project ecologist

Vegetation; **Injury and Death of Fauna;** **Removal of Coarse Woody Debris and Bush Rocks;** **Indirect Impacts on a Threatened Ecological Community; and** **Indirect Impacts on a Threatened Flora Species.**	• The boundaries of vegetation removal are to be clearly defined on the ground to prevent unauthorised clearing and impacts from vehicular and/or foot traffic. 'No go' zones should include areas of retained vegetation, riparian zones and any retained trees within the footprint. • Pre-clearance surveys and an inventory of trees and hollows for removal must be undertaken by a suitably qualified ecologist. • The Gang-gang cockatoo nest trees identified in this BDAR are not to be removed. • A qualified ecologist must be present during the removal of hollow-bearing trees to relocate / rescue any displaced or injured fauna. • If safe to do so without risk to plant operators, hollow-bearing trees should be knocked on the day prior to removal, to encourage fauna to vacate. • If practical, removal of hollow-bearing trees to be undertaken outside of the period of May – September which is the main breeding season for hollow-dependant fauna. • If practical, vegetation clearing within 200 m of the Gang-gang Cockatoo nest trees to be undertaken outside of the nesting period for this species (spring to summer). • Relocate ground timber, bush rocks and any salvaged tree hollows from areas of vegetation clearing (including exotic grassland) into retained areas of vegetation.	vegetation / habitat and fauna to the minimum necessary for construction works. It will also limit injury and death of fauna and ensure that important habitat features (e.g., ground logs) are salvaged and retained onsite.		and site manager.
Removal of Hollow-bearing Trees.	For every hollow-bearing tree that is removed, a nest box will be installed (under the supervision of a suitably qualified ecologist) within retained trees (that do not already contain a hollow). The nest box types installed must target the threatened species impacted by the proposal (such as microbats, arboreal mammals and birds). Maintenance and monitoring of nest boxes will be undertaken for a period of at least 10 years.	This will minimise the impact from the removal of hollow-bearing trees and human made structures, by providing compensatory habitat for hollow-dependent fauna.	Nest boxes to be installed prior to commencement of construction phase. Monitoring and maintenance to occur once annually for at least 10 years.	Project ecologist and site manager.
Reduced Viability of	Appropriate weed management protocol will be implemented. All	This will prevent the introduction and	Construction phase.	Site manager.

Adjacent Habitat due to Edge Effects.	equipment, vehicles and machinery wheels and tracks of excavators and other tracked machinery should be cleaned so that they are completely free of soil, seeds and plant material before entering the site to prevent the introduction of further exotic plant species and pathogens.	spread of weeds on the Subject Site.		
Impacts on Water Quality, Water Bodies and Hydrological Processes.	Appropriate sediment and erosion controls will be installed. no excavated material or fill to be placed in flood prone areas. All stockpiles and material to be secure from a one in ten-year flood level and have effective sediment control works to contain run-off.	This will prevent impacts on water quality in downstream wetlands.	Construction phase.	Site manager.

9. IMPACT SUMMARY

9.1 Serious and Irreversible Impacts on Biodiversity Values

Species and ecological communities with a 'very high' biodiversity risk weighting are potential serious and irreversible impact (SAII) entities. The following potential SAII entities are identified in the BAM-C as being associated with the Subject Site / Project:

- 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.
- Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions.

The Project's impacts on these potential SAII entities are further addressed in this section, (in accordance with the criteria in Section 9.1.2 of the BAM) in order to support the decision maker to determine if the impacts constitute a SAII.

9.1.1 SAII Assessment – 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

The Subject Site's PCT 654 is associated with 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 ('Box Gum Woodlands'), which is listed under the BC Act as a Critically Endangered Ecological Community (CEEC). The community does not meet the condition threshold (in Appendix 2 of the DECCW (2010) *National Recovery Plan White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland*) for the EPBC Act listing as the perennial exotic ground cover is well over 50% (compared with native perennials) (see BAM data sheets in **Appendix A**). The Project would require the removal of 1.85 ha of this CEEC.

The following information is provided in accordance with Section 9.1.2 of the BAM:

a. ***evidence of reduction in geographic distribution (Principle 1, clause 6.7(2)(a) BC Regulation) as the current total geographic extent of the TEC in NSW AND the estimated reduction in geographic extent of the TEC since 1970 (not including impacts of the proposal).***

The estimated reduction in geographic distribution in NSW ranges from a reduction to less than 1% for the Central Lachlan region, to less than 4% for the NSW south-western slopes and southern tablelands (in which the Subject Site occurs) and to less than 7% for the Holbrook area. There are several other estimates, however all are less than 10% (NSW Threatened Species Scientific Committee (TSSC), 2020).

b. extent of reduction in ecological function for the TEC using evidence that describes the degree of environmental degradation or disruption to biotic processes (Principle 2, clause 6.7(2)(b) BC Regulation) indicated by:

- *i. change in community structure*
- *ii. change in species composition*
- *iii. disruption of ecological processes*
- *iv. invasion and establishment of exotic species*
- *v. degradation of habitat, and*
- *vi. fragmentation of habitat*

Remaining areas of Box Gum Woodlands tend to be highly fragmented and disturbed, due to past clearing, cropping, grazing and pasture improvement and often occur as scattered trees (wholly or partly removed) with a degraded understorey and groundlayer (as is the case on the Subject Site). Intact remnants of high condition are very rare. Ongoing threats to remaining remnants include further clearing (for cropping, pasture improvement or other development), deterioration of condition (caused by firewood cutting, increased livestock grazing, weed invasion, inappropriate fire regimes, soil disturbance and increased nutrient loads) and degradation of the landscape (including soil acidification, salinity, and loss of connectivity between remnants) (TSSC, 2020).

c. evidence of restricted geographic distribution (Principle 3, clause 6.7(2)(c) BC Regulation), based on the TEC's geographic range in NSW according to the:

- *i. extent of occurrence*
- *ii. area of occupancy, and*
- *iii. number of threat-defined locations*

As stated above, the estimated reduction in geographic distribution is at least 90% (and likely more). According to the TSSC (2020), the estimated of the current extent of occurrence (EOO) in NSW is 702,800 km² and the estimated current area of occupancy (AOO) in NSW is 151,100 km². There are no known threat-defined locations.

d. evidence that the TEC is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation).

TBDC indicates that data is unknown.

The following assessment of impacts from the Project is undertaken in accordance with Section 9.1.2 of the BAM:

a. the impact on the geographic extent of the TEC (Principles 1 and 3) by estimating the total area of the TEC to be impacted by the proposal:

- *i. in hectares, and*
- *ii. as a percentage of the current geographic extent of the TEC in NSW.*

The Project would require the removal of 1.95 ha of the CEEC. There is also the potential for indirect impacts to adjacent retained remnants during the operational phase (e.g., edge effects and weed spread), however this is considered to be very minor (to negligible), as the Subject Site is already heavily grazed and pasture improved. These existing agricultural activities would have far greater indirect impacts on the CEEC. Overall, the Project would be responsible for a reduction of2.632327831531E-6% of the EOO and 1.2243547319656E-5% of the AOO.

b. the extent that the proposed impacts are likely to contribute to further environmental degradation or the disruption of biotic processes (Principle 2) of the TEC by:

i. estimating the size of any remaining, but now isolated, areas of the TEC; including areas of the TEC within 500 m of the development footprint or equivalent area for other types of proposals

The *Vegetation Map – Southern Forests – VIS 3858* (accessed on the NSW Government SEED Portal) has mapped significant areas of 'Yellow Box-Apple Box Grassy Woodlands / Tableland Dry Grassy Woodland' within 500 m of the Subject Site, however this mapping appears to be an overestimate as many of the mapped areas are cleared exotic pastures. The *State Vegetation Type Map: Central Tablelands Region Version 1.0. VIS_ID 4778* (accessed on the NSW Government SEED Portal) on the other hand, does not map any box gum woodland vegetation communities within 500 m of the Subject Site. Thus, neither of these datasets can be relied upon to obtain an estimate of the size of any remaining areas of the CEEC within 500 m of the development footprint.

Regardless, the potential for indirect impacts to adjacent retained remnants during the operational phase (e.g., edge effects and weed spread) is considered to be very minor (to negligible), as the Subject Site is already heavily grazed and pasture improved. All areas of the CEEC withing 500 m of the Project occur in the same cleared valley and are similarly disturbed, with the existing agricultural activities having far greater indirect impacts on the CEEC than the Project potentially would.

ii. describing the impacts on connectivity and fragmentation of the remaining areas of TEC measured by:

- ***distance between isolated areas of the TEC, presented as the average distance if the remnant is retained AND the average distance if the remnant is removed as proposed, and***
- ***estimated maximum dispersal distance for native flora species characteristic of the TEC, and***
- ***other information relevant to describing the impact on connectivity and fragmentation, such as the area to perimeter ratio for remaining areas of the TEC as a result of the development***

Landscape connectivity is important to the maintenance of box gum woodlands as it facilitates dispersal/interaction of species and the exchange of genetic material across the landscape. It is thus important to consider dispersal distances for native flora in the CEEC. The only native trees recorded in the Subject Site's CEEC were *Eucalyptus melliodora* (Yellow Box) and *E. bridgesiana* (Apple Box). No native understorey species and only occasional native groundcover species were recorded. Both *E. melliodora* and *E. bridgesiana* have a mixed mating breeding system with preferential outcrossing and self-pollination (although the latter leads to a reduction in seed yield and viability) (Burrows, 2000). Dispersal distances for outcrossing can vary; Broadhurst (2013) detected pollen sources from 250 m to 1 km away in seed crops of *E. melliodora* trees.

The Subject Site is situated between large tracks of forested land, including Abercrombie River NP to the west and north and a combination of state forest, private land and various nature reserves (including Blue Mountains National Park NP and Kanangra-Boyd NP) to the east and south. The box gum woodland areas within the Subject Site and in the surrounding cleared valley consist of scattered trees with a disturbed understorey. Overall, the vegetation removal required for the Project is

relatively minor and due to its linear nature, it would not result in the isolation of any patches of box gum woodlands by more than 250 m to 1 km.

iii. describing the condition of the TEC according to the vegetation integrity score for the relevant vegetation zone(s) (Section 4.3). The assessor must also include the relevant composition, structure and function condition scores for each vegetation zone.

The CEEC occurs on the Subject Site as PCT 654 Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion. PCT 654 was found to be in one broad condition state across the Subject Site and was concluded to have one VZ (654_1). The condition of VZ 654_1 is highly disturbed, with the understorey/groundcover being cleared, exotic and heavily grazed. There are however a high number of large, senescent trees with abundant hollows. **Table 9-1** provides the VI score, including the composition, structure and function condition scores for VZ 654_1.

Table 9-1: Vegetation Integrity Score for 654_1

VZ	Composition Score	Structure Condition Score	Function Condition Score	VI Score
654_1	4.5	34.4	45.3	**19.2**

9.1.2 SAII Assessment – Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions

The Subject Site's PCT 951 is associated with Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions ('Tablelands Basalt Forest'), which is listed under the BC Act as a Endangered Ecological Community. The Project would require the removal of 3.58 ha of the TEC.

The following information is provided in accordance with Section 9.1.2 of the BAM:

a. evidence of reduction in geographic distribution (Principle 1, clause 6.7(2)(a) BC Regulation) as the current total geographic extent of the TEC in NSW AND the estimated reduction in geographic extent of the TEC since 1970 (not including impacts of the proposal).

The total remaining area of Tableland Basalt Forest in NSW is estimated to be less than 15,000 ha, which is 5-20% of its original occurrence (TSSC, 2011).

b. extent of reduction in ecological function for the TEC using evidence that describes the degree of environmental degradation or disruption to biotic processes (Principle 2, clause 6.7(2)(b) BC Regulation) indicated by:

- ***i. change in community structure***
- ***ii. change in species composition***
- ***iii. disruption of ecological processes***
- ***iv. invasion and establishment of exotic species***
- ***v. degradation of habitat, and***
- ***vi. fragmentation of habitat***

Approximately 280 ha (<2%) of the TEC is estimated to occur within conservation reserves. The remaining areas occur on private land or on public easements and are highly fragmented (with >70% of patches <10 ha in size) (TSS, 2011). Small-scale clearing associated with rural subdivisions, easements, transport corridors and other localised development continues to threaten the TEC. The integrity and survival of small, isolated stands is impaired by the small population size of many species, enhanced risks from environmental stochasticity, disruption to pollination and dispersal of fruits or seeds, and likely reductions in the genetic diversity of isolated populations. Fragmentation also results in reduced fire frequencies within some patches, which may reduce the viability of some native plant populations (TSSC, 2011).

Much of the remaining area of Tableland Basalt Forest is regrowth forest and woodland from past clearing or characterised as isolated trees within paddocks. These trees may suffer elevated mortality episodes related to drought and insect attack. Changes in structure and species composition of the community, including loss of large trees, which provide habitat resources for a range of fauna, contribute to a large reduction in ecological function of the community. Livestock and rabbit grazing also presents a threat and results in the decline and disappearance of palatable plant species, including shrubs and herbs, and compaction and erosion of topsoil. Weed invasion also presents a significant threat (TSSC, 2011).

c. evidence of restricted geographic distribution (Principle 3, clause 6.7(2)(c) BC Regulation), based on the TEC's geographic range in NSW according to the:

- ***i. extent of occurrence***
- ***ii. area of occupancy, and***
- ***iii. number of threat-defined locations***

The estimated current extent of occurrence (EOO) in NSW is unknown. The estimated current area of occupancy (AOO) in NSW is 15,000 ha. There are no known threat-defined locations.

d. evidence that the TEC is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation).

TBDC indicates that data is unknown.

<u>The following assessment of impacts from the Project is undertaken in accordance with Section 9.1.2 of the BAM:</u>

a. the impact on the geographic extent of the TEC (Principles 1 and 3) by estimating the total area of the TEC to be impacted by the proposal:

- ***i. in hectares, and***
- ***ii. as a percentage of the current geographic extent of the TEC in NSW.***

The Project would require the removal of 2.84 ha of the TEC. There is also the potential for indirect impacts to adjacent retained remnants during the operational phase (e.g., edge effects and weed spread), however this is considered to be very minor (to negligible), as the Subject Site is already heavily grazed and pasture improved. These existing agricultural activities would have far greater indirect impacts on the TEC. Overall, the Project would be responsible for a reduction of 0.02% of the AOO.

b. the extent that the proposed impacts are likely to contribute to further environmental degradation or the disruption of biotic processes (Principle 2) of the TEC by:

i. estimating the size of any remaining, but now isolated, areas of the TEC; including areas of the TEC within 500 m of the development footprint or equivalent area for other types of proposals

The *State Vegetation Type Map: Central Tablelands Region Version 1.0. VIS_ID 4778* (accessed on the NSW Government SEED Portal) maps large areas of PCT 951 in the forested areas surrounding the Subject Site (including significant areas within nature reserves/national parks). The total area of PCT 951 within 500 m of the Subject Site is unknown, but large areas of it was observed on the eastern side of the Subject Site. Regardless, the potential for indirect impacts to adjacent retained remnants during the operational phase (e.g., edge effects and weed spread) is considered to be very minor (to negligible), as the Subject Site is already heavily grazed and pasture improved. The existing agricultural activities would have far greater indirect impacts on the TEC than the Project potentially would.

ii. describing the impacts on connectivity and fragmentation of the remaining areas of TEC measured by:

- ***distance between isolated areas of the TEC, presented as the average distance if the remnant is retained AND the average distance if the remnant is removed as proposed, and***
- ***estimated maximum dispersal distance for native flora species characteristic of the TEC, and***
- ***other information relevant to describing the impact on connectivity and fragmentation, such as the area to perimeter ratio for remaining areas of the TEC as a result of the development.***

Dispersal distances vary between flora species and are often dependent on fauna pollinators (such as bats, birds and insects). Some key flora species recorded in the BAM plots for PCT 951 included *Eucalyptus viminalis*, *E. macrorhyncha*, *Acacia melanoxylon*, *A. daelbata* and *Pittosporum multiflorum*. Eucalypts and Acacias are generally known to often have long distance dispersal distances (around 1 km) (Broadhurst, 2013; Booth, 2017). Dispersal distance for P. multiflorum is unknown, although seed is known to be spread by birds.

The Subject Site is situated between large tracks of forested land, including Abercrombie River NP to the west and north and a combination of state forest, private land and various nature reserves (including Blue Mountains National Park NP and Kanangra-Boyd NP) to the east and south. The *State Vegetation Type Map: Central Tablelands Region Version 1.0. VIS_ID 4778* (accessed on the NSW Government SEED Portal) maps large areas of PCT 951 in the forested areas surrounding the Subject Site (including significant areas within nature reserves/national parks). Overall, the vegetation removal required for the Project is relatively minor and due to its linear nature, it would not result in the isolation of any patches of the TEC.

iii. ***describing the condition of the TEC according to the vegetation integrity score for the relevant vegetation zone(s) (Section 4.3). The assessor must also include the relevant composition, structure and function condition scores for each vegetation zone.***

The TEC occurs on the Subject Site as PCT 951 Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion. PCT 951 was split into two VZs, based on the varying conditions states. VZ 951_1 is characterised as fairly intact open forest / woodland with a shrubby understorey and VZ 951_2 is characterised is heavily disturbed, with the understorey and groundcover being largely cleared and pasture improved. **Table 9-2** provides the VI scores for each VZ, including the composition, structure and function condition scores.

Table 9-2: Vegetation Integrity Score for 654_1

VZ	Composition Score	Structure Condition Score	Function Condition Score	VI Score
951_1	34.6	73.8	76.3	**57.9**
951_2	23.3	75.3	42.4	**42.1**

9.2 Identification of Impacts Requiring Offset

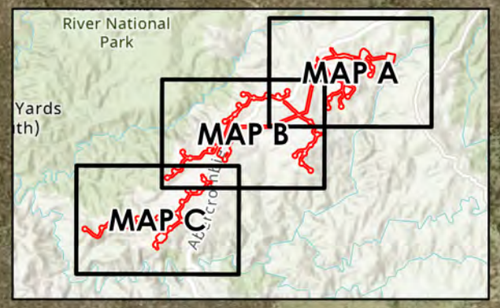
Impacts requiring offset include:

- Direct impacts on native vegetation, as identified in Section 7.
- Direct impacts on identified threatened species and their habitat, as identified in Section 7.

The area and location of impacts requiring offset is depicted in **Figure 8-1**.

9.3 Identification of Impacts Not Requiring Offset

Impacts not requiring offset include the indirect impacts on adjacent areas of vegetation / habitat, as identified in Section 7. The impacts / areas not requiring offset are depicted in **Figure 8-1**.



Vegetation	Development Footprint (ha)	Survey Area (ha)
Exotic Vegetation	204.5	425.3
Native Vegetation	31.7	65.4

Brass Walls Rd
Abercrombie Rd
Abercrombie Rd
Abercrombie Rd
Abercrombie Rd
Jerrong Rd
Jerrong Rd

0 200 400 600 800 1,000 2,000 Meters

Hunter Ecology

MAP A

Figure 9.1 Impact Summary

PYWF_Site_Boundary_v2_01_2

Survey Area

Development Footprint

Vegetation/Habitat Impact

Direct and indirect impacts to exotic vegetation/habitat not requiring offset

Direct impacts to native vegetation/habitat requiring offset

Indirect impacts to native vegetation/habitat not requiring offset

SAII Entities

Potential SAII Entity – Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions

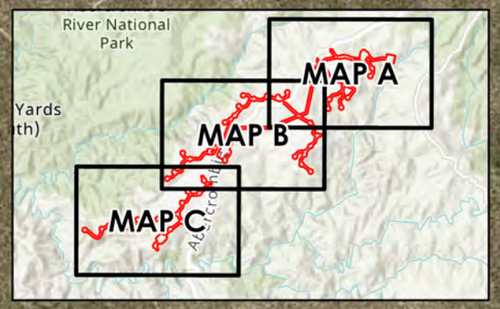
Potential SAII Entity - White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands

DATE : 05/12/2022
Map Version: 1.2

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:18,000



Vegetation	Development Footprint (ha)	Survey Area (ha)
Exotic Vegetation	204.5	425.3
Native Vegetation	31.7	65.4

Abercrombie Rd

Abercrombie Rd

Abercrombie Rd

Abercrombie Rd

0 200 400 600 800 1,000 2,000 Meters

Hunter Ecology

MAP B

Figure 9.1 Impact Summary

PYWF_Site_Boundary_v2_01_2

Survey Area

Development Footprint

Vegetation/Habitat Impact

Direct and indirect impacts to exotic vegetation/habitat not requiring offset

Direct impacts to native vegetation/habitat requiring offset

Indirect impacts to native vegetation/habitat not requiring offset

SAII Entities

Potential SAII Entity – Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions

Potential SAII Entity - 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

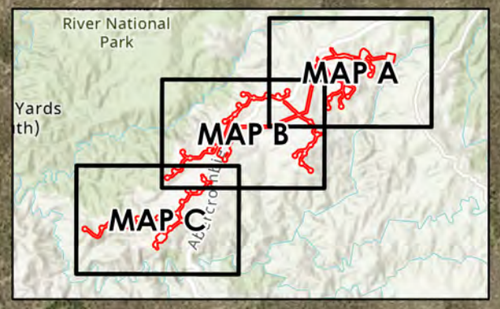
DATE : 05/12/2022
Map Version: 1.2

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:18,000

Vegetation	Development Footprint (ha)	Survey Area (ha)
Exotic Vegetation	204.5	425.3
Native Vegetation	31.7	65.4



Abercrombie Rd

Abercrombie River

Abercrombie River National Park

Abercrombie River

Abercrombie River

Taraiga Rd

0 200 400 600 800 1,000 2,000 Meters

Hunter Ecology

MAP C

Figure 9.1 Impact Summary

PYWF_Site_Boundary_v2_01_2

Survey Area

Development Footprint

Vegetation/Habitat Impact

Direct and indirect impacts to exotic vegetation/habitat not requiring offset

Direct impacts to native vegetation/habitat requiring offset

Indirect impacts to native vegetation/habitat not requiring offset

SAII Entities

Potential SAII Entity – Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions

Potential SAII Entity - 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

DATE : 05/12/2022
Map Version: 1.2

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:18,000

9.4 Ecosystem and Species Credits Required

Table 9-3 and **Table 9-4** outline the ecosystem credits and species credits that measure the impact of the development on biodiversity values.

Table 9-3: Ecosystem Credits Required

PCT	VZ	Area	Total VI Loss	No. of Ecosystem Credits Required
PCT 85 River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion	**85_1**	1.73 ha	47	41
PCT 649 Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion	**649_1**	5.57 ha	47.9	100
PCT 654 Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion	**654_1**	1.95 ha	19.5	24
PCT 727 Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion	**727_1**	7.53 ha	62.5	206
	727_2	1.25 ha	34	19
	727_3	7.38 ha	10.5	0
PCT 951 Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion	**951_1**	0.5 ha	57.9	14
	951_2	2.34 ha	42.1	49
PCT 1093 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion	**1093_1**	3.45 ha	51.4	78

Table 9-4: Species Credits Required

Species	VZ	Habitat condition (VI) loss	Area	No. of Species Credits Required
Callocephalon fimbriatum Gang-gang Cockatoo	727_1	62.5	4.2 ha	131
	951_1	57.9	0.4 ha	12

10. BIODIVERSITY CREDIT REPORT

The biodiversity credit report, including credit classes and matching credit profiles for required ecosystem and species credits, is provided in the following pages.

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00023736/BAAS18112/21/00023737

Proposal Name
Paling Yards Wind Farm

BAM data last updated *
22/06/2023

Assessor Name
Lizzie J Bowman

Assessor Number
BAAS18112

BAM Data version *
61

Proponent Names

Report Created
09/08/2023

BAM Case Status
Finalised

Assessment Revision
2

Assessment Type
Part 5 Activities

Date Finalised
09/08/2023

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
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 Highla	Critically Endangered Ecological Community	654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion
Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions	Endangered Ecological Community	951-Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion

Species
Nil

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

BAM Biodiversity Credit Report (Like for like)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
727-Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion	Not a TEC	16.2	206	19	225
1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion	Not a TEC	3.5	78	0	78
85-River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion	Not a TEC	1.7	41	0	41
654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion	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 Highla	2.0	24	0	24
951-Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion	Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions	2.8	63	0	63
649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion	Not a TEC	5.6	100	0	100

85-River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Eastern Riverine Forests This includes PCT's: 42, 85, 1106, 1318, 4070, 4073, 4075, 4077, 4081	Eastern Riverine Forests >=70% and <90%	85_1	Yes	41	Crookwell, Bungonia, Inland Slopes, Kanangra, Monaro, Murrumbateman, Oberon and Orange. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region

	Southern Tableland Dry Sclerophyll Forests This includes PCT's: 296, 299, 307, 344, 345, 349, 351, 352, 649, 652, 653, 700, 701, 727, 728, 729, 730, 888, 911, 912, 953, 957, 999, 1089, 1093, 1177, 3730, 3731, 3732, 3734, 3735, 3736, 3737, 3738, 3739, 3741, 3742, 3743, 3744, 3745, 3746, 3747, 3749, 4126	Southern Tableland Dry Sclerophyll Forests <50%	649_1	Yes	100	Crookwell, Bungonia, Inland Slopes, Kanangra, Monaro, Murrumbateman, Oberon and Orange. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland,	-	654_1	Yes	24	Crookwell, Bungonia, Inland Slopes, Kanangra, Monaro, Murrumbateman, Oberon and Orange. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388,					

	3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
727-Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Southern Tableland Dry Sclerophyll Forests This includes PCT's: 299, 344, 349, 351, 352, 653, 701, 727, 728, 730, 888, 957, 1093, 1177, 3730, 3732, 3734, 3735, 3737, 3738, 3741, 3743, 3744, 3746, 3747	Southern Tableland Dry Sclerophyll Forests >=50% and <70%	727_1	Yes	206	Crookwell, Bungonia, Inland Slopes, Kanangra, Monaro, Murrumbateman, Oberon and Orange. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Southern Tableland Dry Sclerophyll Forests This includes PCT's: 299, 344, 349, 351, 352, 653, 701, 727, 728, 730, 888, 957, 1093, 1177, 3730, 3732, 3734, 3735, 3737, 3738, 3741, 3743, 3744, 3746, 3747	Southern Tableland Dry Sclerophyll Forests >=50% and <70%	727_2	No	19	Crookwell, Bungonia, Inland Slopes, Kanangra, Monaro, Murrumbateman, Oberon and Orange. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Southern Tableland Dry Sclerophyll Forests This includes PCT's: 299, 344, 349, 351, 352, 653, 701, 727, 728, 730, 888, 957, 1093, 1177, 3730, 3732, 3734, 3735, 3737, 3738, 3741, 3743, 3744, 3746, 3747	Southern Tableland Dry Sclerophyll Forests >=50% and <70%	727_3	No	0	Crookwell, Bungonia, Inland Slopes, Kanangra, Monaro, Murrumbateman, Oberon and Orange. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

951-Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
	Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions This includes PCT's: 730, 742, 744, 802, 951, 952, 953, 963, 1070, 1097, 1100, 1101, 1102, 1103, 1107, 1196, 1197, 1254, 3295, 3305, 3366	-	951_1	Yes	14	Crookwell, Bungonia, Inland Slopes, Kanangra, Monaro, Murrumbateman, Oberon and Orange. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions This includes PCT's: 730, 742, 744, 802, 951, 952, 953, 963, 1070, 1097, 1100, 1101, 1102, 1103, 1107, 1196, 1197, 1254, 3295, 3305, 3366	-	951_2	Yes	49	Crookwell, Bungonia, Inland Slopes, Kanangra, Monaro, Murrumbateman, Oberon and Orange. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Southern Tableland Dry Sclerophyll Forests This includes PCT's: 299, 344, 349, 351, 352, 653, 701, 727, 728, 730, 888, 957, 1093, 1177, 3730, 3732, 3734, 3735, 3737, 3738, 3741, 3743, 3744, 3746, 3747	Southern Tableland Dry Sclerophyll Forests >=50% and <70%	1093_1	Yes	78	Crookwell, Bungonia, Inland Slopes, Kanangra, Monaro, Murrumbateman, Oberon and Orange. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Like for like)

1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Callocephalon fimbriatum / Gang-gang Cockatoo	**727_1, 951_1**	4.6	143.00

Credit Retirement Options

Like-for-like credit retirement options

	Spp	IBRA subregion
Callocephalon fimbriatum / Gang-gang Cockatoo	**Callocephalon fimbriatum /** Gang-gang Cockatoo	Any in NSW

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id
00023736/BAAS18112/21/00023737

Proposal Name
Paling Yards Wind Farm

BAM data last updated *
22/06/2023

Assessor Name
Lizzie J Bowman

Assessor Number
BAAS18112

BAM Data version *
61

Proponent Name(s)

Report Created
09/08/2023

BAM Case Status
Finalised

Assessment Revision
2

Assessment Type
Part 5 Activities

Date Finalised
09/08/2023

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
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 Highla	Critically Endangered Ecological Community	654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion
Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions	Endangered Ecological Community	951-Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion

Species
Nil

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
727-Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion	Not a TEC	16.2	206	19	225.00
1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion	Not a TEC	3.5	78	0	78.00
85-River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion	Not a TEC	1.7	41	0	41.00

654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion	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 Highla	2.0	24	0	24.00
951-Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion	Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions	2.8	63	0	63.00
649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion	Not a TEC	5.6	100	0	100.00

85-River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Eastern Riverine Forests This includes PCT's: 42, 85, 1106, 1318, 4070, 4073, 4075, 4077, 4081	Eastern Riverine Forests >=70% and <90%	85_1	Yes	41	Crookwell,Bungonia, Inland Slopes, Kanangra, Monaro, Murrumbateman, Oberon and Orange. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Variation options

Formation	Trading group	Zone	HBT	Credits	IBRA region
Forested Wetlands	Tier 2 or higher threat status	85_1	Yes (including artificial)	41	IBRA Region: South Eastern Highlands, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Southern Tableland Dry Sclerophyll Forests This includes PCT's: 296, 299, 307, 344, 345, 349, 351, 352, 649, 652, 653, 700, 701, 727, 728, 729, 730, 888, 911, 912, 953, 957, 999, 1089, 1093, 1177, 3730, 3731, 3732, 3734, 3735, 3736, 3737, 3738, 3739, 3741, 3742, 3743, 3744, 3745, 3746, 3747, 3749, 4126	Southern Tableland Dry Sclerophyll Forests <50%	649_1	Yes	100	Crookwell,Bungonia, Inland Slopes, Kanangra, Monaro, Murrumbateman, Oberon and Orange. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Variation options

Formation	Trading group	Zone	HBT	Credits	IBRA region
Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 4 or higher threat status	649_1	Yes (including artificial)	100	IBRA Region: South Eastern Highlands, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the	-	654_1	Yes	24	Crookwell,Bungonia, Inland Slopes, Kanangra, Monaro, Murrumbateman, Oberon and Orange. or

	NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533,					Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	4147, 4149, 4150					
727-Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Southern Tableland Dry Sclerophyll Forests This includes PCT's: 299, 344, 349, 351, 352, 653, 701, 727, 728, 730, 888, 957, 1093, 1177, 3730, 3732, 3734, 3735, 3737, 3738, 3741, 3743, 3744, 3746, 3747	Southern Tableland Dry Sclerophyll Forests >=50% and <70%	727_1	Yes	206	Crookwell,Bungonia, Inland Slopes, Kanangra, Monaro, Murrumbateman, Oberon and Orange. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Southern Tableland Dry Sclerophyll Forests This includes PCT's: 299, 344, 349, 351, 352, 653, 701, 727, 728, 730, 888, 957, 1093, 1177, 3730, 3732, 3734, 3735, 3737, 3738, 3741, 3743, 3744, 3746, 3747	Southern Tableland Dry Sclerophyll Forests >=50% and <70%	727_2	No	19	Crookwell,Bungonia, Inland Slopes, Kanangra, Monaro, Murrumbateman, Oberon and Orange. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Southern Tableland Dry Sclerophyll Forests This includes PCT's: 299, 344, 349, 351, 352, 653, 701, 727, 728, 730, 888, 957, 1093, 1177, 3730, 3732, 3734, 3735, 3737, 3738, 3741, 3743, 3744, 3746, 3747	Southern Tableland Dry Sclerophyll Forests >=50% and <70%	727_3	No	0	Crookwell,Bungonia, Inland Slopes, Kanangra, Monaro, Murrumbateman, Oberon and Orange. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 3 or higher threat status	727_1	Yes (including artificial)	206	IBRA Region: South Eastern Highlands, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 3 or higher threat status	727_2	No	19	IBRA Region: South Eastern Highlands, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 3 or higher threat status	727_3	No	0	IBRA Region: South Eastern Highlands, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
951-Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region

Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions This includes PCT's: 730, 742, 744, 802, 951, 952, 953, 963, 1070, 1097, 1100, 1101, 1102, 1103, 1107, 1196, 1197, 1254, 3295, 3305, 3366	-	951_1	Yes	14	Crookwell,Bungonia, Inland Slopes, Kanangra, Monaro, Murrumbateman, Oberon and Orange. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions This includes PCT's: 730, 742, 744, 802, 951, 952, 953, 963, 1070, 1097, 1100, 1101, 1102, 1103, 1107, 1196, 1197, 1254, 3295, 3305, 3366	-	951_2	Yes	49	Crookwell,Bungonia, Inland Slopes, Kanangra, Monaro, Murrumbateman, Oberon and Orange. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Variation options

Formation	Trading group	Zone	HBT	Credits	IBRA region
Wet Sclerophyll Forests (Grassy sub-formation)	Tier 3 or higher threat status	951_1	Yes (including artificial)	14	IBRA Region: South Eastern Highlands, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Wet Sclerophyll Forests (Grassy sub-formation)	Tier 3 or higher threat status	951_2	Yes (including artificial)	49	IBRA Region: South Eastern Highlands, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Southern Tableland Dry Sclerophyll Forests This includes PCT's: 299, 344, 349, 351, 352, 653, 701, 727, 728, 730, 888, 957, 1093, 1177, 3730, 3732, 3734, 3735, 3737, 3738, 3741, 3743, 3744, 3746, 3747	Southern Tableland Dry Sclerophyll Forests >=50% and <70%	1093_1	Yes	78	Crookwell,Bungonia, Inland Slopes, Kanangra, Monaro, Murrumbateman, Oberon and Orange. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 3 or higher threat status	1093_1	Yes (including artificial)	78	IBRA Region: South Eastern Highlands, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Callocephalon fimbriatum / Gang-gang Cockatoo	**727_1, 951_1**	4.6	143.00

Credit Retirement Options

Like-for-like options

Callocephalon fimbriatum/ Gang-gang Cockatoo	Spp		IBRA region
	Callocephalon fimbriatum/Gang-gang Cockatoo		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Vulnerable	Crookwell, Bungonia, Inland Slopes, Kanangra, Monaro, Murrumbateman, Oberon and Orange. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Vegetation Zones Report

Proposal Details

Assessment Id
00023736/BAAS18112/21/00023737

Assessment name
Paling Yards Wind Farm

BAM data last updated *
22/06/2023

Assessor Name
Lizzie J Bowman

Report Created
09/08/2023

BAM Data version *
61

Assessor Number
BAAS18112

Assessment Type
Part 5 Activities

BAM Case Status
Finalised

Assessment Revision
2

Date Finalised
09/08/2023

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Vegetation Zones

#	Name	PCT	Condition	Area	Minimum number of plots	Management zones
1	727_1	727-Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion	1	7.53	3	

2	727_2	727-Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion	2	1.25	1	
3	727_3	727-Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion	3	7.38	3	
4	1093_1	1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion	1	3.45	2	
5	85_1	85-River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion	1	1.73	1	
6	654_1	654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion	1	1.95	1	
7	951_1	951-Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion	1	0.5	1	
8	951_2	951-Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion	2	2.34	2	

9	649_1	649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion	1	5.57	3	

BAM Predicted Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00023736/BAAS18112/21/00023737	Paling Yards Wind Farm	22/06/2023
Assessor Name	Report Created	BAM Data version *
Lizzie J Bowman	09/08/2023	61
Assessor Number	Assessment Type	BAM Case Status
BAAS18112	Part 5 Activities	Finalised
Assessment Revision		Date Finalised
2		09/08/2023

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Threatened species reliably predicted to utilise the site. No surveys are required for these species. Ecosystem credits apply to these species.

Common Name	Scientific Name	Vegetation Types(s)
Black-chinned Honeyeater (eastern subspecies)	Melithreptus gularis gularis	85-River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion
		654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion
		649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion
Brown Treecreeper (eastern subspecies)	Climacteris picumnus victoriae	727-Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion
		1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
		85-River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion
		654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion
		951-Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion
		649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion
Diamond Firetail	Stagonopleura guttata	727-Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion

Diamond Firetail	Stagonopleura guttata	1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
		85-River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion
		654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion
		649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion
Dusky Woodswallow	Artamus cyanopterus cyanopterus	727-Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion
		1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
		85-River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion
		654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion
		951-Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion
		649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion
Eastern False Pipistrelle	Falsistrellus tasmaniensis	1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
		654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion
		951-Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion
		649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion
Flame Robin	Petroica phoenicea	727-Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion
		1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
		85-River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion
		654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion

Flame Robin	Petroica phoenicea	951-Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion
		649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion
Gang-gang Cockatoo	Callocephalon fimbriatum	727-Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion
		1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
		85-River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion
		654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion
		951-Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion
		649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion
Glossy Black-Cockatoo	Calyptorhynchus lathami	1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
		649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion
Greater Broad-nosed Bat	Scoteanax rueppellii	1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
		951-Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion
		649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion
Grey-headed Flying-fox	Pteropus poliocephalus	1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
		654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion
		649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion
Hooded Robin (south-eastern form)	Melanodryas cucullata cucullata	1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion

Hooded Robin (south-eastern form)	Melanodryas cucullata cucullata	85-River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion
		654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion
		649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion
Large Bent-winged Bat	Miniopterus orianae oceanensis	727-Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion
		1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
		85-River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion
		654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion
		951-Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion
		649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion
Little Eagle	Hieraaetus morphnoides	727-Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion
		1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
		85-River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion
		654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion
		951-Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion
		649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion
Little Lorikeet	Glossopsitta pusilla	1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
		85-River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion
		654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion

Little Lorikeet	Glossopsitta pusilla	649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion
Little Whip Snake	Suta flagellum	654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion
Painted Honeyeater	Grantiella picta	727-Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion
		1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
		85-River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion
		654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion
		649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion
Powerful Owl	Ninox strenua	727-Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion
		1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
		654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion
		951-Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion
		649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion
Regent Honeyeater	Anthochaera phrygia	1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
		85-River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion
		654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion
		649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion
Rosenberg's Goanna	Varanus rosenbergi	727-Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion
		1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion

Rosenberg's Goanna	Varanus rosenbergi	654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion
		649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion
Scarlet Robin	Petroica boodang	727-Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion
		1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
		85-River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion
		654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion
		951-Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion
		649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion
Speckled Warbler	Chthonicola sagittata	727-Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion
		1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
		85-River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion
		654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion
		649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion
Spotted Harrier	Circus assimilis	85-River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion
Spotted-tailed Quoll	Dasyurus maculatus	727-Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion
		1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
		85-River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion
		654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion

Spotted-tailed Quoll	Dasyurus maculatus	951-Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion
		649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion
Superb Parrot	Polytelis swainsonii	85-River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion
		654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion
Swift Parrot	Lathamus discolor	727-Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion
		1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
		85-River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion
		654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion
		951-Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion
		649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion
Varied Sittella	Daphoenositta chrysoptera	727-Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion
		1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
		85-River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion
		654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion
		951-Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion
		649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion
White-bellied Sea-Eagle	Haliaeetus leucogaster	85-River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion
White-throated Needletail	Hirundapus caudacutus	727-Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion

White-throated Needletail	Hirundapus caudacutus	1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
		85-River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion
		654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion
		951-Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion
		649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion
Yellow-bellied Glider	Petaurus australis	1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
		654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion
		951-Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion
		649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion
Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris	1093-Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
		654-Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion
		951-Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion
		649-Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion

Threatened species Manually Added

Common Name	Scientific Name
Swift Parrot	Lathamus discolor

Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

Refer to BAR for detailed justification

Common Name	Scientific Name	Justification in the BAM-C

BAM Candidate Species Report

Proposal Details

Assessment Id 00023736/BAAS18112/21/00023737	Proposal Name Paling Yards Wind Farm	BAM data last updated * 22/06/2023
Assessor Name Lizzie J Bowman	Report Created 09/08/2023	BAM Data version * 61
Assessor Number BAAS18112	Assessment Type Part 5 Activities	BAM Case Status Finalised
Assessment Revision 2	Date Finalised 09/08/2023	

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List of Species Requiring Survey

Name	Presence	Survey Months
Acacia bynoeana Bynoe's Wattle	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Ammobium craspedioides Yass Daisy	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Callocephalon fimbriatum Gang-gang Cockatoo	Yes (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Calyptorhynchus lathami Glossy Black-Cockatoo	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Cercartetus nanus Eastern Pygmy-possum	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Diuris aequalis Buttercup Doubletail	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Eucalyptus aggregata Black Gum	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Eucalyptus robertsonii subsp. hemisphaerica Robertson's Peppermint	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Haliaeetus leucogaster White-bellied Sea-Eagle	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Heleioporus australiacus Giant Burrowing Frog	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Hieraaetus morphnoides Little Eagle	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Keyacris scurra Key's Matchstick Grasshopper	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Lepidium hyssopifolium Aromatic Peppercress	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Leucochrysum albicans subsp. tricolor Hoary Sunray	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Litoria aurea Green and Golden Bell Frog	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Litoria booroolongensis Booroolong Frog	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Litoria castanea Yellow-spotted Tree Frog	No (surveyed) *Survey months are outside of the months specified in Bionet.	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☑ Survey month outside the specified months?
Mixophyes balbus Stuttering Frog	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Ninox strenua Powerful Owl	No (surveyed) *Survey months are outside of the months specified in Bionet.	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☑ Survey month outside the specified months?
Petauroides volans Southern Greater Glider	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Petaurus norfolcensis Squirrel Glider	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Phascogale tapoatafa Brush-tailed Phascogale	No (surveyed) *Survey months are outside of the months specified in Bionet.	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☑ Survey month outside the specified months?
Phascolarctos cinereus Koala	No (surveyed)	☐ Jan ☑ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Polytelis swainsonii Superb Parrot	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Pteropus poliocephalus Grey-headed Flying-fox	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Threatened species Manually Added

Common Name	Scientific Name
Stuttering Frog	Mixophyes balbus
Swift Parrot	Lathamus discolor

Threatened species assessed as not on site

Refer to BAR for detailed justification

Common name	Scientific name	Justification in the BAM-C
Large Bent-winged Bat	Miniopterus orianae oceanensis	Habitat constraints
Pink-tailed Legless Lizard	Aprasia parapulchella	Refer to BAR
Regent Honeyeater	Anthochaera phrygia	Habitat constraints

Swift Parrot	Lathamus discolor	Habitat constraints

BAM Credit Summary Report

Proposal Details

Assessment Id
00023736/BAAS18112/21/00023737

Proposal Name
Paling Yards Wind Farm

BAM data last updated *
22/06/2023

Assessor Name
Lizzie J Bowman

Report Created
09/08/2023

BAM Data version *
61

Assessor Number
BAAS18112

BAM Case Status
Finalised

Date Finalised
09/08/2023

Assessment Revision
2

Assessment Type
Part 5 Activities

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion												
9	649_1	Not a TEC	47.9	47.9	5.6	PCT Cleared - 45%	High Sensitivity to Gain			1.50		100
											Subtotal	**100**

Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands Bioregion												
6	654_1	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 Highla	19.5	19.5	2	PCT Cleared - 95%	High Sensitivity to Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	True	24
											Subtotal	**24**
Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion												
1	727_1	Not a TEC	62.5	62.5	7.5	PCT Cleared - 50%	High Sensitivity to Gain			1.75		206
2	727_2	Not a TEC	34	34.0	1.2	PCT Cleared - 50%	High Sensitivity to Gain			1.75		19

3	727_3	Not a TEC	10.5	10.5	7.4	PCT Cleared - 50%	High Sensitivity to Gain			1.75		0
											Subtotal	**225**
Mountain Gum - Manna Gum open forest of the South Eastern Highlands Bioregion												
7	951_1	Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions	57.9	57.9	0.5	PCT Cleared - 80%	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00	True	14
8	951_2	Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions	42.1	42.1	2.3	PCT Cleared - 80%	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00	True	49
											Subtotal	**63**

Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion												
4	1093_1	Not a TEC	51.4	51.4	3.4	PCT Cleared - 61%	High Sensitivity to Gain			1.75		78
											Subtotal	**78**
River Oak forest and woodland wetland of the NSW South Western Slopes and South Eastern Highlands Bioregion												
5	85_1	Not a TEC	47	47.0	1.7	PCT Cleared - 73%	High Sensitivity to Gain			2.00		41
											Subtotal	**41**
											Total	**531**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAII	Species credits
Callocephalon fimbriatum / Gang-gang Cockatoo (Fauna)									
727_1	62.5	62.5	4.2			Vulnerable	Endangered	False	131
951_1	57.9	57.9	0.4			Vulnerable	Endangered	False	12
								Subtotal	**143**

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APPENDIX A – BAM PLOT DATA SHEETS

PLOT 1

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	Survey Name	Plot ID	Recorders
Date: 4/2/2021	Paling Yards	**P1**	Lizzie & Lorena

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Abund	Stratum	Voucher	Photo #
TG	*Eucalyptus viminalis*	N	40	4	C		
-	*Rubus fruticosus*	HTE	40	30	S/G		
GG	*Joycea pallida*	N	2	50	G		
TG	*Acacia dealbata*	N	1	20	S/E		
FG	*Euchiton sphaericus*	N	0.1	20	G		
-	*Taraxacum officinale*	E	0.2	30	G		
GG	*Aristida ramosa*	N	1	50	G		
-	*Holcus lanatus*	E	5	100	G		
-	*Modiola caroliniana*	E	0.1	10	G		
GG	*Themeda triandra*	N	5	100	G		
GG	*Rytidosperma setaceum*	N	5	100	G		
-	*Rosa canina*	E	2	20	S/E		

BAM Site – Field Survey Form

Survey Name	Date	Recorders
Paling Yards	4/2/2021	Lizzie & Lorena
Plot ID: **P1**		PCT/VZ: PCT 85_1

BAM Attribute (400m² plot)	Sum values	
	Count of native richness	Cover
Trees	**2**	**41**
Shrubs	**0**	**0**
Grasses etc.	**4**	**13**
Forbs	**1**	**0.1**
Ferns	**0**	**0**
Other	**0**	**0**
High threat weed cover		**40**

Cover: 0.1, 0.2, 0.3….. 1,2,3,……,10, 15, 20, 25, ….. 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	**#Tree Stems Count**	**#Stems with Hollows**
80 + cm	1	1
50 – 79 cm	3	
30 – 49 cm	✓	
20 – 29 cm	✓	
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	**Tally:** 36 m	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30….100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
Subplot score % in each	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
	3	0	20	5	3	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	6.2					0.8					0					0				

PLOT 2

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	**Survey Name**	**Plot ID**	**Recorders**
Date: 4/2/2021	Paling Yards	**P2**	Lizzie & Lorena

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Abund	Stratum	Voucher	Photo #
TG	*Eucalyptus bridgesiana*	N	25	4	C		
SG	*Acacia falciformis*	N	5	2	S/M		
-	*Cirsium vulgare*	E	1	15	G		
GG	*Rytidosperma setaceum*	N	20	100	G		
GG	*Bothriochloa macra*	N	1	50	G		
FG	*Oxalis perennans*	N	0.5	100	G		
FG	*Wahlenbergia stricta*	N	0.2	50	G		
-	*Carthamus lanatus*	HTE	10	100	G		
-	*Malva parviflora*	E	0.5	50	G		
GG	*Joycea pallida*	N	0.2	20	G		
FG	*Rumex brownii*	N	0.1	5	G		
FG	*Euchiton sphaericus*	N	0.1	10	G		
FG	*Geranium solander*	N	0.5	40	G		
-	*Solanum nigrum*	E	0.1	2	G		
-	*Taraxacum officinale*	E	0.1	5	G		
-	*Lycium ferocissimum*	HTE	0.2	1	S		
-	*Urtica dioica*	E	0.5	10	G		
GG	*Lomandra longifolia*	N	0.1	1	G		
-	*Rosa canina*	E	0.1	5	E		
GG	*Elymas scaber*	N	0.2	20	G		
FG	*Gonocarpus tetragynus*	N	0.1	4	G		
FG	*Acaena ovina*	N	0.1	4	G		
FG	*Acaena echinata*	N	0.2	10	G		

BAM Site – Field Survey Form

Survey Name	**Date**	**Recorders**
Paling Yards	4/2/2021	Lizzie & Lorena
Plot ID: **P2**		PCT/VZ: PCT 649_1

BAM Attribute (400m² plot)	**Sum values**	
	Count of native richness	**Cover**
Trees	**1**	**25**
Shrubs	**1**	**5**
Grasses etc.	**5**	**21.5**
Forbs	**8**	**1.8**
Ferns	**0**	**0**
Other	**0**	**0**
High threat weed cover		**0.2**

BAM Attribute (1000m² plot)		
DBH	**#Tree Stems Count**	**#Stems with Hollows**
80 + cm		
50 – 79 cm	5	4
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	**Tally:** 48 m	

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					**Bare ground cover %**					**Cryptogam cover %**					**Rock cover %**				
Subplot score % in each	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
	25	10	5	10	5	0	0	0	0	0	15	15	20	15	10	25	20	55	70	15
Average of the 5 subplots	11					0					15					37				

PLOT 3

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	**Survey Name**	**Plot ID**	**Recorders**
Date: 5/2/2021	Paling Yards	**P3**	Lizzie & Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Abund	Stratum	Voucher	Photo #
TG	*Eucalyptus bridgesiana*	N	30	11	C		
GG	*Microlaena stipoides*	N	5	300	G		
GG	*Rytidosperma setaceum*	N	10	500	G		
-	*Carthamus lanatus*	HTE	0.1	5	G		
FG	*Oxalis perennans*	N	0.1	20	G		
FG	*Rumex brownii*	N	0.1	5	G		
GG	*Rytidosperma pallidum*	N	3	100	G		
-	*Urtica dioica*	E	2	30	G		
-	*Lolium perenne*	E	70	800	G		
FG	*Geranium solandri*	N	1	40	G		
-	*Trifolium repens*	E	2	200	G		
FG	*Dichondra repens*	N	0.1	20	G		
-	*Cirsium vulgare*	E	0.5	30	G		
-	*Plantago lanceolata*	E	0.1	5	G		
-	*Lysimachia arvensis*	E	0.1	5	G		
-	*Modiola caroliniana*	E	0.1	10	G		
-	*Lycium ferocissimum*	HTE	0.2	1	S		
-	*Conyza sumatrensis*	E	0.1	2	G		
-	*Hordeum leporinum*	E	10	400	G		
GG	*Elymas scaber*	N	0.2	40	G		
-	*Taraxacum officinale*	E	0.1	4	G		
FG	*Acaena ovina*	N	0.1	10	G		
OG	*Desmodium sp.*	N	0.1	2	G		
-	*Holcus lanatus*	E	0.1	10	G		
-	*Veronica persica*	E	0.1	10	G		
FG	*Acaena echinata*	N	0.1	2	G		
GG	*Bothriochloa macra*	N	0.1	10	G		

BAM Site – Field Survey Form

Survey Name	**Date**	**Recorders**
Paling Yards	5/2/2021	Lizzie & Bart
Plot ID: P3		PCT/VZ: 649_1

BAM Attribute (400m² plot)	**Sum values**	
	Count of native richness	**Cover**
Trees	**1**	**30**
Shrubs	**0**	**0**
Grasses etc.	**5**	**18.3**
Forbs	**6**	**1.5**
Ferns	**0**	**0**
Other	**1**	**0.1**
High threat weed cover		**0.3**

BAM Attribute (1000m² plot)		
DBH	**#Tree Stems Count**	**#Stems with Hollows**
80 + cm	1	1
50 – 79 cm	5	5
30 – 49 cm	4	
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	**Tally:** 42 m	

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					**Bare ground cover %**					**Cryptogam cover %**					**Rock cover %**				
Subplot score % in each	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
	1	2	1	3	5	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Average of the 5 subplots	2.4					0					0					0.4				

PLOT 4

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	**Survey Name**	**Plot ID**	**Recorders**
Date: 5/2/2021	Paling Yards	**P4**	Lizzie & Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Abund	Stratum	Voucher	Photo #
TG	*Eucalyptus dives*	N	10	8	C/E		
TG	*Eucalyptus macrorhyncha*	N	15	10	C/E		
TG	*Eucalyptus goniocalyx*	N	5	2	C		
TG	*Eucalyptus mannifera*	N	5	2	C		
GG	*Poa sieberiana*	N	5	100	G		
GG	*Elymas scaber*	N	1	50	G		
GG	*Lomandra filiformis*	N	0.1	5	G		
GG	*Panicum effusum*	N	0.1	15	G		
-	*Bromus sp.*	E	0.3	20	G		
-	*Taraxacum officinale*	E	0.1	10	G		
-	*Plantago lanceolata*	E	0.1	5	G		
OG	*Hardenbergia violaceae*	N	0.1	2	G		
-	*Phalaris canariensis*	E	0.1	2	G		
-	*Rubus fruticosus*	HTE	0.1	1	E		
-	*Conyza sumatrensis*	E	0.1	5	G		
-	*Carthamus lanatus*	HTE	0.1	4	G		
FG	*Euchiton sphaericus*	N	0.1	5	G		
GG	*Rytidosperma pallidum*	N	1	30	G		
GG	*Microlaena stipoides*	N	5	300	G		
FG	*Poranthera microphylla*	N	0.1	5	G		

BAM Site – Field Survey Form

Survey Name	**Date**	**Recorders**
Paling Yards	5/2/2021	Lizzie & Bart
Plot ID: **P4**		PCT/VZ: 727_1

BAM Attribute (400m² plot)	**Sum values**	
	Count of native richness	**Cover**
Trees	**4**	**35**
Shrubs	**0**	**0**
Grasses etc.	**6**	**12.2**
Forbs	**2**	**0.2**
Ferns	**0**	**0**
Other	**1**	**0.1**
High threat weed cover		**0.2**

BAM Attribute (1000m² plot)		
DBH	**#Tree Stems Count**	**#Stems with Hollows**
80 + cm	1	1
50 – 79 cm	4	3
30 – 49 cm	✓	
20 – 29 cm	✓	
10 – 19 cm	✓	
5 – 9 cm	✓	
<5 cm	✓	
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	**Tally:** 85 m	

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					**Bare ground cover %**					**Cryptogam cover %**					**Rock cover %**				
Subplot score % in each	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
	85	95	95	80	50	10	0	0	0	10	0	0	0	5	10	5	0	0	0	0
Average of the 5 subplots	81					4					3					1				

PLOT 5

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	**Survey Name**	**Plot ID**	**Recorders**
Date: 5/2/2021	Paling Yards	**P5**	Lizzie & Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Abund	Stratum	Voucher	Photo #
TG	*Eucalyptus dives*	N	25	12	C/E		
GG	*Elymas scaber*	N	2	300	G		
FG	*Euchiton sphaericus*	N	0.1	15	G		
-	*Cirsium vulgare*	E	1	30	G		
GG	*Lomandra sp.*	N	0.1	15	G		
FG	*Einadia nutans*	N	1	40	G		
GG	*Rytidosperma setaceum*	N	2	100	G		
GG	*Rytidosperma pallidum*	N	0.5	50	G		
-	*Taraxacum officinale*	E	0.1	10	G		
GG	*Panicum effusum*	N	0.2	30	G		
TG	*Eucalyptus goniocalyx*	N	5	4	C		
FG	*Senecio prenanthoides*	N	0.1	5	G		
FG	*Hardenbergia violaceae*	N	0.1	1	G		
-	*Solanum nigrum*	E	0.1	1	G		
SG	*Acacia brownii*	N	0.5	3	S		
FG	*Goodenia hederacea*	N	0.2	15	G		
GG	*Echinopogon caespitosus*	N	0.1	5	G		
FG	*Gonocarpus tetragynus*	N	0.2	20	G		
GG	*Echinopogon*	N	0.1	10	G		
SG	*Cassinia longifolia*	N	0.1	1	S		
FG	*Scleranthus biflorus*	N	0.1	4	G		
FG	*Acaena echinata*	N	0.1	3	G		

BAM Site – Field Survey Form

Survey Name	**Date**	**Recorders**
Paling Yards	5/2/2021	Lizzie & Bart
Plot ID: **P5**		PCT/VZ: 727_1

BAM Attribute (400m² plot)	**Sum values**	
	Count of native richness	**Cover**
Trees	**2**	**30**
Shrubs	**2**	**0.6**
Grasses etc.	**7**	**5**
Forbs	**8**	**1.9**
Ferns	**0**	**0**
Other	**0**	**0**
High threat weed cover		**0**

BAM Attribute (1000m² plot)		
DBH	**#Tree Stems Count**	**#Stems with Hollows**
80 + cm		
50 – 79 cm	2	2
30 – 49 cm	✓	
20 – 29 cm	✓	
10 – 19 cm	✓	
5 – 9 cm	✓	
<5 cm	✓	
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	**Tally:** 165 m	

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					**Bare ground cover %**					**Cryptogam cover %**					**Rock cover %**				
Subplot score % in each	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
	60	85	65	80	70	0	0	10	0	5	10	5	0	5	10	0	0	10	10	5
Average of the 5 subplots	72					3					6					5				

PLOT 6

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	**Survey Name**	**Plot ID**	**Recorders**
Date: 5/2/2021	Paling Yards	**P6**	Lizzie & Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Abund	Stratum	Voucher	Photo #
TG	*Eucalyptus bridgesiana*	N	25	11	C		
-	*Phalaris canariensis*	E	8	100	G		
FG	*Geranium solandri*	N	60	400	G		
-	*Cirsium vulgare*	E	2	50	G		
-	*Carduus nutans subsp. nutans*	HTE	5	100	G		
-	*Malva parviflora*	E	3	60	G		
-	*Urtica dioica*	E	2	50	G		
-	*Cynodon dactylon*	E	10	400	G		
GG	*Bothriochloa macra*	N	0.2	20	G		
FG	*Rumex brownii*	N	0.1	5	G		
-	*Spergularia sp.*	E	0.1	10	G		
GG	*Rytidosperma setaceum*	N	5	100	G		
-	*Plantago lanceolata*	E	0.1	5	G		
FG	*Senecio prenanthoides*	N	0.1	10	G		
FG	*Acaena ovina*	N	2	100	G		
-	*Anagallis arvensis*	E	0.1	20	G		
FG	*Poranthera microphylla*	N	0.2	10	G		

BAM Site – Field Survey Form

Survey Name	**Date**	**Recorders**
Paling Yards	5/2/2021	Lizzie & Bart
Plot ID: **P6**		PCT/VZ: 649_1

BAM Attribute (400m² plot)	**Sum values**	
	Count of native richness	**Cover**
Trees	**1**	**25**
Shrubs	**0**	**0**
Grasses etc.	**2**	**5.2**
Forbs	**5**	**62.4**
Ferns	**0**	**0**
Other	**0**	**0**
High threat weed cover		**5**

BAM Attribute (1000m² plot)		
DBH	**#Tree Stems Count**	**#Stems with Hollows**
80 + cm	8	8
50 – 79 cm	4	4
30 – 49 cm	✓	
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	**Tally:** 55 m	

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					**Bare ground cover %**					**Cryptogam cover %**					**Rock cover %**				
Subplot score % in each	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
	5	0	0	5	0	0	0	1	0	0	0	0	0	0	0	0	0	5	0	5
Average of the 5 subplots	2					0.2					0					2				

PLOT 7

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	**Survey Name**	**Plot ID**	**Recorders**
Date: 5/2/2021	Paling Yards	**P7**	Lizzie & Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Abund	Stratum	Voucher	Photo #
TG	*Eucalyptus dives*	N	15	10	C		
TG	*Eucalyptus macrorhyncha*	N	10	10	C		
TG	*Eucalyptus rossi*	N	1	1	C		
GG	*Elymus scaber*	N	1		G		
GG	*Rytidosperma pallidum*	N	2		G		
GG	*Rytidosperma setaceum*	N	4		G		
FG	*Gonocarpus tetragynus*	N	0.1		G		
FG	*Poranthera microphylla*	N	0.2		G		
GG	*Lomandra sp.*	N	0.5		G		
GG	*Rytidosperma monticola*	N	0.2		G		
FG	*Senecio prenanthoides*	N	0.2		G		
-	*Plantago lanceolata*	E	0.1	10	G		

BAM Site – Field Survey Form

Survey Name	**Date**	**Recorders**
Paling Yards	5/2/2021	Lizzie & Bart
Plot ID: **P7**		PCT/VZ: 727_1

BAM Attribute (400m² plot)	**Sum values**	
	Count of native richness	**Cover**
Trees	**3**	**26**
Shrubs	**0**	**0**
Grasses etc.	**5**	**7.7**
Forbs	**3**	**0.5**
Ferns	**0**	**0**
Other	**0**	**0**
High threat weed cover		**0**

Cover: 0.1, 0.2, 0.3….. 1,2,3,……,10, 15, 20, 25, ….. 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	**#Tree Stems Count**	**#Stems with Hollows**
80 + cm	2	2
50 – 79 cm	3	1
30 – 49 cm	✓	
20 – 29 cm	✓	
10 – 19 cm	✓	
5 – 9 cm	✓	
<5 cm	✓	
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	**Tally:** 115 m	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30….100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					**Bare ground cover %**					**Cryptogam cover %**					**Rock cover %**				
Subplot score % in each	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
	60	50	20	30	55	5	5	15	10	0	10	15	20	15	10	5	10	10	10	10
Average of the 5 subplots	43					7					14					9				

PLOT 8

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	**Survey Name**	**Plot ID**	**Recorders**
Date: 8/2/2021	Paling Yards	**P8**	Lizzie & Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Abund	Stratum	Voucher	Photo #
TG	*Eucalyptus rossi*	N	20		C		
TG	*Eucalyptus dives*	N	5		C		
TG	*Eucalyptus macrorhyncha*	N	5		C		
SG	*Cassinia longifolia*	N	0.5		G		
GG	*Rytidosperma setaceum*	N	0.4		G		
GG	*Lomandra sp.*	N	0.2		G		
GG	*Rytidosperma monticola*	N	0.2		G		
FG	*Goodenia hederacea*	N	0.2		G		
SG	*Bursaria spinosa*	N	0.2		S/E		
FG	*Poranthera microphylla*	N	0.2		G		
FG	*Gonocarpus tetragynus*	N	0.1		G		

BAM Site – Field Survey Form

Survey Name	**Date**	**Recorders**
Paling Yards	8/2/2021	Lizzie & Bart
Plot ID: **P8**		PCT/VZ: 1093_1

BAM Attribute (400m² plot)	**Sum values**	
	Count of native richness	**Cover**
Trees	**3**	**30**
Shrubs	**2**	**0.7**
Grasses etc.	**3**	**0.8**
Forbs	**3**	**0.5**
Ferns	**0**	**0**
Other	**0**	**0**
High threat weed cover		**0**

Cover: 0.1, 0.2, 0.3….. 1,2,3,……,10, 15, 20, 25, ….. 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	**#Tree Stems Count**	**#Stems with Hollows**
80 + cm	1	1
50 – 79 cm	3	3
30 – 49 cm	✓	
20 – 29 cm	✓	
10 – 19 cm	✓	
5 – 9 cm	✓	
<5 cm	✓	
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	**Tally:** 155 m	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30….100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					**Bare ground cover %**					**Cryptogam cover %**					**Rock cover %**				
Subplot score % in each	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
	80	85	95	80	90	0	0	0	0	0	0	0	5	0	5	10	5	0	0	5
Average of the 5 subplots	86					0					2					4				

PLOT 9

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	**Survey Name**	**Plot ID**	**Recorders**
Date: 5/2/2021	Paling Yards	**P9**	Lizzie & Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Abund	Stratum	Voucher	Photo #
TG	*Eucalyptus rossi*	N	25		C		
TG	*Eucalyptus macrorhyncha*	N	10		C		
TG	*Eucalyptus goniocalyx*	N	4		C		
SG	*Cassinia longifolia*	N	0.2				
GG	*Rytidosperma setaceum*	N	1		G		
GG	*Lomandra sp.*	N	1		G		
FG	*Wahlenbergia stricta*	N	0.1		G		
OG	*Hardenbergia violaceae*	N	0.2		G		
SG	*Bursaria spinosa*	N	0.5		G		
FG	*Hibbertia obtusifolia*	N	0.3		G		
GG	*Rytidosperma monticola*	N	0.2		G		
FG	*Senecio prenanthoides*	N	0.1		G		
SG	*Acacia gunnii*	N	0.3		G		
FG	*Gonocarpus tetragynus*	N	0.2		G		

BAM Site – Field Survey Form

Survey Name	**Date**	**Recorders**
Paling Yards	7/2/2021	Lizzie & Bart
Plot ID: **P9**		PCT/VZ: 1093_1

BAM Attribute (400m² plot)	**Sum values**	
	Count of native richness	**Cover**
Trees	**3**	**39**
Shrubs	**3**	**1**
Grasses etc.	**3**	**2.2**
Forbs	**4**	**0.7**
Ferns	**0**	**0**
Other	**1**	**0.2**
High threat weed cover		**0**

BAM Attribute (1000m² plot)		
DBH	**#Tree Stems Count**	**#Stems with Hollows**
80 + cm	1	
50 – 79 cm	3	1
30 – 49 cm	✓	
20 – 29 cm	✓	
10 – 19 cm	✓	
5 – 9 cm	✓	
<5 cm	✓	
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	**Tally:** 90 m	

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					**Bare ground cover %**					**Cryptogam cover %**					**Rock cover %**				
Subplot score % in each	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
	90	40	95	80	80	0	5	0	5	0	0	5	5	0	5	5	40	0	10	15
Average of the 5 subplots	75					2					3					14				

PLOT 10

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	**Survey Name**	**Plot ID**	**Recorders**
Date: 7/2/2021	Paling Yards	**P10**	Lizzie & Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Abund	Stratum	Voucher	Photo #
TG	*Eucalyptus rossi*	N	35	30	C		
TG	*Eucalyptus macrorhyncha*	N	5	15	C		
TG	*Lomandra filiformis*	N	0.5		G		
GG	*Hardenbergia*	N	0.2		G		
GG	*Rytidosperma pallidum*	N	1		G		
SG	*Acacia gunnii*	N	0.1	2	G		
GG	*Goodenia hederaceae*	N	0.1		G		
GG	*Hibbertia obtusifolia*	N	0.1		G		
GG	*Prostanthera sp.*	N	0.1		G		
FG	*Senecio prenanthoides*	N	0.1		G		
FG	*Poranthera microphylla*	N	0.5		G		
GG	*Rytidosperma monticola*	N	0.2		G		
FG	*Styphandra glauca*	N	0.1	5	G		

BAM Site – Field Survey Form

Survey Name	**Date**	**Recorders**
Paling Yards	7/2/2021	Lizzie & Bart
Plot ID: **P10**		PCT/VZ: 1093_1

BAM Attribute (400m² plot)	**Sum values**	
	Count of native richness	**Cover**
Trees	**3**	**40.5**
Shrubs	**1**	**0.1**
Grasses etc.	**6**	**1.7**
Forbs	**3**	**0.7**
Ferns	**0**	**0**
Other	**0**	**0**
High threat weed cover		**0**

Cover: 0.1, 0.2, 0.3….. 1,2,3,……,10, 15, 20, 25, ….. 100% (foliage cover). *Note: 0.1% cover is approx.. 63x63 cm or a circle about 71 cm diameter, 0.5% approx. 1.4 x 1.4m, 2% cover is approx. 2 x 2m, 5% = 4 x 5m, 25% 10 x 10m*

BAM Attribute (1000m² plot)		
DBH	**#Tree Stems Count**	**#Stems with Hollows**
80 + cm		
50 – 79 cm	4	2
30 – 49 cm	✓	
20 – 29 cm	✓	
10 – 19 cm	✓	
5 – 9 cm	✓	
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	**Tally:** 85 m	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimate can be used when > 10 (eg. 10, 20, 30….100, 200). For a multi-stemmed tree, only the largest living stem is included in the count / estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					**Bare ground cover %**					**Cryptogam cover %**					**Rock cover %**				
Subplot score % in each	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
	95	100	95	100	90	0	0	0	0	0	0	0	0	0	5	5	0	0	0	5
Average of the 5 subplots	96					0					1					2				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

PLOT 11

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	**Survey Name**	**Plot ID**	**Recorders**
Date: 7/2/2021	Paling Yards	**P11**	Lizzie & Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Abund	Stratum	Voucher	Photo #
TG	*Eucalyptus viminalis*	N	20		C		
-	*Carthamus lanatus*	HTE	8		G		
-	*Trifolium repens*	E	5		G		
GG	*Rytidosperma setaceum*	N	30		G		
FG	*Oxalis perennans*	N	1		G		
-	*Solanum nigrum*	E	0.2		G		
FG	*Geranium solandri*	N	2		G		
-	*Carduus nutans*	E	5		G		
-	*Cirsium vulgare*	E	5		G		
-	*Conyza bonariensis*	E	0.1		G		
-	*Phalaris canariensis*	E	2		G		
GG	*Echinopogon ovatus*	N	0.2		G		
GG	*Microlaena stipoides*	N	20		G		
-	*Nassella trichotoma*	HTE	1		G		
FG	*Convolvulus rubescens*	N	0.5		G		
FG	*Acaena ovina*	N	0.2		G		
FG	*Einadia nutans*	N	10		G		
-	*Taraxacum officinale*	E	0.1		G		
-	*Conyza bonariensis*	E	0.1		G		
-	*Echium plantagineum*	E	0.1		G		
FG	*Rumex brownii*	N	0.1		G		
-	*Holcus lanatus*	E	0.5		G		
-	*Gamochaeta calviceps*	E	0.2		G		
-	*Rumex acetosella*	E	0.5		G		
-	*Modiola caroliniana*	E	0.5		G		
FG	*Poranthera microphylla*	N	0.5		G		
-	*Spergularia sp.*	E	2		G		

BAM Site – Field Survey Form

Survey Name	**Date**	**Recorders**
Paling Yards	7/2/2021	Lizzie & Bart
Plot ID: **P11**		PCT/VZ: 951_2

BAM Attribute (400m² plot)	**Sum values**	
	Count of native richness	**Cover**
Trees	**1**	**20**
Shrubs	**0**	**0**
Grasses etc.	**3**	**50.2**
Forbs	**7**	**14.3**
Ferns	**0**	**0**
Other	**0**	**0**
High threat weed cover		**9**

BAM Attribute (1000m² plot)		
DBH	**#Tree Stems Count**	**#Stems with Hollows**
80 + cm	4	1
50 – 79 cm	1	
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	**Tally:** 25 m	

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					Bare ground cover %					Cryptogam cover %					Rock cover %				
Subplot score % in each	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
	20	20	20	80	65	10	50	0	0	0	0	0	0	0	5	5	0	0	0	5
Average of the 5 subplots	41					12					1					2				

PLOT 12

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	**Survey Name**	**Plot ID**	**Recorders**
Date: 6/10/2021	Paling Yards	**P12**	Lizzie & Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Abund	Stratum	Voucher	Photo #
TG	*Eucalyptus viminalis*	N	35		C		
TG	*Eucalyptus macrorhyncha*	N	5		C		
TG	*Acacia melanoxylon*	N	4		C/S		
SG	*Acacia daelbata*	N	6		S		
EG	*Pteridium esculentium*	N	20		G		
GG	*Lomandra longifolia*	N	25		G		
-	*Rubus fruticosus*	HTE	1		S		
-	*Lysimachia arvensis*	E	0.1		G		
FG	*Geranium solanderi*	N	0.1		G		
FG	*Acaena ovina*	N	0.1		G		
-	*Rosa canina*	E	0.1		E/S		
SG	*Pittosporum multiflorum*	N	0.3		E/S		
-	*Cirsium vulgare*	HTE	0.1		G		
-	*Carthamus lanatus*	HTE	0.1		G		
FG	*Oxalis perennans*	N	0.1		G		
FG	*Dichondra repens*	N	0.1		G		
-	*Centella asiatica*	E	0.1		G		
FG	*Plantago debilis*	N	0.1		G		
GG	*Lomandra filiformis*	N	0.1		G		
OG	*Desmodium sp.*	N	0.1		G		
FG	*Daucus glochidiatus*	N	0.1		G		

BAM Site – Field Survey Form

Survey Name	**Date**	**Recorders**
Paling Yards	6/10/2021	Lizzie & Bart
Plot ID: **P12**		PCT/VZ: PCT 951_1

BAM Attribute (400m² plot)	**Sum values**	
	Count of native richness	**Cover**
Trees	**3**	**44**
Shrubs	**2**	**6.3**
Grasses etc.	**2**	**25.1**
Forbs	**6**	**0.6**
Ferns	**1**	**20**
Other	**1**	**0.1**
High threat weed cover		**1.2**

BAM Attribute (1000m² plot)		
DBH	**#Tree Stems Count**	**#Stems with Hollows**
80 + cm	1	1
50 – 79 cm	3	
30 – 49 cm	✓	
20 – 29 cm	✓	
10 – 19 cm	✓	
5 – 9 cm	✓	
<5 cm	✓	
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	**Tally:** 45 m	

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					**Bare ground cover %**					**Cryptogam cover %**					**Rock cover %**				
Subplot score % in each	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
	55	40	80	20	50	10	10	5	5	0	0	10	1	5	5	0	0	0	0	0
Average of the 5 subplots	49					6					4.2					0				

Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10cm in diameter)

PLOT 13

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	**Survey Name**	**Plot ID**	**Recorders**
Date: 6/10/2021	Paling Yards	**P13**	Lizzie & Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Abund	Stratum	Voucher	Photo #
TG	*Eucalyptus goniocalyx*	N	25		C		
TG	*Eucalyptus dives*	N	3		C		
TG	*Eucalyptus macrorhyncha*	N	4		C		
OG	*Mistletoe*	N	0.5		C		
SG	*Acacia falcata*	N	1		S		
EG	*Pteridium esculentum*	N	5		G		
GG	*Poa sieberiana*	N	2		S		
-	*Centella asiatica*	E	0.1		G		
FG	*Plantago debilis*	N	0.1		G		
FG	*Geranium solanderi*	N	0.1		G		
GG	*Lomandra longifolia*	N	30		E/S		
-	*Rubus fruticosus*	HTE	0.1		E		
SG	*Pittosporum multiflorum*	N	0.1		E		
GG	*Themeda triandra*	N	0.5		G		
FG	*Oxalis perennans*	N	0.1		G		
FG	*Acaena ovina*	N	0.1		G		
-	*Carthamus lanatus*	HTE	0.1		G		
SG	*Cassinia longifolia*	N	0.8		S		
SG	*Cassinia arcuata*	N	0.1		S		
FG	*Dichondra repens*	N	0.1		G		
FG	*Hypericum gramineum*	N	0.1		G		

BAM Site – Field Survey Form

Survey Name	**Date**	**Recorders**
Paling Yards	6/10/2021	Lizzie & Bart
Plot ID: **P13**		PCT/VZ: 727_1

BAM Attribute (400m² plot)	**Sum values**	
	Count of native richness	**Cover**
Trees	**3**	**32**
Shrubs	**4**	**2**
Grasses etc.	**3**	**32.5**
Forbs	**6**	**0.6**
Ferns	**1**	**5**
Other	**1**	**0.5**
High threat weed cover		**0.2**

BAM Attribute (1000m² plot)		
DBH	**#Tree Stems Count**	**#Stems with Hollows**
80 + cm	1	1
50 – 79 cm	1	
30 – 49 cm	✓	
20 – 29 cm	✓	
10 – 19 cm	✓	
5 – 9 cm	✓	
<5 cm	✓	
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	**Tally:** 40 m	

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					**Bare ground cover %**					**Cryptogam cover %**					**Rock cover %**				
Subplot score % in each	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
	50	15	80	20	30	5	20	10	5	0	10	10	0	0	2	0	35	0	0	0
Average of the 5 subplots	39					8					4.4					7				

PLOT 14

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	**Survey Name**	**Plot ID**	**Recorders**
Date: 6/10/2021	Paling Yards	**P14**	Lizzie & Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Abund	Stratum	Voucher	Photo #
SG	*Cassinia arcuata*	N	50		S		
-	*Nassella trichotoma*	HTE	20		G		
SG	*Leucopogon juniperinus*	N	0.1		G/S		
-	*Carthamus lanatus*	HTE	0.1		G		
SG	*Leptospermum sp.*	N	0.1		E		
-	*Trifolium repens*	E	0.1		G		
FG	*Oxalis perennans*	N	0.1		G		
-	*Taraxacum officinale*	E	0.1		G		
GG	*Carex inversa*	N	0.1		G		
TG	*Eucalyptus macrorhyncha*	N	0.1		E		

BAM Site – Field Survey Form

Survey Name	**Date**	**Recorders**
Paling Yards	6/10/2021	Lizzie & Bart
Plot ID: **P14**		PCT/VZ: 727_3

BAM Attribute (400m² plot)	**Sum values**	
	Count of native richness	**Cover**
Trees	**1**	**0.1**
Shrubs	**3**	**50.2**
Grasses etc.	**1**	**0.1**
Forbs	**1**	**0.1**
Ferns	**0**	**0**
Other	**0**	**0**
High threat weed cover		**20.1**

BAM Attribute (1000m² plot)		
DBH	**#Tree Stems Count**	**#Stems with Hollows**
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm	✓	
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	**Tally:** 0 m	

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					**Bare ground cover %**					**Cryptogam cover %**					**Rock cover %**				
Subplot score % in each	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
	1	5	1	20	10	80	50	5	5	10	20	5	15	15	30	40	35	80	30	20
Average of the 5 subplots	7.4					30					17					41				

PLOT 15

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	**Survey Name**	**Plot ID**	**Recorders**
Date: 6/10/2021	Paling Yards	**P15**	Lizzie & Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Abund	Stratum	Voucher	Photo #
TG	*Eucalyptus macrorhyncha*	N	60		C/E		
TG	*Eucalyptus mannifera*	N	1		C/E		
SG	*Acacia gunnii*	N	0.1		E		
OG	*Mistletoe*	N	0.2		C		
SG	*Cassinia arcuata*	N	5		S		
SG	*Leptospermum sp.*	N	0.1		E		
GG	*Carex inversa*	N	0.1		G		
FG	*Gonocarpus tetragynus*	N	0.2		G		
FG	*Lomandra filiformis*	N	0.1		G		
GG	*Poa sieberiana*	N	0.1		G		

BAM Site – Field Survey Form

Survey Name	**Date**	**Recorders**
Paling Yards	6/10/2021	Lizzie & Bart
Plot ID: **P15**		PCT/VZ: 727_2

BAM Attribute (400m² plot)	**Sum values**	
	Count of native richness	**Cover**
Trees	**2**	**61**
Shrubs	**3**	**5.2**
Grasses etc.	**2**	**0.2**
Forbs	**2**	**0.3**
Ferns	**0**	**0**
Other	**1**	**0.2**
High threat weed cover		**0**

BAM Attribute (1000m² plot)		
DBH	**#Tree Stems Count**	**#Stems with Hollows**
80 + cm		
50 – 79 cm		
30 – 49 cm	1	
20 – 29 cm	✓	
10 – 19 cm	✓	
5 – 9 cm	✓	
<5 cm	✓	
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	**Tally:** 10 m	

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					**Bare ground cover %**					**Cryptogam cover %**					**Rock cover %**				
Subplot score % in each	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
	40	65	50	10	60	0	5	5	10	5	5	1	2	0	0	50	15	40	80	15
Average of the 5 subplots	45					5					1.6					40				

PLOT 16

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	**Survey Name**	**Plot ID**	**Recorders**
Date: 6/10/2021	Paling Yards	**P16**	Lizzie & Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Abund	Stratum	Voucher	Photo #
SG	*Cassinia arcuata*	N	50		S		
SG	*Persoonia sericea*	N	0.1		E		
GG	*Poa sieberiana*	N	0.1		G		
TG	*Eucalyptus macrorhyncha*	N	0.3		E		
GG	*Cynodon dactylon*	N	0.1		G		
GG	*Lomandra filiformis*	N	0.1		G		
SG	*Melichrus urceolatus*	N	0.5		E/G		
SG	*Acacia sp.*	N	0.1		E		
-	*Nassella trichotoma*	HTE	0.5		G		

BAM Site – Field Survey Form

Survey Name	**Date**	**Recorders**
Paling Yards	6/10/2021	Lizzie & Bart
Plot ID: **P16**		PCT/VZ: 727_3

BAM Attribute (400m² plot)	**Sum values**	
	Count of native richness	**Cover**
Trees	**1**	**0.3**
Shrubs	**4**	**50.7**
Grasses etc.	**3**	**0.3**
Forbs	**0**	**0**
Ferns	**0**	**0**
Other	**0**	**0**
High threat weed cover		**0.5**

BAM Attribute (1000m² plot)		
DBH	**#Tree Stems Count**	**#Stems with Hollows**
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm	✓	
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	**Tally:** 0 m	

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					**Bare ground cover %**					**Cryptogam cover %**					**Rock cover %**				
Subplot score % in each	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
	1	1	0	1	0	15	20	10	20	15	0	1	0	1	0	80	70	85	35	80
Average of the 5 subplots	0.6					16					0.4					70				

PLOT 17

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	**Survey Name**	**Plot ID**	**Recorders**
Date: 6/10/2021	Paling Yards	**P17**	Lizzie & Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Abund	Stratum	Voucher	Photo #
TG	*Eucalyptus viminalis*	N	40		C		
-	*Urtica dioica*	E	0.5		G		
TG	*Eucalyptus macrorhyncha*	N	5		C		
-	*Salix sp.*	HTE	5		C		
SG	*Cassinia longifolia*	N	0.2		E/S		
FG	*Centella asiatica*	N	0.2		G		
SG	*Cassinia arcuata*	N	0.1		E/S		
SG	*Acacia longifolia*	N	0.1		E		
-	*Rubus fruticosus*	HTE	5		S		
FG	*Aceana ovina*	N	0.5		G		
EG	*Pteridium esculentum*	N	8		G		
GG	*Poa sieberiana*	N	0.1		G		
GG	*Lomandra filliformis*	N	0.1		G		
FG	*Oxalis perennans*	N	0.1		G		
GG	*Carex sp.*	N	0.1		G		
TG	*Acacia melanoxylon*	N	1.5		S/E		
FG	*Geranium solanderi*	N	0.1		G		
-	*Taraxacum officinale*	E	0.1		G		
SG	*Leucopogon juniperinus*	N	0.1		G		
FG	*Plantago sp.*	N	0.1		G		
FG	*Rumex brownii*	N	0.1		G		
-	*Carthamus lanatus*	HTE	0.1		G		

BAM Site – Field Survey Form

Survey Name	**Date**	**Recorders**
Paling Yards	6/10/2021	Lizzie & Bart
Plot ID: **P17**		PCT/VZ: 85_1

BAM Attribute (400m² plot)	**Sum values**	
	Count of native richness	**Cover**
Trees	**3**	**46.5**
Shrubs	**4**	**0.5**
Grasses etc.	**3**	**0.3**
Forbs	**6**	**1.1**
Ferns	**1**	**8**
Other	**0**	**0**
High threat weed cover		**10.1**

BAM Attribute (1000m² plot)		
DBH	**#Tree Stems Count**	**#Stems with Hollows**
80 + cm		
50 – 79 cm	2	1
30 – 49 cm	✓	
20 – 29 cm	✓	
10 – 19 cm	✓	
5 – 9 cm	✓	
<5 cm	✓	
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	**Tally:** 105 m	

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					**Bare ground cover %**					**Cryptogam cover %**					**Rock cover %**				
Subplot score % in each	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
	50	80	40	20	60	0	5	5	0	10	0	2	10	0	5	0	0	0	0	0
Average of the 5 subplots	50					4					3.4					0				

PLOT 18

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	**Survey Name**	**Plot ID**	**Recorders**
Date: 7/10/2021	Paling Yards	**P18**	Lizzie & Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Abund	Stratum	Voucher	Photo #
TG	*Eucalyptus melliodora*	N	30		C		
-	*Hordeum sp.*	E	30		G		
-	*Urtica dioica*	E	10		G		
-	*Poa annua*	E	40		G		
-	*Silybum mauritianum*	E	40		G		
FG	*Geranium solandri*	N	1		G		
FG	*Plectranthus*	N	1		G		
-	*Taraxacum officinale*	E	0.2		G		
-	*Trifolium repens*	E	8		G		
FG	*Rumex brownii*	N	0.1		G		
-	*Onopordum acanthium*	E	5		G		
-	*Lysimachia arvensis*	E	0.1		G		
-	*Holcus lanatus*	E	5		G		

BAM Site – Field Survey Form

Survey Name	**Date**	**Recorders**
Paling Yards	7/10/2021	Lizzie & Bart
Plot ID: **P18**		PCT/VZ: 654_1

BAM Attribute (400m² plot)	**Sum values**	
	Count of native richness	**Cover**
Trees	**1**	**30**
Shrubs	**0**	**0**
Grasses etc.	**0**	**0**
Forbs	**3**	**2.1**
Ferns	**0**	**0**
Other	**0**	**0**
High threat weed cover		**0**

BAM Attribute (1000m² plot)		
DBH	**#Tree Stems Count**	**#Stems with Hollows**
80 + cm	2	2
50 – 79 cm	4	4
30 – 49 cm	✓	
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	**Tally:** 20 m	

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					**Bare ground cover %**					**Cryptogam cover %**					**Rock cover %**				
Subplot score % in each	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
	1	5	5	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	3.4					0					0					0				

PLOT 19

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	**Survey Name**	**Plot ID**	**Recorders**
Date: 6/10/2021	Paling Yards	**P19**	Lizzie & Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Abund	Stratum	Voucher	Photo #
SG	*Cassinia arcuata*	N	45		S		
SG	*Leucopogon juniperinus*	N	0.1		G/S		
-	*Nassella trichotoma*	N	15		G		
-	*Taraxacum officinale*	E	0.1		G		
GG	*Cynodon dactylon*	N	0.5		G		
TG	*Eucalyptus macrorhyncha*	N	0.2		E		
SG	*Melichrus urceolatus*	N	0.5		E/G		
FG	*Oxalis perennans*	N	0.1		G		
-	*Carthamus lanatus*	HTE	0.5		G		
SG	*Leptospermum sp.*	N	0.2		S/E		
-	*Trifolium repens*	E	0.1		G		
GG	*Lomandra sp.*	N	0.1		G		

BAM Site – Field Survey Form

Survey Name	**Date**	**Recorders**
Paling Yards	6/10/2021	Lizzie & Bart
Plot ID: **P18**		PCT/VZ: 727_3

BAM Attribute (400m² plot)	**Sum values**	
	Count of native richness	**Cover**
Trees	**1**	**0.2**
Shrubs	**4**	**45.8**
Grasses etc.	**2**	**0.6**
Forbs	**1**	**0.1**
Ferns	**0**	**0**
Other	**0**	**0**
High threat weed cover		**0.5**

BAM Attribute (1000m² plot)		
DBH	**#Tree Stems Count**	**#Stems with Hollows**
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
<5 cm	✓	
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	**Tally:** 0 m	

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					**Bare ground cover %**					**Cryptogam cover %**					**Rock cover %**				
Subplot score % in each	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
	0	0	5	1	5	35	30	10	20	40	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	2.2					27					0					0				

PLOT 20

BAM Site – Plot Species List

400m² plot: Sheet ___ of ___	**Survey Name**	**Plot ID**	**Recorders**
Date: 7/10/2021	Paling Yards	**P11**	Lizzie & Bart

GF Code	Top 3 native species in each growth form group: full species name mandatory. All other native and exotic species: full species name where practicable	N, E or HTE	Cover	Abund	Stratum	Voucher	Photo #
TG	*Eucalyptus viminalis*	N	25		C		
FG	*Oxalis perennans*	N	0.1		G		
GG	*Microlaena stipoides*	N	15		G		
-	*Phalaris canariensis*	E	5		G		
-	*Poa annua*	E	30		G		
FG	*Einadia nutans*	N	5		G		
-	*Carthamus lanatus*	HTE	15		G		
-	*Silybum mauritianum*	E	10		G		
-	*Trifolium repens*	E	5		G		
FG	*Geranium solandri*	N	1		G		
FG	*Rumex brownii*	N	0.2		G		
FG	*Plectranthus*	N	0.5		G		
-	*Lysimachia arvensis*	E	0.1		G		
GG	*Rytidosperma setaceum*	N	2		G		
-	*Hordeum sp.*	E	15		G		
-	*Solanum nigrum*	E	0.1		G		
-	*Holcus lanatus*	E	4		G		
-	*Cirsium vulgare*	E	2		G		
-	*Conyza bonariensis*	E	0.2		G		
FG	*Acaena ovina*	N	0.1		G		
-	*Taraxacum officinale*	E	0.1		G		
-	*Modiola caroliniana*	E	1		G		
FG	*Poranthera microphylla*	N	0.1		G		

BAM Site – Field Survey Form

Survey Name	**Date**	**Recorders**
Paling Yards	7/10/2021	Lizzie & Bart
Plot ID: **P11**		PCT/VZ: 951_2

BAM Attribute (400m² plot)	**Sum values**	
	Count of native richness	**Cover**
Trees	**1**	**25**
Shrubs	**0**	**0**
Grasses etc.	**2**	**17**
Forbs	**7**	**6.9**
Ferns	**0**	**0**
Other	**0**	**0**
High threat weed cover		**15**

BAM Attribute (1000m² plot)		
DBH	**#Tree Stems Count**	**#Stems with Hollows**
80 + cm	2	1
50 – 79 cm	2	1
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm	✓	
<5 cm		
Length of logs (m) (≥ 10 cm diameter, >50cm in length)	**Tally:** 10 m	

BAM Attribute (1 x 1 m plots)																				
	Litter cover %					**Bare ground cover %**					**Cryptogam cover %**					**Rock cover %**				
Subplot score % in each	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45	5	15	25	35	45
	10	5	5	5	10	2	2	0	5	0	0	0	0	0	0	0	0	0	0	0
Average of the 5 subplots	7					1.8					0					0				

APPENDIX B – BAM PLOT PHOTOS

Plot 1 (0 m)

Plot 1 (50 m)

Plot 2 (0 m)

Plot 2 (50 m)

Plot 3 (0 m)

Plot 3 (50 m)

Plot 4 (0 m)

Plot 4 (50 m)

Plot 5 (0 m)

Plot 5 (50 m)

Plot 6 (0 m)

Plot 6 (50 m)

Plot 7 (0 m)

Plot 7 (50 m)

Plot 8 (0 m)

Plot 8 (50 m)

Plot 9 (0 m)

Plot 9 (50 m)

Plot 10 (0 m)

Plot 10 (50 m)

Plot 11 (0 m)

Plot 11 (50 m)

Plot 12 (0 m)

Plot 12 (50 m)

Plot 13 (0 m)

Plot 13 (50 m)

Plot 14 (0 m)

Plot 14 (50 m)

Plot 15 (0 m)

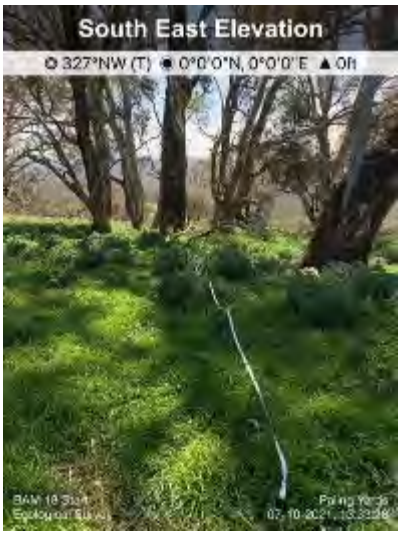
Plot 15 (50 m)

Plot 16 (0 m)

Plot 16 (50 m)

Plot 17 (0 m)

Plot 17 (50 m)



Plot 18 (0 m)

Plot 18 (50 m)

APPENDIX C – RECORDED FLORA & FAUNA SPECIES

FLORA

CLASS MAGNOLIOPSIDA (Flowering Plants)

AMARANTHACEAE	
Ptilotus sp.	
APIACEAE	
Centella asiatica	Indian Pennywort
Daucus glochidiatus	Native Carrot
ASPHODELACEAE	
Stypandra glauca	Nodding Blue Lilly
ASTERACEAE	
*Bidens pilosa**	Cobblers Pegs
Calotis lappulacea	Yellow Burr-Daisy
*Carduus nutans**	Nodding Thistle
*Carthamus lanatus**	Saffron Thistle
Cassinia arcuata	Sifton Bush
Cassinia longifolia	
*Cirsium vulgare**	Spear Thistle
Chrysocephalum apiculatum	Common Everlasting
*Conyza bonariensis**	Flaxleaf Fleabane
*Conyza sumatrensis**	Tall Fleabane
Euchiton sphaericus	Cudweed
*Gamochaeta calviceps**	Cudweed
*Hypochaeris radicata**	Flatweed
*Onopordum acanthium**	Scotch Thistle
Senecio prenanthoides	
*Silybum mauritianum**	Milk Thistle
*Sonchus oleraceus**	Common Sowthistle
*Taraxacum officinale**	Dandelion
Vittadinia sp.	
Xerochrysum viscosum	Sticky Everlasting
BORAGINACEAE	
*Echium plantagineum**	Paterson's Curse
BRASSICACEAE	
*Lepidium bonariense**	Argentine Peppercress
*Sinapis arvensis**	Wild Mustard
CAMPANULACEAE	
Wahlenbergia stricta	Australian Bluebell
Wahlenbergia sp.	
CARYOPHYLLACEAE	
Scleranthus biflorus	Knawel

Spergularia sp.	
CHENOPODIACEAE	
Einadia nutans	Climbing Saltbush
CONVULVULACEAE	
Convolvulus erubescens	Blushing Bindweed
Dichondra repens	Kidney Weed
CYPERACEAE	
Carex appressa	Tall Sedge
Carex inversa	
Cyperus polystachyos	
DILLENIACEAE	
Hibbertia obtusifolia	Hoary Guinea Flower
ERICACEAE (EPACRIDOIDEAE)	
Leucopogon juniperinus	Prickly Beard Heath
Melichrus urceolatus	Urn-heath
FABACEAE (FABOIDEAE)	
Desmodium varians	Slender Tick Trefoil
Desmodium sp.	Tick Trefoil
Hardenbergia violaceae	Purple Coral Pea
*Trifolium repens**	White Clover
FABACEAE (MIMOSOIDEAE)	
Acacia baileyana	Cootamundra Wattle
Acacia brownii	Heath Wattle
Acacia daelbata	Silver Wattle
Acacia falcata	Hickory Wattle
Acacia falciformis	Broad-leaved Hickory
Acacia genistifolia	
Acacia gunnii	Plowshare Wattle
Acacia longifolia	Sydney Golden Wattle
Acacia mearnsii	Black Wattle
Acacia melanoxylon	Blackwood
Acacia sp.	
GERANIACEAE	
Geranium solanderi	Native Geranium
GOODENIACEAE	
Goodenia hederacea	Forest Goodenia
HALORAGACEAE	
Gonocarpus tetragynus	Common Raspwort
HYPERICACEAE	
Hypericum gramineum	Small St John's Wort
*Hypericum perforatum**	St John's Wort
JUNCACEAE	
Juncus sp.	
LAMIACEAE	
*Marrubium vulgare**	White Horehound

Plectranthus sp.	
Prostanthera sp.	
LOMANDRACEAE	
Lomandra filiformis	Wattle Mat-rush
Lomandra longifolia	Spiny-headed Mat-rush
Lomandra sp.	Mat-rush
LORANTHACEAE	
Amyema pendula	Mistletoe
LYTHRACEAE	
*Lythrum hyssopifolia**	Hyssop Loosestrife
MALVACEAE	
*Malva parviflora**	Small-flowered Mallow
*Modiola caroliniana**	Red-flowered Mallow
*Sida rhombifolia**	Paddy's Lucerne
MYRTACEAE	
Eucalyptus blakelyi	Blakley's Red Gum
Eucalyptus bridgesiana	Apple Box
Eucalyptus dives	Broad-leaved Peppermint
Eucalyptus goniocalyx	Long-leaved Box
Eucalyptus macrorhyncha	Red Stringybark
Eucalyptus mannifera	Brittle Gum
Eucalyptus melliodora	Yellow Box
Eucalyptus nortonii	Long-leaved Box
Eucalyptus polyanthamos	Red Box
Eucalyptus rossi	Inland Scribbly Gum
Eucalyptus viminalis	Ribbon Gum
Leptospermum sp.	Tea Tree
OXALIDACEAE	
Oxalis perennans	Yellow Wood-sorrel
PHYLLANTHACEAE	
Poranthera microphylla	
PITTOSPORACEAE	
Bursaria spinosa	Blackthorn
Pittosporum multiflorum	Orangethorn
PLANTAGINACEAE	
Plantago debilis	
*Plantago lanceolata**	Lamb's Tongue
*Veronica persica**	Creeping Speedwell
POACEAE	
Aristida ramosa	Purple Wiregrass
Austrostipa bigeniculata	
Austrostipa scabra	Speargrass
*Avena fatua**	Wild Oats
Bothriochloa macra	Red Grass
*Bromus sp.**	Brome Grass

*Cenchrus clandestinus**	Kikuyu Grass
Chloris truncata	Windmill Grass
Cynodon dactylon	Common Couch
*Dactylis glomerata**	Cocksfoot
Digitaria sp.	
Echinopogon caespitosus	Hedgehog Grass
Echinopogon ovatus	Forest Hedgehog Grass
Elymas scaber	Wheat Grass
*Eragrostis curvula**	African Lovegrass
*Holcus lanatus**	Yorkshire Fog
*Hordeum leporinum**	Barley Grass
Lolium perenne	Perennial Rye Grass
Microlaena stipoides	Weeping Grass
*Nassella trichotoma**	Serrated Tussock
Panicum effusum	Hairy Panic
Paspalidium distans	
*Paspalum dilatatum**	Common Paspalum
*Paspalum urvillei**	Giant Paspalum
*Phalaris aquatica**	Phalaris
*Poa annua**	Winter Grass
Poa sieberiana	Poa Grass
Rytidosperma monticola	
Rytidosperma pallidum	Redanther Wallaby Grass
Rytidosperma setaceum	Smallflower Wallaby Grass
Rytidosperma sp.	Wallaby Grass
*Seteria parviflora**	Slender Pigeon Grass*
Sporobolus creber	Slender Rats Tail Grass
Themeda australis	Kangaroo Grass
POLYGONACEAE	
*Rumex acetosella**	Sorrel
Rumex brownii	Swamp Dock
PRIMULACEAE	
*Lysimachia arvensis**	Scarlet Pimpernel
PROTEACEAE	
Persoonia sericea	
ROSACEAE	
Acaena echinata	
Acaena ovina	
*Crataegus monogyna**	Hawthorn
*Rubus fruticosus**	Blackberry
*Rosa canina**	Dog Rose
SALICACEAE	
Salix sp.	Willow
SAPINDACEAE	
Dodenea viscosa	Sticky Hopbush

SCROPHULARIACEAE	
*Verbascum thapsus**	Common Mullein
SOLANACEAE	
*Lycium ferocissimum**	African Boxthorn
*Solanum nigrum**	Blackberry Nightshade
URTICACEAE	
*Urtica dioica**	Stinging Nettle
CLASS PTERIDOPSIDA (Ferns)	
DENNSTAEDTIACEAE	
Pteridium esculentium	Common Bracken Fern
PTERIDACEAE	
Cheilanthes sp.	Rock Fern

*** Denotes non-endemic / introduced species**
+ Denoted threatened species

FAUNA

CLASS AMPHIBIA	
HYLIDAE	
Litoria dentata	Bleating Tree Frog
Litoria peronii	Peron's Tree Frog
LIMNODYNASTIDAE	
Limnodynastes dumerilii	Eastern Banjo Frog
Limnodynastes peronii	Striped Marsh Frog
Limnodynastes tasmaniensis	Spotted Marsh Frog
MYOBATRACHIDAE	
Crinia signifera	Clicking Froglet
CLASS AVES	
ACCIPITRIDAE	
Accipiter fasciatus	Brown Goshawk
Aquila audax	Wedge-tailed Eagle
Elanus axillaris	Black-shouldered Kite
ALCEDINIDAE	
Dacelo novaeguineae	Laughing Kookaburra
ANATIDAE	
Chenonetta jubata	Australian Wood Duck
Anas superciliosa	Pacific Black Duck
ARDEIDAE	
Egretta novaehollandiae	White-faced Heron
ARTAMIDAE	
Artamus cyanopterus+	Dusky Woodswallow
Cracticus nigrogularis	Pied Butcherbird
Cracticus tibicen	Australian Magpie
Cracticus torquatus	Grey Butcherbird

Strepera graculina	Pied Currawong
CACATUIDAE	
Cacatua galerita	Sulphur Crested Cockatoo
Callocephalon fimbriatum+	Gang-gang Cockatoo
Eolophus roseicapilla	Galah
Zanda funerea	Yellow-tailed Black Cockatoo
CAMPEPHAGIDAE	
Coracina novaehollandiae	Black-faced Cuckoo-shrike
CHARADRIIDAE	
Vanellus tricolor	Banded Lapwing
CLIMACTERIDAE	
Cormobates leucophaea	White-throated Treecreeper
CORVIDAE	
Corvus coronoides	Australian Raven
FALCONIDAE	
Falco berigora	Brown Falcon
Falco cenchroides	Australian Kestrel
Falco longipennis	Australian Hobby
HIRUNDINIDAE	
Hirundo neoxena	Welcome Swallow
Petrochelidon ariel	Fairy Martin
Petrochelidon nigricans	Tree Martin
MALURIDAE	
Malurus cyaneus	Superb Fairy-wren
MELAPHIGIDAE	
Anthochaera carunculata	Red Wattlebird
Caligavis chrysops	Yellow-faced Honeyeater
Manorina melanocephala	Noisy Miner
MONARCHIDAE	
Grallina cyanoleuca	Magpie-lark
MOTACILLIDAE	
Anthus novaeseelandiae	Australasian Pipit
ORIOLIDAE	
Oriolus sagittatus	Olive-backed Oriole
PARDALOTIDAE	
Pardalotus striatus	Striated Pardalote
PODICIPEDIDAE	
Tachybaptus novaehollandiae	Australasian Grebe
POGARGIDAE	
Podargus strigoides	Tawny Frogmouth
PSITTACULIDAE	
Platycercus elegans	Crimson Rosella
Platycercus eximius	Eastern Rosella
RHIPIDURIDAE	
Rhipidura albiscapa	Grey Fantail

Rhipidura leucophrys	Willie Wagtail
STURNIDAE	
*Acridotheres tristis**	Common Myna
CLASS MAMMALIA	
CANIDAE	
Vulpes vulpes	Red Fox
CERVIDAE	
Dama dama	European Fallow Deer
DASYURIDAE	
Sminthopsis murina	Common Dunnart
EMBALLONURIDAE	
Saccolaimus flaviventris+	Yellow-bellied Sheathtail Bat
LEPORIDAE	
*Oryctolagus cuniculus**	European Rabbit
MACROPODIDAE	
Macropus giganteus	Eastern Grey Kangaroo
Notamacropus rufogriseus	Red-necked Wallaby
Osphranter robustus	Common Wallaroo
Wallabia bicolor	Swamp Wallaby
MINIOPTERIDAE	
Miniopterus orianae	Northern Bentwing-Bat
MOLOSSIDAE	
Austronomus australis	White-striped Freetail-Bat
Ozimops planiceps	Southern Free-tailed Bat
Ozimops ridei	Ride's Free-Tailed Bat
MURIDAE	
Mus musculus	House Mouse
PHALANGERIDAE	
Trichosurus vulpecula	Common Brushtail Possum
RHINOLOPHIDAE	
Rhinolophus megaphyllus	Eastern Horseshoe-bat
TACHYGLOSSIDAE	
Tachyglossus aculeatus	Short-beaked Echidna
VESPERTILIONIDAE	
Chalinolobus gouldii	Gould's Wattled Bat
Chalinolobus morio	Chocolate Wattled bat
Falsistrellus tasmaniensis	Eastern False Pipistrelle
Nyctophilus sp.	
Scoteanax rueppellii	Rüppell's Broad-nosed Bat
Scotorepens greyii	Little Broad-nosed Bat
Scotorepens orion	Eastern Broad-nosed Bat
Vespadelus darlingtoni	Large Forest Bat
Vespadelus regulus	Southern Forest Bat
Vespadelus vulturnus	Little Forest Bat

CLASS REPTILIA

AGAMIDAE	
Amphibolurus muricatus	Jacky Lizard
Intellagama lesueurii	Eastern Water Dragon
CHELIDAE	
Chelodina longicollis	Eastern Snake-necked Turtle
SCINCIDAE	
Egernia cunninghami	Cunningham's Skink
Lampropholis guichenoti	Pale-flecked Garden Sunskink
VARANIDAE	
Varanus varius	Lace Monitor

*** Denotes non-endemic / introduced species**
+ Denoted threatened species

APPENDIX D – CAMERA TRAP IMAGES AND OTHER FAUNA PHOTOS

Trichosurus vulpecula **(Common Brushtail Possum)**

T. vulpecula **(Common Brushtail Possum)**

Dama dama **(Fallow Deer)**

T. vulpecula **(Common Brushtail Possum)**

Strepera graculina **(Pied Currawong)**

Ovis aries **(Domestic Sheep)**

Ninox novaeseelandiae **(Southern Boobook)**

Amphibolurus muricatus **(Jacky Lizard)**

Sminthopsis murina (Common Dunnart)

Sminthopsis murina (Common Dunnart)

Wombat burrow

Burrus thermal heat detector image - wallaby

APPENDIX E – BIRD & BAT UTILISATION SURVEY

BIRD AND BAT UTILISATION SURVEY

for the

Paling Yards Wind Farm

Prepared for Global Power Generation Australia Pty Ltd

12 September 2022

ERM

Hunter Ecology

CERTIFICATION

Fieldwork was undertaken by Bart Schiebaan, Lizzie Bowman and Lorena Boyle. Report writing was undertaken by Lucinda Casey and Lizzie Bowman. Qualifications are provided below.

Lizzie Bowman Principal Consultant lizzie@hunterecology.com	Bachelor of Science Grad Cert. Environmental Mgt & Sustainability BAAS 18112 Accredited Assessor Member of the Ecological Consultants Association of NSW
Bart Schiebaan Project Director bart@hunterecology.com	Bachelor of Applied Science (Coastal Management) Cert II Conservation & Land Management Adv. Dip in Business Mgt Certificate IV in Workplace Training and Assessment BAAS 18033 Accredited Assessor
Lorena Boyle Ecologist Lorena.Boyle@erm.com	Bachelor of Zoology
Lucinda Casey Ecologist Lucinda.rose.casey@gmail.com	Bachelor of Biodiversity & Conservation

Licensing and Insurance

When conducting fauna surveys, consultants are required to possess licences to ensure that works are completed appropriately. Hunter Ecology has the relevant Scientific License under the *Biodiversity Conservation Act 2016*, allowing Hunter Ecology to undertake scientific investigations and to collect specimens of protected flora and fauna across NSW. This licence requires that all survey results be reported to DPIE through our BioNet Sensitive Species Data License. Hunter Ecology also holds an Animal Research Authority under the *Animal Research Act 1995*, as administered by NSW Agriculture. Surveys are approved and supervised by an Animal Care and Ethics Committee, applying the standards as detailed in the Australian Code of Practice for the Care and Use of Animals for Scientific Purposes (NHMRC, 1997). Hunter Ecology is First Aid and White Card certified and relevantly trained in off-road vehicle driving. Hunter Ecology is insured with EnviroSure having both Professional Indemnity Insurance (Policy LPS021671363 ($5 mil)) and Public Liability Insurance (Policy LCS021671556 ($20 mil)) as well as Workers Compensation Policy (Policy 208829001).

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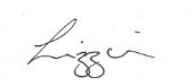

Lizzie Bowman
B.Sc, G.Cert.EnvMgt&Sus
BAAS18112 Accredited Assessor

ABBREVIATIONS

BC Act	Biodiversity Conservation Act 2016
BioNet	NSW Atlas of NSW Wildlife.
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
GPGA	Global Power Generation Australia Pty Ltd
LGA	Local Government Area
OEH	Office of Environmental Heritage
SSD	State Significant Development
WTG	Wind Turbine Generator

TERMS

Barotrauma	Barotrauma results from a rapid reduction in air-pressure caused by the rotation of turbine blades. Resulting in tissue damage to air-containing structures caused by a rapid or extreme change in pressure
Study area	The area directly affected by the proposal. The subject site includes the footprint of the development and any ancillary works, facilities, accesses, or hazard reduction zones that support the construction or operation of the development or activity.
Subject site	The subject site and any additional areas which are likely to be affected by the proposal, either directly or indirectly. The study area should extend as far as is necessary to take all potential impacts into account.
Threatened species	Critically endangered, endangered, or vulnerable species as defined by Schedule 1 of the BC Act, or any such listed species under the EPBC Act.

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Figures

Tables

1. INTRODUCTION

1.1 Background and Purpose

Global Power Generation Australia Pty Ltd (GPGA) (formally known as Union Fenosa Wind Australia Pty Ltd) propose to develop and operate the Paling Yard Wind Farm ('the proposal', 'the project' or 'the proposed development'). The proposed development would be located at Paling Yards, south of Oberon, within the Oberon local government area (LGA). See **Figure 1-1** for the project layout. Hunter Ecology Pty Ltd was engaged by Environmental Resource Management Australia Pty Ltd (ERM) to undertake a bird and bat utilisation survey (BBUS), for the purpose of:

- Assessing the impact of the proposal on birds and bats, as part of the Biodiversity Development Assessment Report (BDAR); and
- Providing baseline data on the utilisation of birds and bats of the wind farm site for a Bird and Bat Adaptive Management Plan (BBAMP) (which would be implemented if the project receives consent). Baseline surveys aim to document the ongoing use of the site by bats and birds to monitor trends in usage by species over time and in response to the post-construction and operational phases of the project.

1.2 Objectives

The objective of this BBUS is to document the diversity and abundance of bird and bat species within and directly adjacent to the proposed development and identify 'at risk' species, susceptible to turbine blade collision impacts or barotraumas. Desktop assessment and targeted surveys aimed to:

- Undertake a review of the existing bird and bat data for the development area;
- Describe the diversity of bird and bat species within the development area;
- Monitor local population of bats and birds through targeted surveys;
- Identify any observed bat or bird species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and/or the NSW *Biodiversity Conservation Act 2016* (BC Act);
- Identify 'at risk' species based on occurrence, flight behaviour, biology, and turbine design;
- Identify potential impacts on 'at risk' species; and
- Provide harm minimization recommendations for the construction and operational phases of the project.

1.3 Wind Turbine Specifications

The project comprises up to 47 wind turbine generators (WTG) and ancillary infrastructure. Each of the turbines consists of a tall tower with 3 long blades mounted at the top designed to capture wind (see **Figure 1-1** for locations of turbines).

The turbine manufacturing industry is dynamic, with new and updated models regularly released. Existing models are often made redundant only a few years after their release. The industry is rapidly growing and benefits from constant innovation and advancement in the efficiency of the turbines. Due to the rapidly evolving industry, the proposed turbine models may be subject to change.

Table 1-1 provides the operational measures of the WTGs. Note that data for this BBUS was collected prior to development of the latest specifications in Table 1-1 when rotor sweep area (RSA) encompassed a larger area than what is currently proposed. For the purposes of this BBUS, the maximum RSA is 30-240 m. Therefore, as it stands, the impacts described and assessed in this report are likely to be less.

Table 1-1: Operational Measures of the Wind Turbine Generators

Rotor sweep area	72-240 m
Maximum chord width of rotor	4 m
Pitch angle of rotor	90°
Rotor diameter	158 m
Rotation period	6.18 m/s

Hunter Ecology

Figure 1.1 Project Layout

- Survey Area
- Development Footprint 12/2022
- Dwelling Location
- PYWF_WTG_Layout_v2_01_20210727
- PYWF_TL_v2_03_20221115
- PYWF_AccessRoad_v2_02_20221115
- PYWF_Existing_TL_v1_01_20210115
- PYWF_Site_Boundary_v2_01_20210727
- PYWF_Substation_v2_04_20221115

DATE : 05/12/2022
Map Version: 1.3

Aerial Imagery: NSW LPI Six Imagery 2019

Projected Coordinate System:
GDA 2020 Zone 55

Scale: 1:42,000

Dwelling locations digitised from geo-referenced image.
For illustration purposes only

0 800 1,600 2,400 3,200 4,000 8,000 Meters

2. BIRD UTILISATION SURVEY

2.1 Methodology

Bird utilisation surveys were undertaken in accordance with the following guidelines:

- AusWEA Wind Farms and Birds: Interim Standards for Risk Assessment (BL&A 2005).
- Best Practice Guidelines for the implementation of Wind Energy Projects in Australia (Clean Energy Council 2018).
- *National Wind Farm Development Guidelines – Draft* (Environment Protection and Heritage Council, 2010).

2.1.1 Fixed-Point Bird Count Method

Bart Schiebaan and Lizzie Bowman of Hunter Ecology and Lorena Boyle of ERM, undertook two separate bird utilisation survey events representing the 2021 Summer (02/2021) and Spring (10/2021) survey events. Each survey event consisted of monitoring 20-24 fixed observation points strategically placed throughout development footprint. Each observation point was monitored for a period of 20 minutes, during this time any bird observations were recorded, including species and abundance, as well as flight height and distance from the observation point.

For the purposes of this report, flight height relative to RSA height is presented and described below. These intervals are based on the height and RSA of the turbine design that is currently proposed for the development.

A = Below RSA (<30 meters above ground level)

B = Within RSA (30-240 meters above ground level)

C = Above RSA (>240 meters above ground level)

When a bird or large flock of birds were recorded flying at multiple height intervals including within the RSA (30-240 m), a conservative approach was taken, and the bird or birds were recorded as flying at RSA height.

2.1.2 Locations of Survey Points

All fixed-point monitoring locations were selected based on their proximity to proposed turbine and associated ancillary infrastructure locations (see **Figure 4-2** in the BDAR for survey locations). Note that due to changes in development layout over time, some monitoring points have been removed and others added between surveys. Monitoring points 5, 18 and 20 were made redundant after the Summer (02/2021) survey event and additional monitoring points 21-24 were added during the Spring (10/2021) survey event.

2.1.3 Survey Timing and Weather Conditions

The two bird utilisation survey events represent the Summer (02/2021) and Spring (10/2021) monitoring events for 2021 and are expected to coincide with peak biodiversity and bio-abundance of

avian species utilising the site. To account for diurnal differences in bird activity, each fixed-point observation location was monitored at a different time of day between 6 am and 7 pm. Environmental variables including cloud cover, temperature, wind and rain were also recorded at all observation points prior to monitoring. **Table 2-1** details the time of day and weather conditions during the monitoring of each fixed-point observation location.

Table 2-1: Survey Timing and Weather Conditions

Monitoring Point	SUMMER 02-02-2021 – 10-02-2021			SPRING 01-10-2021 – 07-10-2021		
	Time	Temp	Weather Conditions	Time	Temp	Weather Conditions
1	6:20 pm	25°C	Light cloud, light breeze, no rain.	9:30am	12°C	Overcast, light rain.
2	1:05 pm	23°C	Light cloud, light breeze, no rain.	1:24 pm	13°C	Overcast, moderate wind.
3	1:12 pm	22°C	Light cloud, light breeze, no rain.	3:07 pm	12°C	Overcast, moderate wind.
4	5:33 pm	26°C	Moderate cloud, no wind, no rain.	4:10 pm	12°C	Overcast, moderate wind.
5	5:58 pm	24°C	Moderate cloud, light breeze, no rain.	Na	Na	Na
6	3:00 pm	27°C	Moderate cloud, light breeze, no rain.	1:09 pm	18°C	Overcast.
7	2:26 pm	26°C	Moderate wind, moderate cloud, no rain.	12:24 am	18°C	Mostly cloudy.
8	2:01 pm	26°C	Moderate cloud, moderate wind, no rain.	11:48 am	18°C	Mostly cloudy.
9	1:08 pm	26°C	moderate cloud, light breeze, no rain.	10:45 am	18°C	Mostly cloudy.
10	1:07 pm	28°C	Light cloud, heavy wind, no rain.	10:49 am	12°C	Cloudy and windy.
11	4:39 pm	23°C	Moderate cloud, light breeze, no rain.	9:23 am	11°C	Patchy cloud, no wind.
12	5:32 pm	23°C	Moderate cloud, light breeze, no rain.	10:04 am	12°C	Patchy cloud, light wind.
13	6:38 pm	20°C	Moderate cloud, moderate wind, no rain.	11:09 am	12°C	Patchy cloud, mod-high wind.
14	4:23 pm	26°C	Moderate cloud, light breeze, no rain.	11:52 pm	11°C	Patchy cloud, moderate wind.
15	4:47 pm	26°C	Moderate cloud, light wind, no rain.	12:55 pm	13°C	Patchy cloud, high wind.
16	7:14 am	22°C	Light cloud, light breeze, no rain.	3:49 pm	12°C	Patchy cloud, moderate to high wind.

17	6:10 am	23°C	Light cloud, light breeze, no rain.	11:50 am	12°C	Partly cloudy.
18	1:35 pm	27°C	Moderate cloud, no wind, rain.	Na	Na	Na
19	2:34 pm	27°C	Moderate cloud, moderate wind, no rain.	11:22 am	18°C	Mostly cloudy.
20	4:45 pm	26°C	Light cloud, no wind, rain.	Na	Na	Na
21	Na	Na	Na	2:10 pm	11°C	Overcast and windy.
22	Na	Na	Na	3:04 pm	13°C	Overcast and windy.
23	Na	Na	Na	3:51 pm	14°C	Overcast and windy.
24	Na	Na	Na	5:50 pm	13°C	Overcast.

2.1.4 Limitations

The bird utilisation surveys were undertaken in spring and summer and therefore cover the optimal survey times for most bird types, including resident, summer and transient migratory species. However, the timing of these survey events has the potential to preclude the detection of some wintering and migratory species typically absent during this time of year. Future bird utilisation surveys should aim to address temporal variability with a particular focus on these species.

2.2 Bird Utilisation Results

2.2.1 Species Composition

A total of 19 species were recorded during the Summer (02/2021) survey across 20 monitoring locations. The Spring (10/2021) survey experienced an increase in observed diversity, with a total of 34 species recorded across 22 monitoring locations. The total number of species observed across both survey events amounted to 37, accounting for approximately 17% of the 215 avian species reported to occur within the Oberon LGA (species list as reported by Bionet Atlas of NSW). Do note though that Bionet data includes many specific habitat dependant species that are not likely to occur within the areas of the site where turbines have been proposed for development.

Figures 2-1 and **2-2** detail the cumulative number of species recorded across fixed-point monitoring locations, demonstrating the relationship between survey effort and the total number of species observed. Neither survey reached an asymptote.

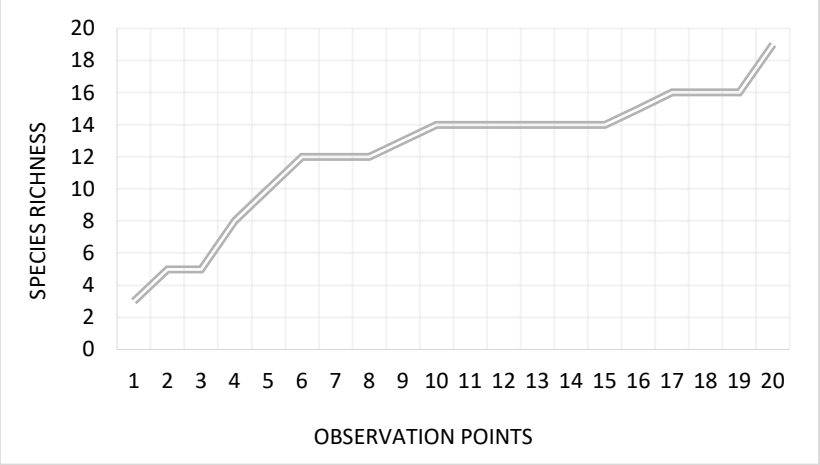

Figure 2-1: Cumulative Number of Bird Species Recorded Across 20 Fixed Point Monitoring Locations During the Summer (02/2021) BUS

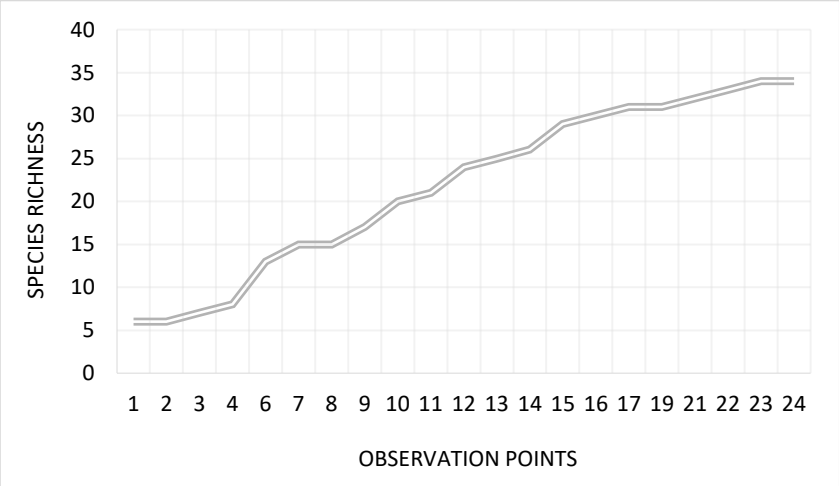

Figure 2-2: Cumulative Number of Bird Species Recorded Across 22 Fixed Point Monitoring Locations During the Spring (10/2021) BUS

2.2.2 Bird Species Abundance

The species observed utilising the site during the Summer (02/2021) and Spring (10/2021) surveys are detailed in **Table 2-3** and **Table 2-4**, respectively. Both tables include a list of the species observed during the BUS at each point, as well as the number of individuals per species recorded at each height zone (below RSA [<30 m], at [30-240m] and above [>240] RSA).

Total abundance varied between Summer and Spring, with 123 individual birds counted across the 20 Summer survey points, and 497 birds observed across the 22 Spring survey points. The increase in abundance in Spring is likely attributed to seasonal variability and changes in behaviour associated with nesting and rearing fledglings, coupled with the observance of several large flocks of Australian Magpie (*Cracticus tibicen*) and Sulphur-crested Cockatoo (*Cacatua galeritaand*), both known to form large family groups. It should not be discounted that many individual birds have the potential to be represented multiple times across monitoring locations, resulting in potential inflation of the total observed abundance.

The Australian Magpie, Sulphur-crested Cockatoo and Wedge-tailed Eagle (*Aquila audux*) were well represented in both the Summer and Spring survey events. Other dominant species included Eastern Rosella (*Platycercus eximius*) and Noisy Miner (*Manorina melanocephala*) in Summer and Australian Raven (*Corvus coronoides*) and Crimson Rosella (*Platycerus elegans*) in Spring. **Table 2-2** shows the five most dominant species represented in each survey event and their relative abundance (i.e., percentage of total observations). **Tables 2-3** and **2-4** provide a summary of all observations.

Table 2-5 shows the distribution of bird numbers among the survey points for both survey events. The total number of birds counted at each survey point varied from 0-17 in Summer, and 6-92 in Spring. The largest observations were flocks of Australian Magpie and Sulphur crested Cockatoo. The abundance of birds varied between survey points, however, no obvious trends in site utilisation were observed across the two surveys events.

Table 2-2: Five Most Dominant Species Recorded

SUMMER (02/2021)		SPRING (10/2021)	
Species / Common Name	**Relative Abundance**	**Species / Common Name**	**Relative Abundance**
Cracticus tibicen Australian Magpie	26.7%	***Cracticus tibicen*** Australian Magpies	25%
Aquila audux Wedge-tailed Eagle	12.2%	***Cacatua galerita*** Sulphur-crested Cockatoo	20.6%
Cacatua galerita Sulphur-crested Cockatoo	11.4%	***Corvus coronoides*** Australian Raven	12.7%
Platycercus eximius Eastern Rosella	9.8%	***Aquila audux*** Wedge-tailed Eagle	10%
Manorina melanocephala Noisy Miner	8%	***Platycerus elegans*** Crimson Rosella	7.5%

Table 2-3: Summer 02/2021 – Number and Height Distribution of Birds by Species Recorded at each Survey Point

Species Name Common Name	Point 1		Point 2		Point 3		Point 4		Point 5		Point 6		Point 7		Point 8		Point 9		Point 10		Point 11		Point 12		Point 13		Point 14		Point 15		Point 16		Point 17		Point 18		Point 19		Point 20		Σ	Σ	Σ	% Imp
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	Total	
Anthochaera carunculate Red Wattlebird	3		1												1														1										6	0	6	4.9
Anthus novaeseelandiae Australasian Pipit							1																							1									2	0	2	1.6
Aquila audux Wedge-tailed Eagle	1					1		2		2		2		1												4		2										1	14	15	12.2
Cacatua galerita Sulphur-crested Cockatoo								10																		4												0	14	14	11.4
Coracina novaehollandiae Black-faced Cuckoo-shrike																																					1		1	0	1	0.8
Cormobates leucophaea White-throated Treecreeper																																					1		1	0	1	0.8
Cracticus tibicen Australian Magpie				2			2		2								3				4		4		8				4			3				1			28	5	33	26.8
Egretta novaehollandiae White-faced Heron																			1																				1	0	1	0.8
Eolophus roseicapilla Galah												2																		2								0	4	4	3.3
Falco berigora Brown Falcon											1																												1	0	1	0.8
Falco cenchroides Australian Kestrel								1		2						2										1													0	6	6	4.9
Falco longipennis Australian Hobby																																2							0	2	2	1.6
Manorina melanocephala Noisy Miner																	4				2		2												2				10	0	10	8.1
petrochelidon ariel Fairy Martin									2																														2	0	2	1.6
Platycercus eximius Eastern Rosella	2																				4		4						2										12	0	12	9.8
Platycerus elegans Crimson Rosella			2								4																												6	0	6	4.9
Rhipidura albiscapa Grey Fantail																																					2		2	0	2	1.6
Vanellus tricolor Banded Lapwing							1																																1	0	1	0.8
Zanda funereal Yellow-tailed Black Cockatoo										4																													0	4	4	3.3
Totals	6	0	3	2	0	1	4	13	4	8	5	4	0	1	1	2	7	0	1	0	10	0	10	0	8	0	0	9	7	2	1	5	0	2	0	0	3	0	4	0	74	49	123	100
	6		5		1		17		12		9		1		3		7		1		10		10		8		9		9		6		2		0		3		4					

Notes: A – Denotes below rotor sweep height (0-30m), B – Denotes at RSA height (30-240m) C – Denotes above RSA height (>240); Note that no birds were recorded flying over 240 m in this survey so there is no C column in the table. ∑ denotes the sum of bird numbers. % Imp denotes the percentage of total observations.

Table 2-4: Spring (10/2021) – Number and Height Distribution of Birds by Species Recorded at each Survey Point

Scientific Name Common Name	Point 1		Point 2		Point 3		Point 4		Point 6		Point 7		Point 8		Point 9		Point 10		Point 11		Point 12		Point 13		Point 14		Point 15		Point 16		Point 17		Point 19		Point 21		Point 22		Point 23		Point 24		Σ	Σ	Σ	% Imp.
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	Total	
Accipiter fasciatus Brown Goshawk																																				1				1	0	2	2	0.4
Anthochaera carunculate Red Wattlebird									1																														1	0	1	0.2
Anthus novaeseelandiae Australasian Pipit																						1																		1	0	1	0.2
Aquila audux Wedge-tailed Eagle		4		7		15						1						1				1		3		6		5		5		2								0	50	50	10
Artamus cyanopterus Dusky Woodswallow																										6														6	0	6	1.2
Cacatua galerita Sulphur-crested Cockatoo																		8		60		30		2		1				2										0	103	103	21
Caligavis chrysops Yellow-faced Honeyeater											4																													4	0	4	0.8
Callocephalon fimbriatum Gang-gang Cockatoo																						2																		0	2	2	0.4
Chenonetta jubata Australian Wood Duck																			20		4																			24	0	24	4.8
Coracina novaehollandiae Black-faced Cuckoo-shrike																													2											2	0	2	0.4
Corvus coronoides Australian Raven		5	2		3					1				2		19	3			3		5		5		1						2		3	2			1		3	3		13	50	63	13
Cracticus tibicen Australian Magpie		1		2		50		6		4		5	2		1			1		5		7					1			2	1			5		1		2		2		27	5	120	125	25
Dacelo novaeguineae																					2										2										4	0	4	0.8

Laughing Kookaburra																																														
Egretta novaehollandiae White-faced Heron																													1														1	0	1	0.2
Elanus axillaris Bar-shouldered Kite										1			1																														1	1	2	0.4
Eolophus roseicapilla Galah															1																				1								2	0	2	0.4
Falco berigora Brown Falcon																1																											0	1	1	0.2
Falco cenchroides Australian Kestrel	1								1					1		2																		3					2				4	6	10	2
Grallina cyanoleuca Magpie-lark											1														1																		2	0	2	0.4
Hirundo neoxena Welcome Swallow																																			2								2	0	2	0.4
Malurus cyaneus Superb Fairy-wren																																							2				2	0	2	0.4
Manorina melanocephala Noisy Miner									2		2				1		1																2				2				3		13	0	13	2.6
Menura novaehollandiae Superb Lyrebird																											1				1												2	0	2	0.4
Oriolus sagittatus Olive-backed Oriole																											1																1	0	1	0.2
Pardalotus striatus Striated pardalote																	1				1										1												3	0	3	0.6
petrochelidon ariel Fairy Martin																	2		2		2														2								8	0	8	1.6
Petrochelidon nigricans Tree Martin															4																												4	0	4	0.8
Platycercus eximius Eastern Rosella									4																										2				2		2		10	0	10	2

Platycerus elegans Crimson Rosella	2										28								2												4						2						38	0	38	7.6
Rhipidura albiscapa Grey Fantail	2																																										2	0	2	0.4
Rhipidura leucophrys Willie Wagtail									1																																		1	0	1	0.2
Strepera graculina Pied Currawong																		1								1		1															0	3	3	0.6
Tachybaptus novaehollandiae Australasian Grebe																					1																						1	0	1	0.2
Vanellus tricolor Banded Lapwing							2																																				2	0	2	0.4
A & B Totals	**5**	**10**	**2**	**9**	**3**	**65**	**2**	**6**	**9**	**6**	**35**	**6**	**3**	**3**	**7**	**22**	**7**	**11**	**24**	**68**	**10**	**45**	**1**	**10**	**1**	**9**	**9**	**6**	**1**	**9**	**9**	**4**	**4**	**11**	**9**	**1**	**4**	**4**	**6**	**5**	**8**	**28**				
Observation Point total	**15**		**11**		**68**		**8**		**15**		**41**		**6**		**29**		**18**		**92**		**55**		**11**		**10**		**15**		**10**		**13**		**15**		**10**		**8**		**11**		**36**		**159**	**338**	**497**	**100**

Notes: Yellow highlighting denotes a vulnerable species under the BC Act 2016, A – Denotes below rotor sweep height (0-30m), B – Denotes at RSA height (30-240m) C – Denotes above RSA height (>240); Note that no birds were recorded flying over 240m in this survey so there is no C column in the table. ∑ denotes the sum of bird numbers. % Imp denotes the percentage of total observations.

Table 2-5: Number of Birds Recorded at Each Survey Point

Survey Point	SUMMER (02/2021)				SPRING (10/2021)			
	Below RSA Height	At RSA Height	Total	% Importance	Below RSA Height	At RSA Height	Total	% Importance
1	6	0	6	4.9	5	10	15	3.0
2	3	2	5	4.1	2	9	11	2.2
3	0	1	1	0.8	3	65	68	13.7
4	4	13	17	13.8	2	6	8	1.6
5	4	8	12	9.8	n/a	n/a	n/a	n/a
6	5	4	9	7.3	9	6	15	3.0
7	0	1	1	0.8	35	6	41	8.2
8	1	2	3	2.4	3	3	6	1.2
9	7	0	7	5.7	7	22	29	5.8
10	1	0	1	0.8	7	11	18	3.6
11	10	0	10	8.1	24	68	92	18.5
12	10	0	10	8.1	10	45	55	11.1
13	8	0	8	6.5	1	10	11	2.2
14	0	9	9	7.3	1	9	10	2.0
15	7	2	9	7.3	9	6	15	3.0
16	1	5	6	4.9	1	9	10	2.0
17	0	2	2	1.6	9	4	13	2.6
18	0	0	0	0.0	n/a	n/a	n/a	n/a
19	3	0	3	2.4	4	11	15	3.0
20	4	0	4	3.3	n/a	n/a	n/a	n/a
21	n/a	n/a	n/a	n/a	9	1	10	2.0
22	n/a	n/a	n/a	n/a	4	4	8	1.6
23	n/a	n/a	n/a	n/a	6	5	11	2.2
24	n/a	n/a	n/a	n/a	8	28	36	7.2
Total	**74**	**49**	**123**	**100**	**159**	**338**	**497**	**100**
	60.2%	**39.9%**			**32%**	**68%**		

Notes: N/a - Denotes that no BUS was undertaken at this location during the survey event.

2.2.3 Bird Flight Heights

Bird flight heights were classified as below (<30 m), at (30-240 m), and above (>240m) RSA height. The number of birds recorded at different flight heights is presented in **Table 2-6**. Note that no birds were recorded flying above RSA height (>240 m). The percentage of birds recorded flying below (<30m) and at RSA height (30-240m) varied significantly between the Summer and Spring surveys, with a total of 60.2% below RSA height and 39.9% within RSA height in Spring, compared to a total of 32% below RSA height and 68% within RSA height in Summer. Some of the variability in the data may be attributed to several flocks of Sulphur-crested Cockatoos (*Cacatua galeritaand*) and Australian Magpies (*Cracticus tibicen*) recorded flying below and within RSA height. Note that when birds were recorded flying at multiple height intervals including within the RSA (30-240 m), a conservative approach was taken and birds were recorded as flying at RSA height.

Of the species recorded utilising the wind farm site across the two surveys, a total of 13 species were recorded flying within RSA height (7 species in Spring and 10 species in Summer). **Table 2-7** details the four most highly represented species recorded flying at RSA height for both survey events. Of the most highly represented species, three were consistent across the two survey events, these include the Wedge-tailed Eagle (*Aquila audux*), Australian Magpie (*Cracticus tibicen)* and Sulphur-Crested Cockatoo (*Cacatua galeritaand*).

Table 2-6: Percentage of Species Recorded Flying within RSA

SUMMER (02/2021)						
Species	**Common Name**	**Total A**	**Total B**	**Grand Total**	**% At RSA**	**% of all RSA birds**
Aquila audux	Wedge-tailed Eagle	1	14	15	93.3	28.6
Cacatua galerita	Sulphur-crested Cockatoo	0	14	14	100	28.6
Cracticus tibicen	Australian Magpie	28	5	33	15.2	10.2
Eolophus roseicapilla	Galah	0	4	4	100	8.2
Falco cenchroides	Australian Kestrel	0	6	6	100	12.2
Falco longipennis	Australian Hobby	0	2	2	100	4.1
Zanda funerea	Yellow-tailed Black Cockatoo	0	4	4	100	8.2
Total		**29**	**49**	**78**	**62.8**	**100**
SPRING (10/2021)						
Species	**Common Name**	**Total A**	**Total B**	**Grand Total**	**% At RSA**	**% of all RSA birds**
Accipiter fasciatus	Brown Goshawk	0	2	2	100	0.6
Aquila audux	Wedge-tailed Eagle	0	50	50	100	14.8
Cacatua galerita	Sulphur-crested Cockatoo	0	103	103	100	30.5
Callocephalon fimbriatum	Gang-gang Cockatoo	0	2	2	100	0.6
Corvus coronoides	Australian Raven	13	50	63	79.4	14.8
Cracticus tibicen	Australian Magpie	5	120	125	96	35.5

Elanus axillaris	Bar-shouldered Kite	1	1	2	50	0.3
Falco berigora	Brown Falcon	0	1	1	100	0.3
Falco cenchroides	Australian Kestrel	4	6	10	60	1.8
Strepera graculina	Pied Currawong	0	3	3	100	0.9
Total		**23**	**338**	**361**	**93.6**	**100**

Notes: Yellow highlighting denotes a threatened species, A – Denotes below rotor sweep height (0-30 m), B – Denotes at RSA height (30-240 m). Note that no birds were recorded flying over 240 m in this survey.

Table 2-7: Four Most Dominant Species Recorded Flying within RSA

SUMMER (02/2021)		SPRING (10/2021)	
Species / Common Name	**% of all RSA Birds**	**Species / Common Name**	**% of all RSA Birds**
Aquila audux Wedge-tailed Eagle	28.6 %	***Cracticus tibicen*** Australian Magpie	35.5 %
Cacatua galerita Sulphur-crested Cockatoo	28.6 %	***Cacatua galerita*** Sulphur-crested Cockatoo	30.5 %
Falco cenchroides Australian Kestrel	12.2 %	***Aquila audux*** Wedge-tailed Eagle	14.8 %
Cracticus tibicen Australian Magpie	10.2 %	***Corvus coronoides*** Australian Raven	14.8 %

2.2.4 Raptors

Table 2-8 details the species of raptors observed during the Summer and Spring BUS. During the Summer survey event a total of four raptor species were observed, and five during the Spring event, amounting to a total of six total species of raptor across both surveys. Raptors were well represented in both surveys, accounting for 19.5% of all observations in Summer and 13% of all observations in Spring, with the majority of these observations falling within RSA height.

The most highly represented species of raptor in both BUS was the Wedge-tailed Eagle (*Aquila audux*). The observed high utilisation rate of the species suggests that the wind farm site likely forms part of the feeding territories for multiple families of eagles. The tendency of the species to fly within the proposed RSA height along with their flight behaviours places them at risk of rotor strike during the operational phase of the development, for this reason the population should be monitored closely.

Table 2-8: Recorded Raptor Species

Summer (02/2021)					Spring (10/2021)				
Species / Common Name	**A**	**B**	**Total**	**% Imp.**	**Species / Common Name**	**A**	**B**	**Total**	**% Imp.**
Aquila audux Wedge-tailed eagle	1	14	15	12.2	***Accipiter fasciatus*** Brown Goshawk	0	2	2	0.4
Falco berigora Brown Falcon	1	0	1	0.8	***Aquila audux*** Wedge-tailed eagle	0	50	50	10
Falco cenchroides Australian Kestrel	0	6	6	4.9	***Elanus axillaris*** Bar Shouldered Kite	1	1	2	0.4
Falco longipennis Australian Hobby	0	2	2	1.6	***Falco berigora*** Brown Falcon	0	1	1	0.2
					Falco cenchroides Australian Kestrel	4	6	10	2
Total	**2**	**22**	**24**	**19.5%**	**Total**	**5**	**60**	**65**	**13%**

Notes: A – Denotes below RSA (0-30m), B – Denotes at RSA (30-240m) C – Denotes above RSA (>240). Note that no birds were recorded flying over 240 m. % Imp – Denotes the percentage of all observations recorded during the BUS.

2.2.6 Threatened Bird Species

Most birds found to utilise the wind farm site were common species. Of the species recorded during the BUS surveys, only two of the observed species are currently listed as threatened under State or Commonwealth legislation. These species include Dusky Woodswallow (*Artamus cyanopterus cyanopterus)* and Gang-gang Cockatoo (*Callocephalon fimbriatum*). Both species are listed as vulnerable under the *Biodiversity Conservation Act 2016* (BC Act) and both were only observed within the Spring survey event and in low densities.

Dusky Woodswallow was observed at monitoring point 15 with a total of 6 individuals, all flying below (<30 m) RSA height. Two Gang-gang Cockatoos (*C. fimbriatum*) were observed at monitoring point 12, both recorded flying within (30-240 m) RSA height. Together these species account for 1.6 % of the total of birds observed during the Spring survey event.

2.2.7 Review of May 2013 BUS (ERM, 2014)

In May 2013 (20th & 21st), ERM undertook a BUS at the Paling Yards Wind Farm. The results of this are presented in ERM (2014). The survey consisted of utilising the fixed-point bird count methodology, monitoring 18 fixed-point observation locations for a period of 15 minutes. Across the 18 monitoring points, a total of 125 birds were observed, with the most abundant being Australian Raven (*Corvus coronoides*), Australian Magpie (*Cracticus tibicen*) and Wedge-tailed eagle (*Aquila audux*). One threatened species was recorded, being Scarlet Robin (*Petroica boodang*); this species was recorded below RSA height (which at the time of the survey was defined as 30-175 m) and was considered unlikely to fly at RSA height.

Wedge-tailed Eagle (*Aquila audux*) was observed flying within RSA height nine times during the BUS, which accounted for 7% of the total number of birds observed during the survey. Overall, the species was observed flying at heights from 10 m to over 250 m across the study area.

Few birds were recorded flying at RSA height outside of the BUS and were limited to Sulphur-Crested Cockatoo (*Cacatua galeritaand*), Australian Magpie (*Cracticus tibicen*) and Australian Raven (*Corvus coronoides*), all of which were recorded infrequently flying close to the lower limit of the RSA at a height between 25 and 35 m. The majority of birds recorded incidentally and during the BUS were seen to hug the contours, rarely flying directly above ridge tops where the turbines are proposed.

Using the data collected and a 99% avoidance rate, the collision risk for Wedge-tailed eagle (*Aquila audux*) was modelled using the Band Model (SNH 200 & 2010, Band 2000). The results indicated that the Wedge tailed Eagle had a collision risk which would result in 0.052 bird per month or 0.62 birds per annum colliding with rotors once the project is operational. However, it should be noted that the analysis was undertaken applying turbine specifications that are no longer part of the proposed development.

2.3 Discussion of Impacts

2.3.1 Bird Collision-related Mortality

It is widely accepted that operational wind farms present some level of risk to the avian species that inhabit and pass through the area. The risk is attributed to the potential for birds to directly collide with turbine rotors (rotor strike), and to a lesser extent, collide with associated infrastructure such as guy lines and powerlines. Such collisions can directly result in injury or fatality and are considered a major ecological concern posed by wind farms.

Wind farm related avian collisions are well documented and researched globally, this research has led to the understanding that avian collision risk is influenced by a broad array of variables including species-specific factors, site-specific factors, and wind farm-specific factors.

Factors related to species-specific flight behaviour are recognised to influence the risk of collision in avian species. High wing loading, low manoeuvrability and reduced capability for powered flight have been linked to a greater risk of collision (De Lucas *et al*, 2008). Species with such flight behaviours have increased reliance on thermal and orographic updrafts to gain altitude and soar, factors that are dependent on wind strength, terrain topography and seasonal variations in temperature. Low manoeuvrability in flight diminishes the capacity of a species to escape an encountered object fast enough to avoid collision (Marques *et al*, 2014).

As a result of these flight-behaviours, Accipitriformes (raptors and birds of prey) have the highest rates of turbine collision, yielding significantly higher rates of mortality in comparison to other groups (Thaxter *et al*, 2017). Three Accipitriformes have been identified as utilising the Paling Yards wind farm site, including Wedge-tailed Eagle (*Aquila audux*), Brown Goshawk (*Accipiter fasciatus*) and Bar Shouldered Kite (*Elanus axillaris*). These species tend to be *k*-selected with low fecundity and late ages of maturity, leaving them highly sensitive to impacts of additional mortality.

Of the three Accipitriformes species present, the Wedge-tailed Eagle was observed in the highest abundance, accounting for 12.2% of species observed in the (02/2021) survey and 10% in the Spring

(10/2021). The observed high abundance of the Wedge-tailed Eagle paired with its heightened vulnerability to turbine collision places it at a higher risk. Close on-going monitoring will be essential to ensure the longevity of the local population.

An assessment of bird global vulnerability to collision mortality at windfarms undertaken by Thaxter et al (2017) has estimated that the fatality rate for Accipitriformes species is equal to approximately 0.07 birds per turbine per year. Based on the current proposal of 47 wind turbines, the annual fatality rate of Accipitriformes species at the Paling Yards wind farm would be approximately 3.29 birds. The vast majority of species observed in both survey events belong to the Passeriformes order, with a significantly lower estimated collision fatality rate of approximately 0.022 birds per turbine per year. This equates to an estimated 1.03 fatalities per year based on the current development proposal. See **Table 2-9**.

These collision estimations are based on a collation of 9538 collision fatalities observed at wind farms globally over a 10-year period and have the potential to provide valuable insight; however, these wind farms occur in Europe and North America and their statistics should be applied with caution to Australian conditions. These generalised estimations also do not consider site-specific factors, species abundance and activity levels, or turbine specifications that have the potential to reduce or inflate actual observed fatality rates at the Paling Yards wind farm.

Table 2-9: Estimated Annual Collision-related Fatality Rates for Confirmed Bird Species, by Order

Bird Order	Associated Protected or Threatened Species*	Thaxter et al. (2017) Annual Fatality Rate	Estimated Annual Fatality Rate
Accipitriformes	*Aquila audax* (Wedge-tailed Eagle), *Elanus axillaris* (Black-shouldered Kite), *Haliaeetus leucogaster* (White-bellied Sea-Eagle), *H. morphnoides* (Little Eagle) and *Circus assimilis* (Spotted Harrier)	0.07 birds per WTG.	3.29 birds.
Apodiformes	*Apus pacificus* (Fork-tailed Swift), *Hirundapus caudacutus* (White-throated Needletail)	0.021 birds per WTG.	0.99 birds.
Falconiformes	*Accipiter fasciatus* (Brown Goshawk), *Falco cenchroides* (Australian Kestrel), *F. longipennis* (Australian Hobby) and *F. berigor* (Brown Falcon)	No annual fatality rate for this order was provided in Thaxter et al. (2017).	
Passeriformes	*Monarcha melanopsis* (Black-faced Monarch), *Cracticus tibicen* (Australian Magpie), *Strepera graculina* (Pied Currawong), *Corvus coronoides* (Australian Raven)	0.022 birds per WTG.	1.03 birds.
Pelecaniformes	*Egretta novaehollandiae* (White-faced Heron)	0.022 birds per WTG.	1.03 birds.
Psittaciformis	*Cacatua galerita* (Sulphur-crested Cockatoo), *Calyptorhynchus funereus* (Yellow-tailed Black Cockatoo), *Eolophus*	0.03 birds per WTG.	1.41 birds.

	roseicapilla (Galah), *Polytelis swainsonii* (Superb Parrot), *Calyptorhynchus lathami* (Glossy Black-Cockatoo), *Glossopsitta pusilla* (Little Lorikeet), *Callocephalon fimbriatum* (Gang-gang Cockatoo), *Lathamus discolor* (Swift Parrot)		
Strigiformes	*Ninox strenua* (Powerful Owl)	0.022 birds per WTG.	1.03 birds.

*** These species were confirmed in the BDAR as being potentially impacted. They include confirmed ecosystem credit or species credit species, migratory species and recorded protected native species that are likely to fly at RSA height.**

2.3.2 Habitat Reduction

The installation of WTG also has the potential to contribute to alienation of habitat resulting from species actively avoiding the WTG and connecting ancillary. In Australia, birds are generally considered to avoid flying through WTG at a rate of 95% to 99% (Smales, 2005). This avoidance effect essentially leads to a loss of habitat within the development footprint, however, also greatly reduces the number of birds interacting with the WTGs once the wind farm enters its operational phase.

3. BAT UTILISATION SURVEY

3.1 Methodology

Bat utilisation surveys were undertaken in accordance with the following guidelines:

- AusWEA Wind Farms and Birds: Interim Standards for Risk Assessment (BL&A 2005).
- Best Practice Guidelines for the implementation of Wind Energy Projects in Australia (Clean Energy Council 2018).
- *National Wind Farm Development Guidelines, Draft* (Environment Protection and Heritage Council, 2010).

3.1.1 Survey Timing and Weather Conditions

Bat echolocation detection surveys were undertaken over seven nights in summer (3-9 February 2021). This survey represents the Spring 2021 pre-construction phase monitoring event and is expected to have captured the peak biodiversity and abundance of microbat species within the development area. Targeted surveys for *Pteropus poliocephalus* (Grey-headed Flying Fox) were also undertaken in summer (3-10 February 2021) and spring (1-7 October 2022). These included nocturnal spotlighting and diurnal searches for colony camps. **Table 3-1** details the weather conditions during the surveys and **Table 3-2** details the Anabat deployment schedule.

3.1.2 Recording Protocol

Bat echolocation detection was undertaken at five locations, using two Anabat Express and three Anabat Swift detectors (see **Table 3-2** for the deployment schedule and **Figure 4-2** of the BDAR for survey locations). Detectors were pre-programmed to commence recording 30 minutes before dusk and ceased recording 30 minutes after sunrise.

Table 3-1: Weather Conditions During Bat Surveys

Date	Temp. Range	Wind	Cloud Cover	Rain
2/2/2021	12-24°C	Moderate-high	Cloudy	31 mm
3/2/2021	11-23°C	Moderate-high	Moderate	0.2 mm
4/2/2021	12-25.5°C	Calm	Clear	0 mm
5/2/2021	16-25.5°C	Calm	Cloudy	3 mm
6/2/2021	18-27°C	Moderate	Cloudy	0.2 mm
7/2/2021	10-25.5°C	Moderate	Cloudy	21 mm
8/2/2021	11.5-21.5°C	Moderate-high	Cloudy	0 mm
9/2/2021	13.5-28.2°C	Moderate-high	Cloudy	0 mm
10/2/2021	8.5-22°C	Calm-moderate	Cloudy	0 mm
1/10/2021	5-22.5°C	Moderate	Cloudy	19 mm

2/10/2021	7-17.2°C	Moderate	Moderate	0.5 mm
3/10/2021	7-17°C	Moderate	Moderate	3 mm
4/10/2021	5-16°C	Calm	Clear	None
5/10/2021	4-12.5°C	Moderate-high	Cloudy	2 mm
6/10/2021	1-17.5°C	Moderate	Clear	None
7/10/2021	2.5-21°C	Moderate	Clear	None

Table 3-2: Anabat Deployment Schedule

Detector Name	(Model Serial no.)	Deployment Dates	Latitude	Longitude	Site Code
Anabat1	(Swift SN583085)	3-4 Feb	-34.1259	149.7623	A1-1
		5-9 Feb	-34.1583	149.7276	A1-2
Anabat2	(Swift SN583108)	2-4 Feb	-34.1261	149.7678	A2-1
		5-9 Feb	-34.1261	149.7116	A2-2
Anabat3	(Express SN542982)	3-6 Feb	-34.1857	149.7299	A3-1
		7-9 Feb	-34.1757	149.7138	A3-2
Anabat4	(Express SN54294)	2-9 Feb	-34.1732	149.723	A4-1
Anabat6	(Express SN507220)	2-6 Feb	-34.1733	149.7183	A6-1

3.1.3 Call Analysis

All bat call data was analysed by Balance Environmental, the details of the analysis are as follows:

A total of 21 raw ZCA files were recorded using the three Anabat Express devices, these files were then processed using Anabat Insight (Version 1.9.7: Titley Scientific, Brisbane) to extract individual zero-crossing call sequence files for analysis. The data collected using the three Anabat Swift devices amounted to a total of 23,690 full-spectrum acoustic files in WAV format.

All WAV and Zero-crossing call sequence files were passed through a noise filter using Anabat Insight to remove any files where bat sounds were absent. This process excluded 23,891 files, leaving 18,580 for further analysis.

The Anabat Insight Decision Tree analysis function was used to process the remaining files and group them according to similarities in call pulse characteristics (e.g., characteristic frequency, slope, duration). Each group was then reviewed manually to verify species identities and separate, if necessary, the different species assigned to the group. Calls were thus assigned either a positive species label, where identification was unequivocal, or a multi-species group label, where identity

remained “unresolved” because the call had features potentially attributable to two or more species. Where the Decision Tree attributed many files to a single group, the manual species verification for that group proceeded only until at least a few calls of each constituent species were teased out for each detector-night.

Files that contained calls from multiple species in different frequency bands were assigned a “mixed” species label once all potential species were identified for a site. Species confirmation was achieved by comparing call spectrograms and derived metrics with those of regionally relevant reference calls and published call descriptions. Consideration was also given to the probability of species’ occurrence based on published distribution information and online database records

3.1.4 Limitations

The identification of echolocation calls for microbats in South-eastern Australia is facilitated by the fact that many calls are species specific. Calls that could not be definitively identified were narrowed down to two potential species matches or assigned to a genus.

The applied methodology is limited in that it is not possible to census bat numbers as to provide a reliable estimation of the abundance of bats occurring at the site. This limitation is due to the inability of Anabat Insight to differentiate calls of individuals of the same species. Anabat Insight can therefore only inform us of the presents or absents of a species and inform us of their activity levels, however, does not provide reliable information of population densities and utilisation rates at the site.

The echolocation recording devices utilised during the survey are limited to recording in the immediate location that the detector has been deployed and is not likely to reliably record calls further than 20-30m away. The height at which a recording device has been placed is also recognised to have an impact on the species detected due to the behavioural differences exhibited by different species (Collins & Jones 2009).

Furthermore, the levels of bat activity are subjective to environmental conditions including air temperature, wind speed, cloud cover, rain and moonlight. For example, high wind speeds and heavy rain fall have all been correlated with lower levels of activity (Perks & Goodenough 2020).

3.2 Bat Utilisation Survey Results

3.2.1 Microbat Species Composition, Distribution and Abundance

See **Table 3-2** for overall bat species recorded at each survey location. The positively identified calls amounted to a total of 13 species with the addition of one call signature that was narrowed down to genus level (see **Table 3-3**). The unresolved calls consisted primarily of the species positively identified and were generally narrowed down to two potential species options. The exception to this was the possible occurrence of the Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*). This unresolved call was identified based on a single call recorded at A6. A further 2094 calls could not be identified through Anabat Insight, accounting for approximately 10.7% of all recorded calls.

Based on the positively identified calls, the most recorded species was the Large Forest Bat (*Vespadelus darlingtonia*) with a total of 3324 positively identified calls across the entire survey event.

This was followed by Ride's Free-Tailed Bat (*Ozimops ridei*) with 1270 calls, and the White-striped Freetail Bat (*Austronomus australis*) with 737 calls.

The majority of species were a regular occurrence across Anabat locations and don't appear limited to any particular section of the wind farm (see **Table 3-3**). The two exceptions were the Eastern Horseshoe Bat (*Rhinolophus megaphyllus*), positively identified by a single call recorded at site A3-2, and the Yellow-bellied Sheathtail-bat that was 'possibly' identified based on a single call recorded at site A6-1.

Table 3-3: Bat Species Recorded at each Survey Location

Species / Common Name	A1-1	A1-2	A2-1	A2-2	A3-1	A3-2	A4-1	A6-1
Rhinolophus megaphyllus Eastern Horseshoe Bat						●		
Chalinolobus gouldii Gould's wattled bat	●	●	●	●	●	●	●	●
Chalinolobus morio Chocolate wattled bat	●	●	●	●	●	●	●	●
Falsistrellus tasmaniensis Eastern False Pipistrelle	●	●	●	●	●	●	●	●
***Nyctophilus* sp.**	●	●	●	●	●	●	●	●
Scoteanax rueppellii Greater Broad-nosed Bat	●	●	●	●	●	●	●	●
Scotorepens greyii Little broad-nosed bat	○	●	●	●	○	●	●	●
Scotorepens orion Eastern broad-nosed bat	●	●	●	●	●	●	●	●
Vespadelus darlingtoni Large forest bat	●	●	●	●	●	●	●	●
Vespadelus regulus Southern Forest Bat	●	●	●	●	●	●	●	●
Vespadelus vulturnus Little Forest Bat	●	●	●	●	●	●	●	●
Miniopterus orianae *Large Bent-winged Bat*	○		○	●	○	●	●	○
Austronomus australis White-striped Freetail Bat	●	●	●	●	●	●	●	●
Ozimops planiceps South-Eastern Free-Tailed Bat	●	●	●	●	●	●	●	●
Saccolaimus flaviventris								○

Yellow-bellied Sheath tail-bat								

Notes: ● – Denotes "definite" – at least one call recorded at the site was unequivocally identified to the species. ○ – Denotes "possible" – calls had some characteristics of the species but could not be reliably attributed. Yellow Highlighting denotes a vulnerable species listed under the BC Act.

Table 3-4: Abundance of Recordings for each Bat Species

Species / Common Name	A1-1	A1-2	A2-1	A2-2	A3-1	A3-2	A4-1	A6-1	Species total
Positively identified calls									
Rhinolophus megaphyllus Eastern Horseshoe Bat						1			1
Chalinolobus gouldii Gould's wattled bat	38	85	32	65	54	54	205	94	627
Chalinolobus morio Chocolate wattled bat	18	45	18	35	73	133	109	159	590
Falsistrellus tasmaniensis Eastern False Pipistrelle	5	21	44	20	13	2	66	13	184
***Nyctophilus* sp.**	6	66	80	165	131	7	19	19	493
Scoteanax rueppellii Greater Broad-nosed Bat	6	11	21	26	25	3	23	7	122
Scotorepens greyii Little broad-nosed bat		12	4	1		1	19	1	38
Scotorepens orion Eastern broad-nosed bat	3	12	9	4	33	2	17	8	88
Vespadelus darlingtoni Large forest bat	92	510	603	377	324	139	910	369	3324
Vespadelus regulus Southern Forest Bat	13	248	48	53	25	6	107	3	503
Vespadelus vulturnus Little Forest Bat	27	24	15	84	38	28	38	59	313
Miniopterus orianae *Large Bent-winged Bat*				4		1	4		9
Austronomus australis White-striped Freetail Bat	66	98	157	146	54	35	79	102	737
Ozimops planiceps South-Eastern Free-Tailed Bat	33	8	4	36	17	5	18	28	149
Ozimops ridei Ride's Free-Tailed Bat	26	33	36	182	55	35	843	60	1270
Total positively identified calls:	333	1173	1071	1198	842	451	2457	922	8447

Unresolved calls									
Chalinolobus gouldii Gould's wattled bat / ***Ozimops ridei*** Ride's Free-Tailed Bat	172	166	247	824	162	91	2595	189	4446
Chalinolobus morio Chocolate wattled bat / ***Vespadelus vulturnus*** Little Forest Bat	2	354	36	3	113	98		5	611
Falsistrellus tasmaniensis Eastern False Pipistrelle / ***Scotorepens greyii*** Little broad-nosed bat	8	39	66	16	18	5	118	11	281
Scotorepens orion Eastern broad-nosed bat / ***Scoteanax rueppellii*** Greater Broad-nosed Bat	2	14	9	83	32	6	21	9	176
Vespadelus spp.	31	808	147	141	553	128	807	377	2992
Vespadelus sp. / ***Miniopterus orianae*** Large Bent-winged Bat	1		8	8	2		22	2	43
Possible ***Saccolaimus flaviventris*** Yellow-bellied Sheath tail-bat								1	1
mixed spp-not identified-surplus	32	210	280	1002	186	33	259	47	2049
Site total:	581	2764	1864	3275	1908	813	6279	1563	19047

3.2.2 Threatened Microbat Species

The vast majority of calls identified were from common species that are not of conservation concern (i.e., are not listed as threatened under state or federal legislation). A total of three threatened species were positively identified, these include Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Greater Broad-nosed Bat (*Scoteanax rueppellii*) and Large Bent-winged Bat (*Miniopterus orianae*). Additionally, Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) was 'possibly' identified, however, this was based on the analysis of a single call and not a reliable indication of the presents of the species.

Eastern False Pipistrelle and Greater Broad-nosed Bat are both well represented in the data, with significant levels of activity recorded across all survey locations. Large Bent-winged Bat is less well represented, with a total of 9 positively identified calls across 3 survey locations, and an additional 43 'possible' calls across 6 survey locations (see previous **Table 3-3**).

3.2.4 Review of May 2013 Microbat Survey (ERM, 2014)

In May 2013 (20-24th) ERM Australia undertook bat call detection surveys at the Paling Yards Wind Farm to obtain information regarding bat utilisation of the site. Surveys were conducted at 5 locations, totalling 18 unit nights and yielding a total of 2,981 bat calls for analysis. Of the calls analysed, 12 microbat species were identified with varying levels of confidence (5 definite (100%), 1 probable (>60%), 3 possible (20-60%), and 3 that could represent one of two species). This included 3 threatened species (Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Greater Broad-nosed Bat (*Scoteanax rueppellii*) and Eastern Bent-winged bat (*Miniopterus orianae oceanensis*)), although none were a definite identification.

Of the threatened species recorded, only Eastern False Pipistrelle was identified at all five survey locations. There were 19 probable recordings, 2 possible recordings and 181 calls that were narrowed down to Eastern False Pipistrelle or Eastern broad-nosed bat (*Scotorepens orion*). Greater Broad-nosed Bat was recorded 4 times with a 'possible' (20-60%) confidence at a single survey location situated in an open pasture overlooking a wooded valley. Eastern Bent-winged bat was recorded at two survey locations. One of the recordings was assigned a 'possible' (20-60%) confidence, and an additional three recordings were determined to be the Eastern Bent-winged bat or the Large Forest Bat (*Vespadelus regulus*).

Note that the timing of the survey (late autumn) was not optimal for microbats and is expected to represent lower diversity and abundance than that observed during the summer and spring months.

3.2.1 Flying Foxes

Grey-headed Flying Fox was not recorded in the Subject Site and there are no BioNet records within 10 km of the Subject Site. A review of the Department of Agriculture, Water & Environment's *Interactive Flying-fox Web Viewer* indicates that the closest flying fox camp is at Thilmere, approx. 75 km east of the Subject Site. Overall, while its presence cannot be discounted, it is considered that this species would rarely occur in the Subject Site and collision risk would be very low (although future monitoring would ensure that this was the case).

3.3 Discussion of Impacts

3.3.1 Collision-related Mortality

Operational wind farms are recognised to pose a risk to bat species utilising the site resulting in collision with turbines and associated ancillary. These issues often result from sensory failure where bats are unable to visually or acoustically detect moving turbine blades. It has been hypothesised that bats are also drawn to turbines through the acoustics the turbines give off, the attraction of insects congregating around turbine lights or the promise of a potential roost where turbines have been mistaken for habitat (BL&A, 2011). This attraction effect only further compounds the issue, leading to further bat fatalities.

The species definitively identified throughout the survey belong to three families, including Rhinolophidae, Molossidae and Vespertilionidae. Rhinolophidae consisted of a single species the (Eastern Horseshoe Bat (*Rhinolophus megaphyllus*)), identified from a single call at one survey

location. Molossidae also consisted of a single species (White-striped Freetail Bat (*Austronomus australis*)) recorded at all survey locations with high levels of activity. The remaining definitively identified calls belonged to the Vespertilionidae family, which was well represented throughout the survey. The Vespertilionidae recordings included the three definitively identified threatened species including Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Greater Broad-nosed Bat (*Scoteanax rueppellii*) and Large Bent-winged Bat (*Miniopterus orianae*).

The analysis of bat species' global vulnerability to collision mortality at wind farms undertaken by Thaxter *et al*, (2017) has been used to estimate the rated collision risk for each of the represented families. The highest average rate of collision was observed in the Molossidae family with approximately 0.78 bat collisions per turbine per year, followed by Emballonuridae, with 0.7 bat collisions per turbine per year. See **Table 3-5**.

The Thaxter et al, (2017) models predict much higher collision rates for bats than birds. These collision estimations are based on the collation of 888 bat collision fatalities observed at wind farms globally over a 10-year period and have the potential to provide valuable insight; however, these wind farms occur in Europe and North America and their statistics should be applied with caution to Australian conditions. These generalised estimations also do not take into account site-specific factors, species abundance and activity levels, or turbine specifications that have the potential to reduce or inflate actual observed fatality rates at the Paling Yards wind farm. It is also unclear the role barotrauma has in contributing to fatality rates in wind farms as opposed to death directly attributed to collision alone (see Section 3.3.2 of this report).

Table 3-5: Estimated Annual Collision-related Fatality Rates for Recorded Microchiropteran Bat Species

Family	Species Recorded within Survey Area	Thaxter et al. (2017) Annual Fatality Rate	Estimated Annual Fatality Rate
Emballonuridae	*Saccolaimus flaviventris* (Yellow-bellied Sheathtail Bat)+	0.7 bats per WTG.	32.9 bats.
Miniopteridae	*Miniopterus orianae oceanensis* (Large Bent-winged Bat)+	0.68 bats per WTG.	32 bats.
Molossidae	*Tadarida australis* (White-striped Freetail Bat), *Ozimops planiceps* (Southern Free-tailed Bat), *O. ridei* (Ride's Free-Tailed Bat)	0.78 bats per WTG.	36.7 bats.
Rhinolophidae	*Rhinolophus megaphyllus* (Eastern Horseshoe Bat)	0.64 bats per WTG.	30.1 bats.
Vespertilionidae	*Chalinolobus gouldii* (Gould's Wattled Bat), *Chalinolobus morio* (Chocolate Wattled bat), *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)+, *Nyctophilus* sp., *Scoteanax rueppellii* (Greater Broad-nosed Bat)+, *Scotorepens greyii* (Little Broad-nosed Bat), *S. orion* (Eastern Broad-nosed Bat), *Vespadelus darlingtoni* (Large Forest Bat), *V. regulus* (Southern Forest Bat), *V. vulturnus* (Little Forest Bat).	0.69 bats per WTG.	32.4 bats.

3.3.2 Barotrauma

Decompression hypothesis proposes that barotrauma results from a rapid reduction in air-pressure caused by the rotation of turbine blades. Barotrauma results in tissue damage to air-containing structures caused by a rapid or extreme change in pressure, and this often results in lung damage as they cannot accommodate the air expansion (Baerwald *et al.* 2008). Microbats have been identified as particularly vulnerable to these effects, often with fatal consequences. The Australian Bat Society has estimated the fatality rates range from 1.6 bats per turbine per year to over 90 bats per turbine per year.

4. MITIGATION AND HARM MINIMISATION

As indicated in this assessment, there are uncertainties around the ongoing impact of collision and barotrauma related mortalities. The current literature is focused on Europe and North America and the statistics from these studies should be applied with caution to Australian conditions. In order to address these uncertainties, a specific Bat and Bird Adaptive Management Plan (BBAMP) is to be developed with the objective of minimising the impacts of the operational wind farm. The BBAMP will outline the required monitoring measures, key thresholds for determining permissible impacts and corrective actions that are required to achieve the objective of the plan. The plan will additionally outline the roles and responsibilities of the proponent, operator and agencies implementing, assessing, and enforcing the plan. Monitoring should include assessments of monthly mortality and periodic BBUS. Appropriate mitigation measures will be identified (such as the regular removal of lamb carcasses during lambing season, to decrease the attraction of the area to feeding raptors).

The monitoring plan will be developed in consultation with the Office of Environmental Heritage (OEH) to ensure that the plan meets the requirements and standards set forth by the agency. The frequency of reporting collision data will be determined during the preparation of the monitoring programme. The adaptive management measures that can be implemented, should collision thresholds be exceeded, will be negotiated with the OEH when collision rates are detected. Bird and bat collision monitoring will be undertaken with consideration for the monitoring guidelines provided by the Australian Wind Energy Association.

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APPENDIX F – BAT CALL ANALYSIS REPORT

Microbat Call Identification Report

Prepared for ("Client"):	Hunter Ecology
Survey location/project name:	Paling Yards (Goulburn area)
Survey dates:	2nd – 10th February 2021
Client project reference:	
Job no.:	HEC-2101
Report date:	22 April 2021

Methods

Data received & post processing

Bat echolocation detection was undertaken at eight separate sites in the Paling Yards district, between Oberon and Goulburn, using two Anabat Express and three Anabat Swift detectors (Titley Scientific, Brisbane). **Table 1** shows the deployment schedule, derived from metadata saved in the acoustic files, and assigns site codes for use later in this report.

The 21 raw ZCA files recorded on the Express units were processed with *Anabat Insight* (Version 1.9.7; Titley Scientific, Brisbane) to extract individual zero-crossing call sequence files (ZC files) for analysis. This process yielded 19,781 ZC files from the three detectors. Data from the three Swift detectors included 23,690 full-spectrum acoustic files (WAV format).

All WAV and ZC files were passed through a noise filter in *Anabat Insight* to remove files containing only non-bat noise. This process excluded 23,891 files, leaving 18,580 for further analysis.

Table 1 Detector deployment schedule for the Paling Yards bat survey, February 2021.

Detector name (Model Serial no.)	Deployment dates	Latitude	Longitude	Site-code
Anabat1 (Swift SN583085)	3-4 Feb	-34.1259	149.7623	A1-1
	5-9 Feb	-34.1583	149.7276	A1-2
Anabat2 (Swift SN583108)	2-4 Feb	-34.1261	149.7678	A2-1
	5-9 Feb	-34.1857	149.7116	A2-2
Anabat3 (Express SN542982)	3-6 Feb	-34.1764	149.7299	A3-1
	7-9 Feb	-34.1757	149.7138	A3-2
Anabat4 Express SN542945	2-9 Feb	-34.1732	149.723	A4-1
Anabat6 Express SN507220	2-6 Feb	-34.1733	149.7183	A6-1

Call analysis and species identification

The *Anabat Insight* Decision Tree analysis function was used to process all files that passed the noise filter (*i.e.,* those that contained bat calls) and group them according to similarities in call pulse characteristics (e.g., characteristic frequency, slope, duration). Each group was then reviewed manually to verify species identities and separate, if necessary, the different species assigned to the group.

Calls were thus assigned either a positive species label, where identification was unequivocal, or a multi-species group label, where identity remained "unresolved" because the call had features potentially attributable to two or more species. Where the Decision Tree attributed many files to a single group, the manual species verification for that group proceeded only until at least a few calls of each constituent species were teased out for each detector-night.

Some files that contained calls from multiple species in different frequency bands were assigned a "mixed" species label once all potential species were identified for a site.

Species confirmation was achieved by comparing call spectrograms and derived metrics with those of regionally relevant reference calls and published call descriptions (*e.g.,* Pennay *et al.* 2004). Consideration was also given to the probability of species' occurrence based on published distribution information (e.g., Churchill 2008; van Dyck et al. 2013) and on-line database records (e.g., http://www.ala.org.au).

Reporting standard

The format and content of this report follows Australasian Bat Society standards for the interpretation and reporting of bat call data (Reardon 2003), available on-line at http://www.ausbats.org.au/.

Species nomenclature follows Armstrong *et al.* (2020).

Results & Discussion

A total of 16,998 individual calls were identified in 16,531 files; and another 2049 files contained multiple unidentified calls of species that were otherwise reliably identified.

At least 15, possibly 17 species were detected during the survey (see **Table 2**). Almost half (8448) of the identified calls were allocated reliably to one of 14 distinct species plus the undifferentiated *Nyctophilus* genus, two species of which (*N. geoffroyi* and *N. gouldi*) potentially occur in the study area.

The other 8550 "unresolved" calls were assigned to seven species groups, six of which represented only species that were otherwise positively identified. The other unresolved call group contained just one call, which potentially belonged to the Yellow-bellied Sheath-tailed Bat (*Saccolaimus flaviventris*). Since this call was in a ZC file and consisted of only one well-defined pulse with no visible harmonic pattern it is impossible to be certain of the source of the call.

Appendix 1 provides a breakdown of the number of calls allocated to each species or unresolved species group for the eight survey sites. Sample call spectrograms of each species and unresolved call-group are shown in **Appendix 2**.

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Table 2 Bat species recorded during the Paling Yards survey, 2-10 February 2021.
For site coordinates and other deployment details (survey dates, etc.) see **Table 1**.

♦ = "definite" – at least one call recorded at the site was unequivocally identified to the species

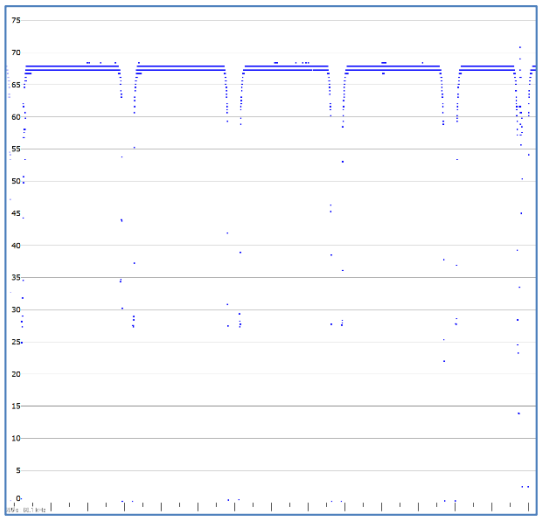
□ = "possible" – calls had some characteristics of the species but could not be reliably attributed

Site:	A1-1	A1-2	A2-1	A2-2	A3-1	A3-2	A4-1	A6-1
Rhinolophus megaphyllus						♦		
Chalinolobus gouldii	♦	♦	♦	♦	♦	♦	♦	♦
Chalinolobus morio	♦	♦	♦	♦	♦	♦	♦	♦
Falsistrellus tasmaniensis	♦	♦	♦	♦	♦	♦	♦	♦
Nyctophilus sp.	♦	♦	♦	♦	♦	♦	♦	♦
Scoteanax rueppellii	♦	♦	♦	♦	♦	♦	♦	♦
Scotorepens greyii	□	♦	♦	♦	□	♦	♦	♦
Scotorepens orion	♦	♦	♦	♦	♦	♦	♦	♦
Vespadelus darlingtoni	♦	♦	♦	♦	♦	♦	♦	♦
Vespadelus regulus	♦	♦	♦	♦	♦	♦	♦	♦
Vespadelus vulturnus	♦	♦	♦	♦	♦	♦	♦	♦
Miniopterus orianae	□		□	♦	□	♦	♦	□
Austronomus australis	♦	♦	♦	♦	♦	♦	♦	♦
Ozimops planiceps	♦	♦	♦	♦	♦	♦	♦	♦
Ozimops ridei	♦	♦	♦	♦	♦	♦	♦	♦
Saccolaimus flaviventris								□

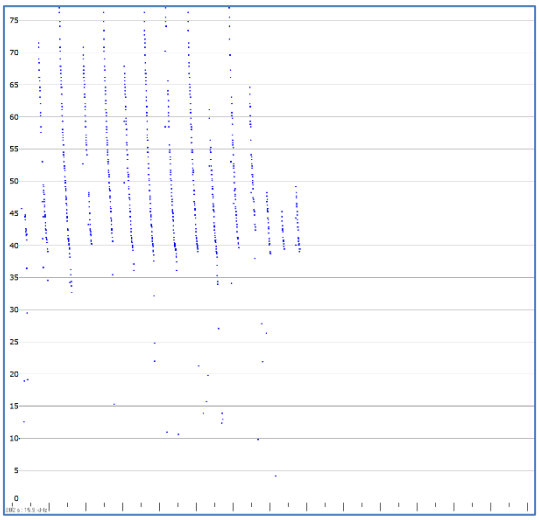
Appendix 1 Paling Yards bat-detection survey, 2-10 February 2021: number of bat calls allocated per species or unresolved group per site.

Site:	A1-1	A1-2	A2-1	A2-2	A3-1	A3-2	A4-1	A6-1	Species total
Positively identified calls									
Rhinolophus megaphyllus						1			1
Chalinolobus gouldii	38	85	32	65	54	54	205	94	627
Chalinolobus morio	18	45	18	35	73	133	109	159	590
Falsistrellus tasmaniensis	5	21	44	20	13	2	66	13	184
Nyctophilus sp.	6	66	80	165	131	7	19	19	493
Scoteanax rueppellii	6	11	21	26	25	3	23	7	122
Scotorepens greyii		12	4	1		1	19	1	38
Scotorepens orion	3	12	9	4	33	2	17	8	88
Vespadelus darlingtoni	92	510	603	377	324	139	910	369	3324
Vespadelus regulus	13	248	48	53	25	6	107	3	503
Vespadelus vulturnus	27	24	15	84	38	28	38	59	313
Miniopterus orianae				4		1	4		9
Austronomus australis	66	98	157	146	54	35	79	102	737
Ozimops planiceps	33	8	4	36	17	5	18	28	149
Ozimops ridei	26	33	36	182	55	35	843	60	1270
Unresolved calls									
C. gouldii / O. ridei	172	166	247	824	162	91	2595	189	4446
C. morio / V. vulturnus	2	354	36	3	113	98		5	611
F. tasmaniensis / S. greyii	8	39	66	16	18	5	118	11	281
S. orion / S. rueppellii	2	14	9	83	32	6	21	9	176
Vespadelus spp.	31	808	147	141	553	128	807	377	2992
Vespadelus sp. / *M. orianae*	1		8	8	2		22	2	43
Possible *Saccolaimus flaviventris*								1	1
mixed spp-not identified-surplus	32	210	280	1002	186	33	259	47	2049
Site total	581	2764	1864	3275	1908	813	6279	1563	19047

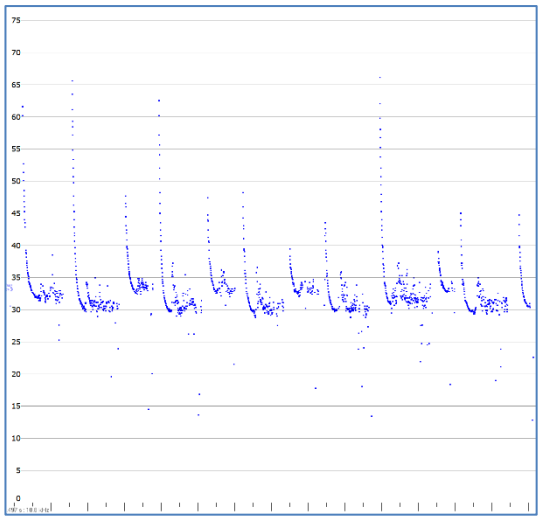
Appendix 2 Representative sonograms from the Paling Yards survey, 2-10 February 2021.
X-axis (time)=10 msec per tick; time between pulses removed



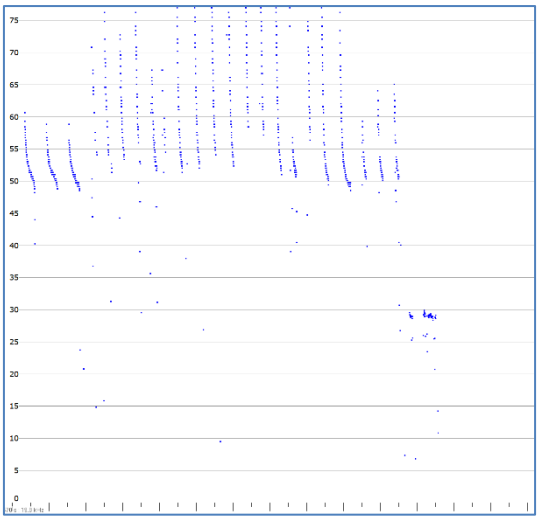
Rhinolophus megaphyllus



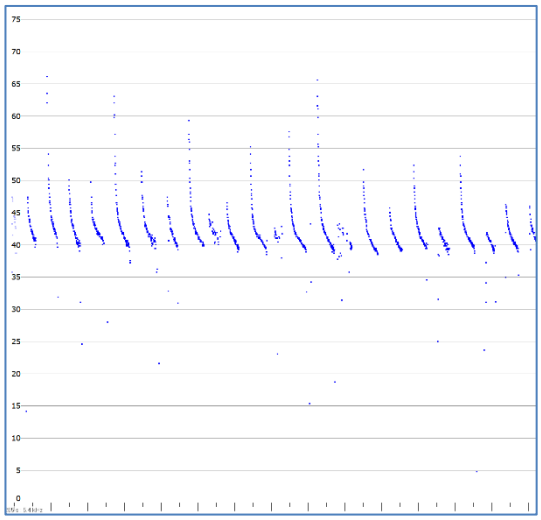
Nyctophilus sp.



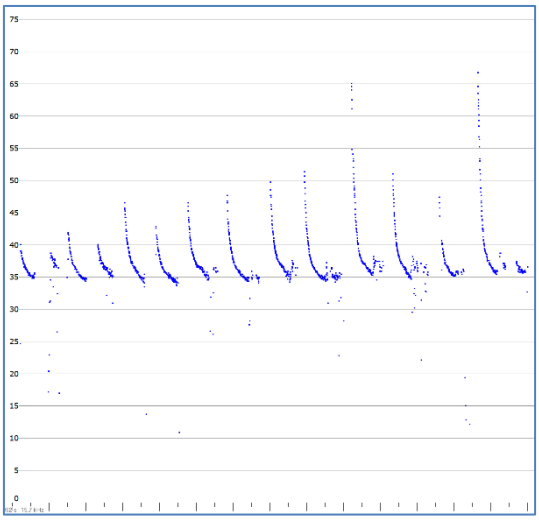
Chalinolobus gouldii



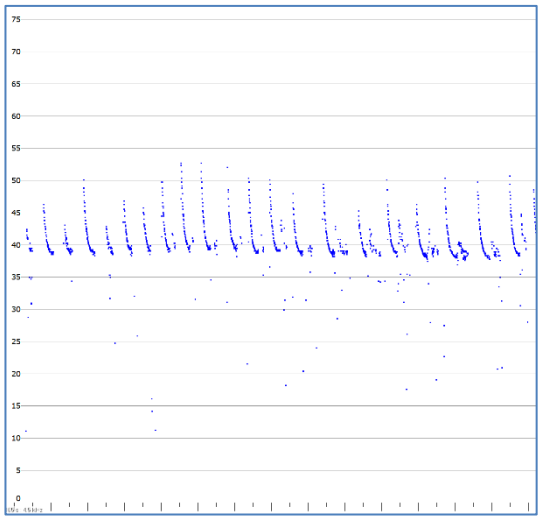
Chalinolobus morio



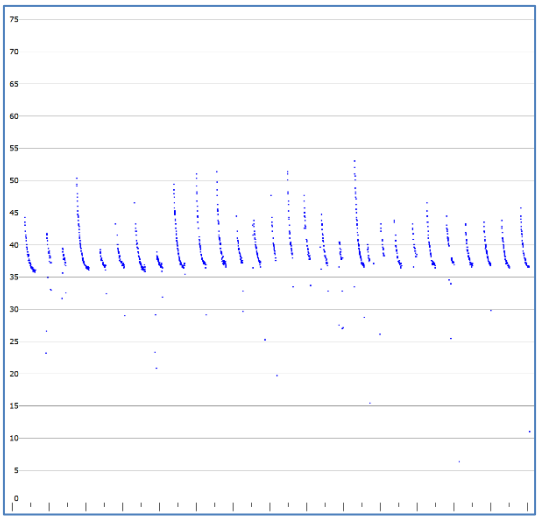
Falsistrellus tasmaniensis



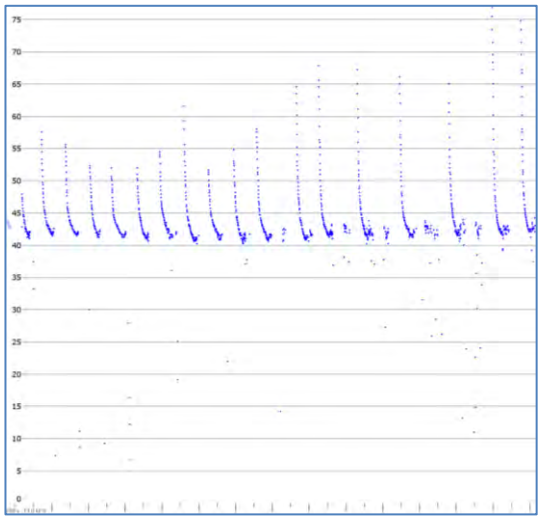
Scoteanax rueppellii



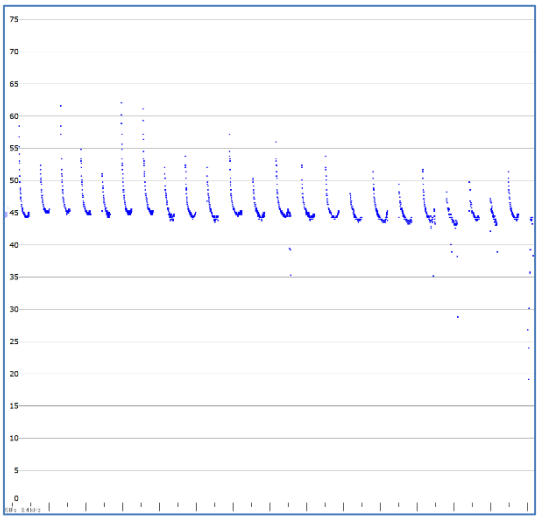
Scotorepens greyii



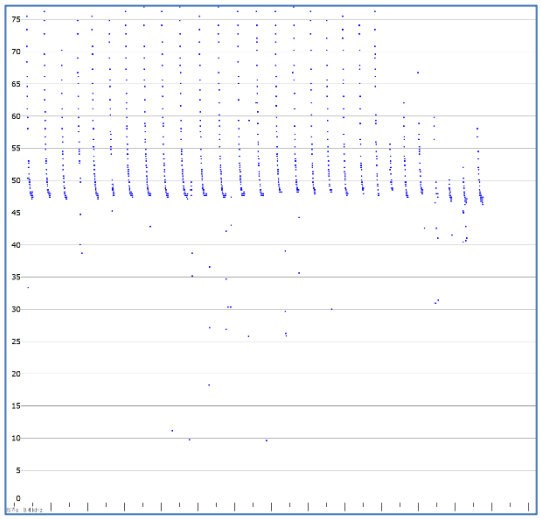
Scotorepens orion



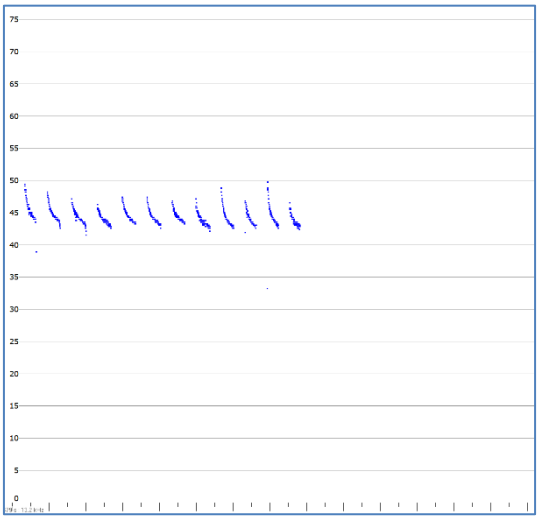
Vespadelus darlingtoni



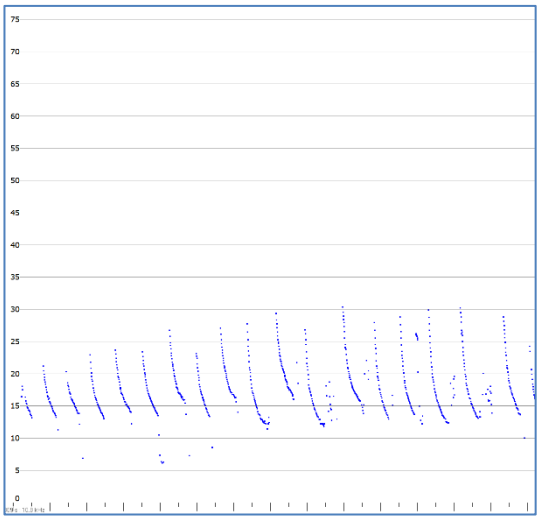
Vespadelus regulus



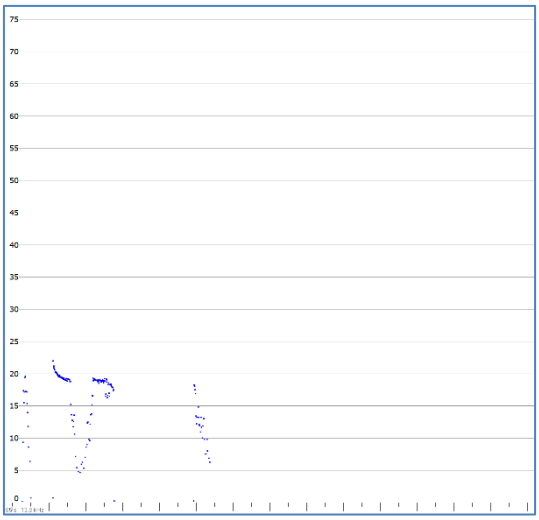
Vespadelus vulturnus



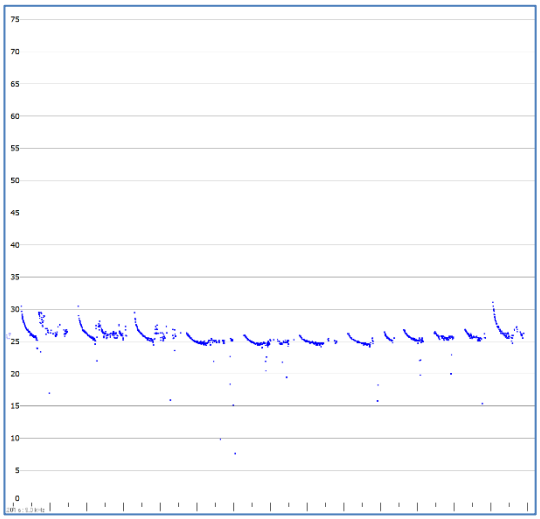
Miniopterus orianae



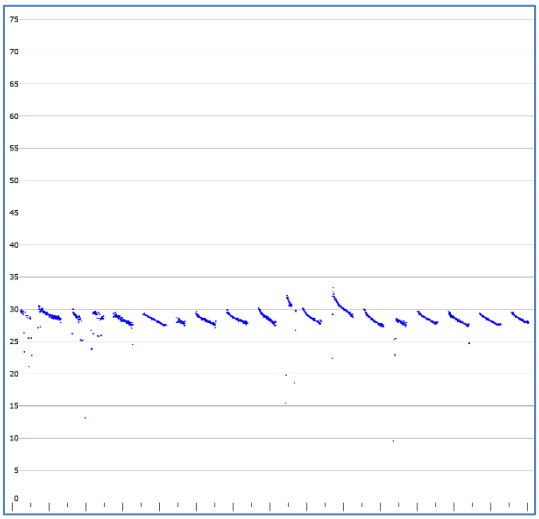
Austronomus australis



Possibly *Saccolaimus flaviventris*



Ozimops planiceps



Ozimops ridei

APPENDIX G – SIGNIFICANT IMPACT ASSESSMENTS UNDER THE EPBC ACT

The Commonwealth EPBC Act requires approval for actions that are likely to have a significant impact on Matters of National Environmental Significance (MNES). There are seven MNES that are triggers for Commonwealth assessment and approval. The MNES and study area-specific responses are as follows:

World Heritage Areas – The Subject Site is near the World Heritage Area, the Greater Blue Mountains Area. The Greater Blue Mountains Heritage Area includes eight national parks (NPs) or reserves and the closest of these is the Blue Mountains NP and Kanangra-Boyd NP. The bushland on the eastern side of the Subject Site connects with these NPs. Overall, these NPs are unlikely to impacted by the proposal in any significant way.

National Heritage Places – The Subject Site is near the National Heritage Place, the Greater Blue Mountains Area. As above, the Greater Blue Mountains Heritage Area includes eight national parks NPs or reserves and the closest of these is the Blue Mountains NP and Kanangra-Boyd NP. The bushland on the eastern side of the Subject Site connects with these NPs, but overall, they are unlikely to impacted by the proposal in any significant way.

Wetlands of International Importance (declared Ramsar wetlands) – The following Wetlands of International Importance occur within 10 km of the Subject Site:

- Banrock station wetland complex – Subject Site is 800-900 km upstream of this wetland.
- Hattah-Kulkyne Lakes – Subject Site is 600-700 km upstream of this wetland.
- Riverland – Subject Site is 800-900 km upstream of this wetland.
- The Coorong, and Lakes Alexandrina and Albert Wetland – Subject Site is 900-1000 km upstream of this wetland.

The Project would have minor hydrological impacts and is not expected to impact on these wetlands.

Listed Threatened Species and Ecological Communities – The Subject Site contains one TEC listed under the EPBC Act and potential habitat for several threatened species listed under the EPBC Act (see the EPBC Protected Matters Search Tool results in **Appendix H** and confirmed ecosystem credit species in **Table 4-3** of the BDAR). Overall, the following threatened entities are potentially impacted by the proposal:

- *Anthochaera Phrygia* (Regent Honeyeater)
- *Callocephalon fimbriatum* (Gang-gang Cockatoo)
- *Dasyurus maculatus* (Spotted-tailed Quoll)
- *Grantiella picta* (Painted Honeyeater)
- *Hirundapus caudacutus* (White-throated Needletail
- *Lathamus discolor* (Swift Parrot)
- *Phascolarctos cinereus* (Koala)
- *Polytelis swainsonii* (Superb Parrot)
- *Pteropus poliocephalus* (Grey-headed Flying-fox)

Impact assessments under the EPBC Act, in accordance with the DoE (2013) Significant Impact Guidelines 1.1 - Matters of National Environmental Significance (which are provided in full below), were undertaken for these species; these impact assessments concluded that the proposal would not have had a significant impact on the assessed species.

Note: the Subject Site's White Box-Yellow Box-Blakely's Red Gum Grassy Woodland does not meet the condition threshold (in Appendix 2 of DECCW (2010)) for the EPBC Act listing as it contains a heavily exotic-dominant groundlayer (see BAM data sheets in **Appendix A**).

Listed Migratory Species – Six listed migratory species have the potential to occur within the Subject Site, based on a review of the species predicted to occur in the area and the site's habitat potential (see the EPBC Protected Matters Search Tool results in **Appendix H**). These include:

- *Hirundapus caudacutus* (White-throated Needletail)
- *Monarcha melanopsis* (Black-faced Monarch)
- *Motacilla flava* (Yellow Wagtail)
- *Myiagra cyanoleuca* (Satin Flycatcher)
- *Rhipidura rufifrons* (Rufous Fantail)
- *Anthus novaeseelandiae* (Australasian Pipit)
- *Apus pacificus* (Fork-tailed Swift)

Impact assessments under the EPBC Act, in accordance with the DoE (2013) *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* (which are provided in full below), were undertaken for these species; these impact assessments concluded that the proposal would not have a significant impact on the assessed species.

Commonwealth Marine Area – The Subject Site does not occur near any Commonwealth marine areas.

Commonwealth Land – The Proposal would not impact on any Commonwealth lands.

The Great Barrier Reef Marine Park – Not applicable

Overall, it is considered unlikely that any MNES would be significantly impacted by the Proposal and thus referral to the Commonwealth DoE is not necessary.

SIGNIFICANT IMPACT ASSESSMENTS

Anthochaera Phrygia (Regent Honeyeater) – Critically Endangered Species

A. phrygia has a patchy distribution, but it is thought to comprise a single population across eastern Australia, with some exchange of individuals between regularly used areas. It is estimated that only 350-400 birds remain (DoE, 2016). Birds can move large distances and may use different areas (likely depending on food resource availability) however the exact nature of these movements is still poorly understood. Breeding though is confined to a small number of known locations. Four of these locations (the Bundarra-Barraba, Capertee Valley and Hunter Valley districts in NSW and the Chiltern area in VIC) are considered 'key' breeding areas, where breeding is regularly recorded. Several subsidiary areas have also been identified (see **Table G-1**).

Table G-1: *Anthochaera phrygia* (Regent Honeyeater) Breeding Areas

Key Breeding Areas	Subsidiary Breeding Areas
Bundarra-Barraba	Inverell-Ashford-Emmaville
	Pilliga
	Warrumbungles
Hunter Valley / Central Coast	Central Coast
	Central Hunter Valley
	Lower Hunter Valley
	Upper Hunter Valley
	Goulburn River
	Widden Valley
Capertee Valley	Mudgee-Munghorn Gap-Wollar
	Burragorang River Valleys
Chiltern	Albury-Thurgoona
	Killawarra-Glenrowan
	Bobinawarrah-Carboor
	Lurg-Benalla district

Suitable habitat includes dry open forest and woodland, particularly Box-Ironbark woodland, and Casuarina riparian forests. Woodlands containing large numbers of mature trees and high canopy cover are preferred and mistletoe is a vital habitat component (EES, 2022). *A. Phrygia* is a generalist forager, feeding mainly on Eucalypt nectar (preferred species include *Eucalyptus sideroxylon, E. melliodora, E. albens* and *E. robusta*), Nectar and fruit from the mistletoes *Amyema miquelii*, *A. pendula* and *A. cambagei*, but also (when nectar/fruit is scarce) lerp and honeydew (EES, 2022).

As discussed in the BDAR, bird utilisation surveys were undertaken over multiple survey periods and *A. phrygia* was not recorded. It is considered that *A. phrygia* would rarely occur in the Subject Site. There are no BioNet records of within 10 km of the Subject Site, the Subject Site is not near any key or subsidiary breeding areas and the Subject Site is not in a 'mapped important area'. Further, the box-gum woodland vegetation types within the proposed development footprint are highly disturbed, with a sparse canopy, cleared understorey and a groundcover almost entirely dominated by exotic pasture species. It cannot however be entirely discounted that the species may fly over the Subject Site during nomadic flights. Nomadic flight paths of *A. phrygia* are poorly understood and difficult to predict.

A. phrygia is listed as critically endangered under the EPBC Act and the following assessment address the critically endangered species significant impact criteria.

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

- ***Lead to a long-term decrease in the size of a population***

The population size of *A. phrygia* is already very low (350-400 birds (DoE, 2016)), making it highly vulnerable to stochastic events such as wildfire or disease and the loss of genetic diversity. Thus, anything that may impact on even a small number of birds should be considered significant. *A. phrygia* would not breed in or anywhere near the Subject Site and impacts associated with the Project would be more related to habitat loss (vegetation removal) or wind turbine collision risk.

The area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape; it is unlikely to significantly reduce foraging habitat for *A. phrygia*. Whilst the risk of wind turbine collision cannot be ruled out, it is considered unlikely. As discussed above, *A. phrygia* would rarely occur in the Subject Site. It would also be unlikely for *A. phrygia* to fly at Rotor Sweep Area (RSA) height, although this risk would be heightened during nomadic flights. It is notable though that the proposed locations of the Project's turbines are almost all within existing cleared areas. It is much less likely that *A. phrygia* would choose to travel across these cleared open areas, rather than the abundantly vegetated areas surrounding the Subject Site.

Overall, it is considered unlikely that the Project will lead to a long-term decrease in the size of a population

- ***Reduce the area of occupancy of the species***

As discussed above, it is considered that *A. phrygia* would rarely occur in the Subject Site. There are no BioNet records of within 10 km of the Subject Site, the Subject Site is not near any breeding areas and the site's box-gum woodland vegetation types are all highly disturbed. The proposed locations of the turbines are within existing cleared areas and it is considered unlikely that their presence will affect nomadic flight paths (which would be more likely to occur across the surrounding vegetated areas). Finally, the area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape.

Overall, the Project is unlikely to reduce the area of occupancy of the species.

- ***Fragment an existing population into two or more populations***

The area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape; it is unlikely to significantly reduce foraging habitat for *A. phrygia* and would not fragment or isolate any areas of habitat. The Project is unlikely to fragment an existing population into two or more populations.

- ***Adversely affect habitat critical to the survival of a species***

The Subject Site is not near any key or subsidiary breeding areas and does not occur in a 'mapped important area'. The Project is unlikely to adversely affect habitat critical to the survival of a species.

- ***Disrupt the breeding cycle of a population***

The Subject Site is not near any key or subsidiary breeding areas and does not occur in a 'mapped important area'. The Project is unlikely to disrupt the breeding cycle of a population.

- ***Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline***

The Subject Site is not near any breeding areas and the area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape. Also, most of the proposed locations of the turbines are within existing cleared areas and it is considered unlikely that their presence will affect nomadic flight paths (which would be more likely to occur across the surrounding vegetated areas). The Project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

- ***Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat***

The Project would not be responsible for the introduction of harmful invasive species to the Subject Site (such as cats, foxes etc.). The Project is unlikely to result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.

- ***Introduce disease that may cause the species to decline***

The Project is unlikely to introduce any diseases that may cause the species to decline.

- ***Interfere with the recovery of the species***

The DAWE (2016) recovery plan for *A. phrygia* has been reviewed. For the reasons already stated above, the Project is unlikely to interfere with the recovery of the species.

Callocephalon fimbriatum (Gang-gang Cockatoo) – Endangered Species

C. fimbriatum generally spends spring and summer in tall mountain forests and woodland, preferring heavily timbered, mature wet sclerophyll forest. During autumn and winter, it often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark associations. Breeding habitat requirements for *C. fimbriatum* are old growth forest or woodland with hollows in eucalyptus trees. Hollows chambers need to be approx. 20 cm in floor diameter, 22–90 cm deep and 5–9.4 m above the ground. Nesting sites are often near water and breeding aggregations are reliant on stands of multiple suitable hollow-bearing trees, within a few hundred metres of each other. Breeding pairs utilise multiple nest trees over different years, which may be a way of minimising nest parasitism or predation (DAWE, 2022).

Breeding *C. fimbriatum* was confirmed to be present at the Site. Adult *C. fimbriatum* were observed and young could be heard calling in the vicinity of a large hollow-bearing tree external to the Survey Area, north of the proposed transmission line in the north-eastern portion of the Survey Area. In this same area, another large hollow-bearing tree of suitable size and height for breeding *C. fimbriatum* was observed north of the Survey. A lone adult male/s was also observed close to this area and overall, there is ample evidence to suggest that the second hollow would be utilised for breeding by *C. fimbriatum*. In addition to the breeding observations, there were several sightings of *C. fimbriatum* in the wider Survey Area. See **Figure 4-3** of the BDAR for all *C. fimbriatum* observations.

C. fimbriatum is listed as vulnerable under the EPBC Act and the following assessment address the vulnerable species significant impact criteria.

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

- ***lead to a long-term decrease in the size of an important population of a species***

The proposed locations of the Project's turbines are mostly within existing cleared areas or if not, within edge habitat or habitat that is already highly disturbed (i.e., cleared/grazed and exotic understorey). The area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape and it is unlikely to significantly reduce foraging habitat for *C. fimbriatum.* Neither of the two identified nest trees occur within the Project footprint, however to

account for indirect impacts, the BioNet ecological data for *C. fimbriatum* requires that any native vegetation within a circular buffer radius of 200 m around a nest tree is include in a species polygon. The Project footprint occurs within 200 m of both nest trees. Development within this buffer may cause disturbance to the breeding pair that may use it; however it is also considered that this impact would also be minor in the context of the surrounding landscape. As mentioned above, breeding pairs of *C. fimbriatum* utilise multiple nest trees over different years (DAWE, 2022) and thus this is likely to be one of several hollows used by a breeding pair. There is also scope to ensure that vegetation clearing within the 200 m buffers of the nest trees is not undertaken during the nesting season for *C. fimbriatum.*

Potential operational impacts of the Project on *C. fimbriatum* are less clear. Section 7.3.1 of the BDAR provides an assessment of the impacts from wind turbine strike. A review of Thaxter et al.'s (2017) fatality rates (from wind turbine collision) for different bird classification groups (by order) was included in this assessment. Thaxter et al. (2017) estimated that annual fatality rate of birds in the Psittaciformis order (of which *C. fimbriatum* is in) to be 0.03 birds per turbine. Based on the Project's proposed 47 turbines, this would be 1.41 birds of the Psittaciformis order per year. It is important to note that Thaxter et al.'s (2017) study was based on statistics from wind farms in Europe and North America and the statistics from these studies should be applied with caution to Australian conditions. To address these uncertainties, the Project proposes to develop a Bird and Bat Adaptive Management Program (BBAMP). The BBAMP will outline monitoring measures, key thresholds for determining permissible impacts and corrective actions that are required to achieve the BBAMP objectives (which are essentially to minimise impacts on birds and bats during the operational phase). This is discussed in Section 7 of the BDAR.

Overall, it is considered unlikely that the Project will lead to a long-term decrease in the size of an important population of a species.

- ***reduce the area of occupancy of an important population***

The Project's proposed wind turbine locations are mainly in existing cleared areas, which minimises vegetation removal and reduces turbine collision risk. The proposed BBAMP would ensure that the collision risk is managed appropriately throughout the operational phase. Development within the 200 m buffers of the nest trees may cause disturbance to the breeding pair that may use it; however it is also considered that this impact would also be minor in the context of the surrounding landscape. As mentioned above, breeding pairs of *C. fimbriatum* utilise multiple nest trees over different years (DAWE, 2022) and thus this is likely to be one of several hollows used by a breeding pair. There is also scope to ensure that vegetation clearing within the 200 m buffers of the nest trees is not undertaken during the nesting season for *C. fimbriatum.*

The Project is unlikely to reduce the area of occupancy of an important population.

- ***Adversely affect habitat critical to the survival of a species***

There is no listed habitat critical to the survival of *C. fimbriatum.* The Project is unlikely to adversely affect habitat critical to the survival of a species.

- ***Disrupt the breeding cycle of an important population***

The Project's proposed wind turbine locations are mainly in existing cleared areas, which minimises vegetation removal and reduces turbine collision risk. The proposed BBAMP would ensure that the collision risk is managed appropriately throughout the operational phase. The removal of the breeding hollow would have some impact on the breeding pair that may use it, however it is also considered

that this impact would also be minor in the context of the surrounding landscape. Development within the 200 m buffers of the nest trees may cause disturbance to the breeding pair that may use it; however it is also considered that this impact would also be minor in the context of the surrounding landscape. As mentioned above, breeding pairs of *C. fimbriatum* utilise multiple nest trees over different years (DAWE, 2022) and thus this is likely to be one of several hollows used by a breeding pair. There is also scope to ensure that vegetation clearing within the 200 m buffers of the nest trees is not undertaken during the nesting season for *C. fimbriatum.*

The Project is unlikely to disrupt the breeding cycle of an important population.

- ***Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline***

The Project's proposed wind turbine locations are mainly in existing cleared areas, which minimises vegetation removal and reduces turbine collision risk. The proposed BBAMP would ensure that the collision risk is managed appropriately throughout the operational phase. Development within the 200 m buffers of the nest trees may cause disturbance to the breeding pair that may use it; however it is also considered that this impact would also be minor in the context of the surrounding landscape. As mentioned above, breeding pairs of *C. fimbriatum* utilise multiple nest trees over different years (DAWE, 2022) and thus this is likely to be one of several hollows used by a breeding pair. There is also scope to ensure that vegetation clearing within the 200 m buffers of the nest trees is not undertaken during the nesting season for *C. fimbriatum.*

- ***Result in invasive species that are harmful to a vulnerable species becoming established in the species' habitat***

The Project is unlikely to result in invasive species that are harmful to a vulnerable species becoming established in the species' habitat.

- ***Introduce disease that may cause the species to decline***

The Project is unlikely to introduce disease that may cause a decline to *C. fimbriatum* (such as Psittacine beak and feather disease (PBFD)).

- ***Interfere substantially with the recovery of the species***

For the reasons stated above, the Project is unlikely to interfere substantially with the recovery of the species.

Dasyurus maculatus (Spotted-tailed Quoll) – Endangered Species

D. maculatus inhabits a wide range of habitats, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Important habitat features include hollow-bearing trees, fallen logs, other animal burrows, small caves and rock outcrops (which may all be used as den sites). Mature, undisturbed forest is also preferred. A variety of prey are targeted, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits, reptiles, insects and domestic fowl. *D. maculatus* also consumes carrion. Home ranges are large (200-500 ha for females and 500-4000 ha for males).

D. maculatus is likely to occur in the vegetated parts of the Subject Site. BioNet records indicate that it was recorded in the Subject Site ('Paling Yards' property) in 1950 and more recently (2014) approx. 5 km south-west of Subject Site.

D. maculatus is listed as endangered under the EPBC Act and the following assessment address the endangered species significant impact criteria.

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

- ***Lead to a long-term decrease in the size of a population***

The area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape and it is unlikely to significantly reduce habitat for *D. maculatus*. The proposed locations of the Project's turbines are mostly within existing cleared areas or if not, within edge habitat or habitat that is already highly disturbed (i.e., cleared/grazed and exotic understorey). The operational impacts would also be very minimal for this species. Overall, it is considered unlikely that the Project will lead to a long-term decrease in the size of a population.

- ***Reduce the area of occupancy of the species***

The Project is unlikely to affect the ability of *D. maculatus* to occupy the Subject Site, due to the minimal removal of disturbed habitat and the minimal operational impacts. The Project is unlikely to reduce the area of occupancy of the species.

- ***Fragment an existing population into two or more populations***

The area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape; it is unlikely to significantly reduce foraging habitat for *D. maculatus* and would not fragment or isolate any areas of habitat. The Project is unlikely to fragment an existing population into two or more populations.

- ***Adversely affect habitat critical to the survival of a species***

There is no listed critical habitat for *D. maculatus*. The Project is unlikely to adversely affect habitat critical to the survival of a species.

- ***Disrupt the breeding cycle of a population***

The Project is unlikely to affect the ability of *D. maculatus* to breed in the Subject Site, due to the minimal removal of disturbed habitat and the minimal operational impacts. The Project is unlikely to disrupt the breeding cycle of a population.

- ***Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline***

The area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape and it is unlikely to significantly reduce habitat for *D. maculatus*. The proposed locations of the Project's turbines are mostly within existing cleared areas or if not, within edge habitat or habitat that is already highly disturbed (i.e., cleared/grazed and exotic understorey). The operational impacts would also be very minimal for this species. The Project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

- ***Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat***

The Project would not be responsible for the introduction of harmful invasive species to the Subject Site (such as cats, foxes etc.). The Project is unlikely to result in invasive species that are harmful to a

critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.

- ***Introduce disease that may cause the species to decline***

The Project is unlikely to introduce any diseases that may cause the species to decline.

- ***Interfere with the recovery of the species***

For the reasons already stated above, the Project is unlikely to interfere with the recovery of the species.

Grantiella picta (Painted Honeyeater) – Vulnerable Species

G. picta generally occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Qld. It is a nomadic species and during winter it is more likely to be found in the north of its distribution. It inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests. *G. picta* is a specialist feeder on the fruits of *Amyema* mistletoes growing on woodland eucalypts and acacias, although insects and nectar from mistletoe or eucalypts are also occasionally eaten (EES, 2022; DAWE, 2022).

As discussed in the BDAR, bird utilisation surveys were undertaken over multiple survey periods and *G. picta* was not recorded. It is considered that *G. picta* would rarely occur in the Subject Site. There are no BioNet records of within 10 km of the Subject Site. Further, the box-gum woodland vegetation types in the proposed development footprint are highly disturbed, with a sparse canopy, cleared understorey and a groundcover almost entirely dominated by exotic pasture species. It cannot however be entirely discounted that the species may fly over the Subject Site during nomadic flights. Nomadic flight paths of *G. picta* are poorly understood and difficult to predict.

G. picta is listed as vulnerable under the EPBC Act and the following assessment address the vulnerable species significant impact criteria.

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

- ***Lead to a long-term decrease in the size of an important population of a species***

The area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape; it is unlikely to significantly reduce foraging habitat for *G. picta*. Whilst the risk of wind turbine collision cannot be ruled out, it is considered unlikely. As discussed above, *G. picta* would rarely occur in the Subject Site. It would also be unlikely for *G. picta* to fly at RSA height, although this risk would be heightened during nomadic flights. It is notable though that the proposed locations of the Project's turbines are mostly within existing cleared areas, or if not, within edge habitat or highly disturbed habitat. It is much less likely that *G. picta* would choose to travel across these cleared open areas, rather than the abundantly vegetated areas surrounding the Subject Site.

Section 7.3.1 of the BDAR provides an assessment of the impacts from wind turbine strike. A review of Thaxter et al.'s (2017) fatality rates (from wind turbine collision) for different bird classification groups (by order) was included in this assessment. Thaxter et al. (2017) estimated that annual fatality rate of birds in the Passeriformes order (of which *G. picta* is in) to be 0.022 birds per turbine. Based on the Project's proposed 47 turbines, this would be 1.03 birds of the Passeriformes order per year. It

is important to note that Thaxter et al.'s (2017) study was based on statistics from wind farms in Europe and North America and the statistics from these studies should be applied with caution to Australian conditions. To address these uncertainties, the Project proposes to develop a Bird and Bat Adaptive Management Program (BBAMP). The BBAMP will outline monitoring measures, key thresholds for determining permissible impacts and corrective actions that are required to achieve the BBAMP objectives (which are essentially to minimise impacts on birds and bats during the operational phase). This is discussed in Section 7 of the BDAR.

Overall, it is considered unlikely that the Project will lead to a long-term decrease in the size of an important population of a species.

- ***Reduce the area of occupancy of an important population***

As discussed above, it is considered that *G. picta* would rarely occur in the Subject Site and would also rarely fly at RSA height. There are no BioNet records of within 10 km of the Subject Site and the site's box-gum woodland vegetation types are highly disturbed. The proposed locations of the turbines are within existing cleared areas (or areas that are already highly disturbed), and it is considered unlikely that their presence will impact nomadic flight paths (which would be more likely to occur across the surrounding vegetated areas). The proposed BBAMP would ensure that uncertainties around collision risk is managed appropriately throughout the operational phase. Finally, the area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape.

Overall, the Project is unlikely to reduce the area of occupancy of an important population.

- ***Fragment an existing population into two or more populations***

The area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape; it is unlikely to significantly reduce habitat for *G. picta* and would not fragment or isolate any areas of habitat. The Project is unlikely to fragment an existing population into two or more populations.

- ***Adversely affect habitat critical to the survival of a species***

There is no listed habitat critical to the survival of *G. picta.* The Project is unlikely to adversely affect habitat critical to the survival of a species.

- ***Disrupt the breeding cycle of an important population***

The Subject is unlikely to be important for *G. picta* breeding. The Project is unlikely to disrupt the breeding cycle of an important population.

- ***Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline***

The area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape. Also, most of the proposed locations of the turbines are within existing cleared areas (or at least highly disturbed areas) and it is considered unlikely that their presence will affect nomadic flight paths (which would be more likely to occur across the surrounding vegetated areas). The Project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

- ***Result in invasive species that are harmful to a vulnerable species becoming established in the species' habitat***

The Project would not be responsible for the introduction of harmful invasive species to the Subject Site (such as cats, foxes etc.). The Project is unlikely to result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.

- ***Introduce disease that may cause the species to decline***

The Project is unlikely to introduce any diseases that may cause the species to decline.

- ***Interfere substantially with the recovery of the species***

For the reasons already stated above, the Project is unlikely to interfere substantially with the recovery of the species.

Hirundapus caudacutus (White-throated Needletail) – Vulnerable Species

H. caudacutus is an aerial species (where it forages for aerial insects) and because of this, conventional foraging habitat descriptions are inapplicable. It is however, mostly recorded above wooded areas including open forest and rainforest, and may also fly between trees or in clearings, below the canopy (DAWE, 2022). It can also occur over heathland, and sometimes (but less often) over grasslands, swamps, sandy beaches and around coastal cliffs. *H. caudacutus* typically roosts in trees in forests and woodlands, amongst dense foliage and occasionally hollows. It breeds in Asia, in wooded lowlands and sparsely vegetated hills, as well as mountains covered with coniferous forests (EES, 2022; DAWE, 2022).

H. caudacutus breeds in Asia and spends the non-breeding season in Australasia, mainly in Australia. It is widespread throughout eastern and south-eastern Australia. In NSW, it occurs in all coastal regions and extends inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains (DAWE, 2022).

As discussed in the BDAR, bird utilisation surveys were undertaken over multiple survey periods and *H. caudacutus* was not recorded. There are occasional BioNet records of *H. caudacutus* within 10 km of the Subject Site though and the species is likely to occur in the area.

H. caudacutus is listed as vulnerable under the EPBC Act and the following assessment address the vulnerable species significant impact criteria.

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

- ***Lead to a long-term decrease in the size of an important population of a species***

The area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape and impacts associated with the Project would be more related to wind turbine collision risk. Section 7.3.1 of the BDAR provides an assessment of the impacts from wind turbine strike. A review of Thaxter et al.'s (2017) fatality rates (from wind turbine collision) for different bird classification groups (by order) was included in this assessment. Thaxter et al. (2017) estimated that annual fatality rate of birds in the Apodiformes order (of which *H. caudacutus* is in) to be 0.021 birds per turbine. Based on the Project's proposed 47 turbines, this would be 0.99 birds of the Apodiformes order per year. It is important to note that Thaxter et al.'s (2017) study was based on statistics from wind farms in Europe and North America and the statistics from these studies should be applied with caution to Australian conditions. To address these uncertainties, the Project proposes to develop a Bird and Bat Adaptive Management Program (BBAMP). The BBAMP will outline monitoring measures,

key thresholds for determining permissible impacts and corrective actions that are required to achieve the BBAMP objectives (which are essentially to minimise impacts on birds and bats during the operational phase). This is discussed in Section 7 of the BDAR.

Finally, it is noted that the proposed locations of the Project's turbines are mostly within existing cleared areas, or if not, within edge habitat or highly disturbed habitat. *H. caudacutus* is more commonly recorded over wooded habitats (DAWE, 2022), and the locations of the turbines in cleared areas would reduce collision risk for the species.

The Project is unlikely to lead to a long-term decrease in the size of an important population of a species.

- ***Reduce the area of occupancy of an important population***

The Project's proposed wind turbine locations are mainly in existing cleared areas, which minimises vegetation removal and reduces turbine collision risk (as *H. caudacutus* prefers to fly over wooded habitat (DAWE, 2022)). The proposed BBAMP would ensure that the collision risk is managed appropriately throughout the operational phase. The Project is unlikely to reduce the area of occupancy of an important population.

- ***Adversely affect habitat critical to the survival of a species***

There is no listed habitat critical to the survival of *H. caudacutus.* The Project is unlikely to adversely affect habitat critical to the survival of a species.

- ***Disrupt the breeding cycle of an important population***

The Project's proposed wind turbine locations are mainly in existing cleared areas, which minimises vegetation removal and reduces turbine collision risk (as *H. caudacutus* prefers to fly over wooded habitat (DAWE, 2022)). The proposed BBAMP would ensure that the collision risk is managed appropriately throughout the operational phase. The Project is unlikely to disrupt the breeding cycle of an important population.

- ***Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline***

The Project's proposed wind turbine locations are mainly in existing cleared areas, which minimises vegetation removal and reduces turbine collision risk (as *H. caudacutus* prefers to fly over wooded habitat (DAWE, 2022)). The proposed BBAMP would ensure that collision risk is managed appropriately throughout the operational phase. The Project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

- ***Result in invasive species that are harmful to a vulnerable species becoming established in the species' habitat***

The Project is unlikely to result in invasive species that are harmful to a vulnerable species becoming established in the species' habitat.

- ***Introduce disease that may cause the species to decline***

There are no known diseases that present a threat to *H. caudacutus* that may be introduced on the site.

- ***Interfere substantially with the recovery of the species***

For the reasons stated above, the Project is unlikely to interfere substantially with the recovery of the species.

Lathamus discolor (Swift Parrot) – Critically Endangered Species

L. discolor breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of SA to south-east Qld. Total population estimates of *L. discolor* range between 1000 breeding pairs (NSW Scientific Committee, 2000) and 300 individuals (Olah et al., 2021). Movement pathways used by *L. discolor* are not well understood. Although large scale movement trends have been demonstrated across mainland Australia (Saunders et al. in prep), it is not known if long distance movements across Bass Strait or on the mainland are undertaken in groups, nocturnally or diurnally, at specific heights or what triggers such movements (Saunders and Tzaros, 2011).

The *L. discolor* recovery plan (Saunders and Tzaros, 2011) lists several priority areas of NSW that contain habitat of particular importance for conservation management because they are used by large proportions of the *L. discolor* population or have been used repeatedly between seasons (site fidelity), or for prolonged periods of time (site persistence). These areas include the Hawkesbury – Nepean, Hunter-Central Rivers, Lachlan, Murray, Murrumbidgee, Northern Rivers, Southern Rivers and Sydney Metro. The Subject Site does not occur in any of these areas. As discussed in the BDAR, bird utilisation surveys were undertaken over multiple survey periods and *L. discolor* was not recorded. There are also no *L. discolor* BioNet records within 10 km of the Subject Site.

L. discolor is listed as critically endangered under the EPBC Act and the following assessment address the critically endangered species significant impact criteria.

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

- ***Lead to a long-term decrease in the size of a population***

Total population estimates of *L. discolor* are low and range between 1000 breeding pairs (NSW Scientific Committee, 2000) and 300 individuals (Olah et al., 2021), making it highly vulnerable to stochastic events such as wildfire or disease and the loss of genetic diversity. Thus, anything that may impact on even a small number of birds should be considered significant.

The area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape and impacts associated with the Project would be more related to wind turbine collision risk. Section 7.3.1 of the BDAR provides an assessment of the impacts from wind turbine strike. A review of Thaxter et al.'s (2017) fatality rates (from wind turbine collision) for different bird classification groups (by order) was included in this assessment. Thaxter et al. (2017) estimated that annual fatality rate of birds in the Psittaciformis order (of which *H. caudacutus* is in) to be 0.03 birds per turbine. Based on the Project's proposed 47 turbines, this would be 1.41 birds of the Psittaciformis order per year. It is important to note that Thaxter et al.'s (2017) study was based on statistics from wind farms in Europe and North America and the statistics from these studies should be applied with caution to Australian conditions. To address these uncertainties, the Project proposes to develop a Bird and Bat Adaptive Management Program (BBAMP). The BBAMP will outline monitoring measures, key thresholds for determining permissible impacts and corrective actions that are required to achieve the BBAMP objectives (which are essentially to minimise impacts on birds and bats during the operational phase). This is discussed in Section 7 of the BDAR.

Whilst the risk of wind turbine collision cannot be ruled out, it is considered unlikely. As discussed above, *L. discolor* would rarely occur in the Subject Site. It is also notable that the proposed locations of the Project's turbines are mostly within existing cleared areas. It is less likely that *L. discolor* would

choose to travel across these cleared open areas, rather than the abundantly vegetated areas surrounding the Subject Site.

Overall, it is considered unlikely that the Project will lead to a long-term decrease in the size of a population

- ***Reduce the area of occupancy of the species***

As discussed above, it is considered that *L. discolor* would rarely occur in the Subject Site. The proposed locations of the turbines are mainly within existing cleared areas, and it is considered unlikely that their presence will affect migratory flight paths (which would be more likely to occur across the surrounding vegetated areas). The proposed BBAMP would ensure that the collision risk is managed appropriately throughout the operational phase. Finally, the area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape. Overall, the Project is unlikely to reduce the area of occupancy of the species.

- ***Fragment an existing population into two or more populations***

The area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape; it is unlikely to significantly reduce foraging habitat for *L. discolor* and would not fragment or isolate any areas of habitat. The Project is unlikely to fragment an existing population into two or more populations.

- ***Adversely affect habitat critical to the survival of a species***

The Subject Site does occur in or near any critical habitat for *L. discolor* and does not occur in a 'mapped important area'. The Project is unlikely to adversely affect habitat critical to the survival of a species.

- ***Disrupt the breeding cycle of a population***

The Subject Site is not near any breeding areas and does not occur in a 'mapped important area'. The Project is unlikely to disrupt the breeding cycle of a population.

- ***Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline***

The Subject Site is not near any breeding areas and the area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape. Also, most of the proposed locations of the turbines are within existing cleared areas and it is considered unlikely that their presence will affect migratory flight paths (which would be more likely to occur across the surrounding vegetated areas). The proposed BBAMP would ensure that the collision risk is managed appropriately throughout the operational phase. The Project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

- ***Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat***

The Project would not be responsible for the introduction of harmful invasive species to the Subject Site (such as cats, foxes etc.). The Project is unlikely to result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.

- ***Introduce disease that may cause the species to decline***

The Project is unlikely to introduce any diseases that may cause the species to decline.

- ***Interfere with the recovery of the species***

The DAWE (2016) recovery plan for *L. discolor* has been reviewed. For the reasons already stated above, the Project is unlikely to interfere with the recovery of the species.

Phascolarctos cinereus (Koala) – Endangered Species

P. cinereus inhabits eucalypt woodlands and forests, feeding on the foliage of several eucalypt and non-eucalypt species, with preferred feed trees varying depending on area. Home range size varies with quality of habitat, ranging from <2 ha to several hundred hectares in size (EES, 2022).

The Subject Site contains several 'Koala use tree species', listed in Schedule 2 of the Koala SEPP for the Central and Southern Tablelands koala management area. These include *Eucalyptus blakelyi* (Blakely's Red Gum), *E. melliodora* (Yellow Box), *E. bridgesiana* (Apple Box) *E. dives* (Broad-leaved Peppermint), *E. goniocalyx* (Bundy), *E. macrorhyncha* (Red Stringybark), *E. mannifera* (Brittle Gum), *E. nortonii* (Large-flowered Bundy), *E. rossii* (Inland Scribbly Gum) and *E. viminalis* (Ribbon Gum).

There are four BioNet records within 10 km of the Subject Site. One of these records is very close to the northern portion of the Subject Site, but it dates back to 1974. All other records are confined to Wiarborough NR. As detailed in the BDAR, targeted surveys for *P. cinereus* were undertaken over two separate survey periods; the species was not recorded. It cannot be discounted that P. cinereus may occasionally occur in the Subject Site, but the Subject Site is unlikely to provide breeding habitat.

P. cinereus is listed as endangered under the EPBC Act and the following assessment address the endangered species significant impact criteria.

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

- ***Lead to a long-term decrease in the size of a population***

The proposed locations of the Project's turbines are mostly within existing cleared areas, or if not, within edge habitat or highly disturbed habitat. The area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape; it is unlikely to significantly reduce habitat for *P. cinereus*. It is considered unlikely that the Project will lead to a long-term decrease in the size of a population.

- ***Reduce the area of occupancy of the species***

The proposed locations of the Project's turbines are mostly within existing cleared areas, or if not, within edge habitat or highly disturbed habitat. The area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape; it is unlikely to significantly reduce habitat for *P. cinereus*. The Project is unlikely to reduce the area of occupancy of the species.

- ***Fragment an existing population into two or more populations***

The area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape; it is unlikely to significantly reduce foraging habitat for *P. cinereus* and would

not fragment or isolate any areas of habitat. The Project is unlikely to fragment an existing population into two or more populations.

- ***Adversely affect habitat critical to the survival of a species***

There is no listed habitat critical to the survival of *P. cinereus.* The Project is unlikely to adversely affect habitat critical to the survival of a species.

- ***Disrupt the breeding cycle of a population***

As detailed in the BDAR, targeted surveys for *P. cinereus* were undertaken over two separate survey periods; the species was not recorded. It cannot be discounted that P. cinereus may occasionally occur in the Subject Site, but the Subject Site is unlikely to provide breeding habitat. The Project is unlikely to disrupt the breeding cycle of a population.

- ***Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline***

The area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape; it is unlikely to significantly reduce foraging habitat for *P. cinereus* and would not fragment or isolate any areas of habitat. The Project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

- ***Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat***

The Project would not be responsible for the introduction of harmful invasive species to the Subject Site (such as dogs). The Project is unlikely to result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.

- ***Introduce disease that may cause the species to decline***

The Project is unlikely to introduce any diseases (such as Chlamydia) that may cause the species to decline.

- ***Interfere with the recovery of the species***

The DAWE (2022) recovery plan for *P. cinereus* and the NSW Koala Strategy (NSW Government, 2018). has been reviewed. For the reasons already stated above, the Project is unlikely to interfere with the recovery of the species.

Polytelis swainsonii (Superb Parrot) – Vulnerable Species

P. swainsonii is found throughout eastern inland NSW. On the South-western Slopes (of which the Subject is located in) the core breeding area is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west. Birds breeding in this region are mainly absent during winter, when they migrate north to the region of the upper Namoi and Gwydir Rivers. The other main breeding sites are in the Riverina along the corridors of the Murray, Edward and Murrumbidgee Rivers where birds are present all year round. It is estimated that there are less than 5000 breeding pairs left in the wild (EES, 2022).

P. swainsonii inhabits Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. On the South West Slopes, nesting hollows can be in open Box-Gum Woodland or isolated paddock trees. Species known to be used are *Eucalyptus blakelyi* (Blakely's Red Gum), *E. melliodora* (Yellow Box), *E. bridgesiana* (Apple Box) and *E. polyanthamos* (Red Box). It may forage up to 10 km from nesting sites, primarily in grassy box woodland (EES, 2022).

As discussed in the BDAR, bird utilisation surveys and targeted surveys for breeding *P. swainsonii* were undertaken over multiple survey periods and *P. swainsonii* was not recorded. There are also no *P. swainsonii* BioNet records within 10 km of the Subject Site. It is concluded that *P. swainsonii* is unlikely to breed in the Survey Area, but it cannot be rued out that it may occasionally forage there.

P. swainsonii is listed as vulnerable under the EPBC Act and the following assessment address the vulnerable species significant impact criteria.

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

- ***Lead to a long-term decrease in the size of an important population of a species***

The area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape and impacts associated with the Project would be more related to wind turbine collision risk. Section 7.3.1 of the BDAR provides an assessment of the impacts from wind turbine strike. A review of Thaxter et al.'s (2017) fatality rates (from wind turbine collision) for different bird classification groups (by order) was included in this assessment. Thaxter et al. (2017) estimated that annual fatality rate of birds in the Psittaciformis order (of which *H. caudacutus* is in) to be 0.03 birds per turbine. Based on the Project's proposed 47 turbines, this would be 1.41 birds of the Psittaciformis order per year. It is important to note that Thaxter et al.'s (2017) study was based on statistics from wind farms in Europe and North America and the statistics from these studies should be applied with caution to Australian conditions. To address these uncertainties, the Project proposes to develop a Bird and Bat Adaptive Management Program (BBAMP). The BBAMP will outline monitoring measures, key thresholds for determining permissible impacts and corrective actions that are required to achieve the BBAMP objectives (which are essentially to minimise impacts on birds and bats during the operational phase). This is discussed in Section 7 of the BDAR.

Finally, it is noted that the proposed locations of the Project's turbines are mostly within existing cleared areas, or if not, within edge habitat or highly disturbed habitat. It is less likely that *P. swainsonii* would choose to travel across these cleared open areas, rather than the abundantly vegetated areas surrounding the Subject Site.

The Project is unlikely to lead to a long-term decrease in the size of an important population of a species.

- ***Reduce the area of occupancy of an important population***

The Project's proposed wind turbine locations are mainly in existing cleared areas, which minimises vegetation removal and reduces turbine collision risk. The proposed BBAMP would ensure that the collision risk is managed appropriately throughout the operational phase. The Project is unlikely to reduce the area of occupancy of an important population.

- ***Adversely affect habitat critical to the survival of a species***

There is no listed habitat critical to the survival of *P. swainsonii.* The Project is unlikely to adversely affect habitat critical to the survival of a species.

- ***Disrupt the breeding cycle of an important population***

The Project's proposed wind turbine locations are mainly in existing cleared areas, which minimises vegetation removal and reduces turbine collision risk. The proposed BBAMP would ensure that the collision risk is managed appropriately throughout the operational phase. The Project is unlikely to disrupt the breeding cycle of an important population.

- ***Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline***

The Project's proposed wind turbine locations are mainly in existing cleared areas, which minimises vegetation removal and reduces turbine collision risk. The proposed BBAMP would ensure that collision risk is managed appropriately throughout the operational phase. The Project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

- ***Result in invasive species that are harmful to a vulnerable species becoming established in the species' habitat***

The Project is unlikely to result in invasive species that are harmful to a vulnerable species becoming established in the species' habitat.

- ***Introduce disease that may cause the species to decline***

The Project is unlikely to introduce disease that may cause the species to decline.

- ***Interfere substantially with the recovery of the species***

For the reasons stated above, the Project is unlikely to interfere substantially with the recovery of the species.

Pteropus poliocephalus (Grey-headed Flying-fox) – Vulnerable Species

Targeted surveys for *P. poliocephalus* were also undertaken in summer (3-10 February 2021) and spring (1-7 October 2022). These included nocturnal spotlighting and diurnal searches for colony camps. Grey-headed Flying Fox was not recorded in the Subject Site and there are no BioNet records within 10 km of the Subject Site. A review of DAWE's *Interactive Flying-fox Web Viewer* indicates that the closest flying fox camp is at Thilmere, approx. 75 km east of the Subject Site. Overall, while its presence cannot be discounted, it is considered that this species would rarely occur in the Subject Site and wind turbine collision risk would be very low (although future monitoring would ensure that this was the case).

P. poliocephalus is listed as vulnerable under the EPBC Act and the following assessment address the vulnerable species significant impact criteria.

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

- ***Lead to a long-term decrease in the size of an important population of a species***

The area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape and impacts associated with the Project would be more related to wind turbine collision risk. Section 7.3.1 of the BDAR provides an assessment of the impacts from wind turbine strike. To address uncertainties around collision risk, the Project proposes to develop a Bird and Bat Adaptive Management Program (BBAMP). The BBAMP will outline monitoring measures, key thresholds for determining permissible impacts and corrective actions that are required to achieve the BBAMP objectives (which are essentially to minimise impacts on birds and bats during the

operational phase). This is discussed in Section 7 of the BDAR. It is also notable though that the proposed locations of the Project's wind turbines are mostly within existing cleared areas, or if not, within edge habitat or highly disturbed habitat, which would minimise collision risk.

Overall, it is considered unlikely that the Project will lead to a long-term decrease in the size of an important population of a species.

- ***Reduce the area of occupancy of an important population***

As discussed above, it is considered that *P. poliocephalus* would rarely occur in the Subject Site. There are no BioNet records of within 10 km of the Subject Site and the Subject is at least 75 km from the nearest colony camp. The area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape. The proposed locations of the turbines are within existing cleared areas (or areas that are already highly disturbed) which would minimise collision risk. The proposed BBAMP would ensure that uncertainties around collision risk are managed appropriately throughout the operational phase.

Overall, the Project is unlikely to reduce the area of occupancy of an important population.

- ***Fragment an existing population into two or more populations***

The area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape; it is unlikely to significantly reduce habitat for *P. poliocephalus* and would not fragment or isolate any areas of habitat. The Project is unlikely to fragment an existing population into two or more populations.

- ***Adversely affect habitat critical to the survival of a species***

There is no listed habitat critical to the survival of *P. poliocephalus.* The Project is unlikely to adversely affect habitat critical to the survival of a species.

- ***Disrupt the breeding cycle of an important population***

P. poliocephalus was not recorded during the targeted surveys and there are no BioNet records within 10 km of the Subject Site. A review of DAWE's *Interactive Flying-fox Web Viewer* indicates that the closest flying fox camp is at Thilmere, approx. 75 km east of the Subject Site. The Project is unlikely to disrupt the breeding cycle of an important population.

- ***Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline***

The area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape. Most of the proposed locations of the turbines are within existing cleared areas (or at least highly disturbed areas), which would minimise collision risk and finally the proposed BBAMP would ensure that the collision risk is managed appropriately throughout the operational phase. The Project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

- ***Result in invasive species that are harmful to a vulnerable species becoming established in the species' habitat***

The Project would not be responsible for the introduction of harmful invasive species to the Subject Site (such as cats, foxes etc.). The Project is unlikely to result in invasive species that are harmful to a vulnerable species becoming established in the species' habitat.

- ***Introduce disease that may cause the species to decline***

The Project is unlikely to introduce any diseases that may cause the species to decline.

- ***Interfere substantially with the recovery of the species***

For the reasons already stated above, the Project is unlikely to interfere substantially with the recovery of the species.

Hirundapus caudacutus (White-throated Needletail) – Migratory Species

H. caudacutus is an aerial species (where it forages for aerial insects) and because of this, conventional foraging habitat descriptions are inapplicable. It is however, mostly recorded above wooded areas including open forest and rainforest, and may also fly between trees or in clearings, below the canopy (DAWE, 2022). It can also occur over heathland, and sometimes (but less often) over grasslands, swamps, sandy beaches and around coastal cliffs. *H. caudacutus* typically roosts in trees in forests and woodlands, amongst dense foliage and occasionally hollows. It breeds in Asia, in wooded lowlands and sparsely vegetated hills, as well as mountains covered with coniferous forests (EES, 2022; DAWE, 2022).

H. caudacutus breeds in Asia and spends the non-breeding season in Australasia, mainly in Australia. It is widespread throughout eastern and south-eastern Australia. In NSW, it occurs in all coastal regions and extends inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains (DAWE, 2022).

As discussed in the BDAR, bird utilisation surveys were undertaken over multiple survey periods and *H. caudacutus* was not recorded. There are occasional BioNet records of *H. caudacutus* within 10 km of the Subject Site though and the species is likely to occur in the area.

H. caudacutus is listed as migratory under the EPBC Act and the following assessment address the migratory species significant impact criteria.

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

- ***Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species***

The area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape and impacts associated with the Project would be more related to wind turbine collision risk. Section 7.3.1 of the BDAR provides an assessment of the impacts from wind turbine strike. A review of Thaxter et al.'s (2017) fatality rates (from wind turbine collision) for different bird classification groups (by order) was included in this assessment. Thaxter et al. (2017) estimated that annual fatality rate of birds in the Apodiformes order (of which *H. caudacutus* is in) to be 0.021 birds per turbine. Based on the Project's proposed 47 turbines, this would be 0.99 birds of the Apodiformes order per year. It is important to note that Thaxter et al.'s (2017) study was based on statistics from wind farms in Europe and North America and the statistics from these studies should be applied with caution to Australian conditions. To address these uncertainties, the Project proposes to develop a Bird and Bat Adaptive Management Program (BBAMP). The BBAMP will outline monitoring measures, key thresholds for determining permissible impacts and corrective actions that are required to achieve the BBAMP objectives (which are essentially to minimise impacts on birds and bats during the operational phase). This is discussed in Section 7 of the BDAR.

Finally, it is noted that the proposed locations of the Project's turbines are mostly within existing cleared areas, or if not, within edge habitat or highly disturbed habitat. *H. caudacutus* is more

commonly recorded over wooded habitats (DAWE, 2022), and the locations of the turbines in cleared areas would reduce collision risk for the species.

The Project is unlikely to substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for *H. caudacutus.*

- ***Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species***

It is unlikely that the Project would result in an invasive species that is harmful to *H. caudacutus* becoming established in an area of important habitat for *H. caudacutus*.

- ***Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species***

The Project's proposed wind turbine locations are mainly in existing cleared areas, which minimises vegetation removal and reduces turbine collision risk (as *H. caudacutus* prefers to fly over wooded habitat (DAWE, 2022)). The proposed BBAMP would ensure that the collision risk is managed appropriately throughout the operational phase. The Project is unlikely to seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of *H. caudacutus*.

Monarcha melanopsis (Black-faced Monarch)

M. melanopsis is widespread in eastern Australia during spring, summer and autumn. It generally winters in southern and eastern Papua New Guinea. The movements of *M. melanopsis* are poorly known, however the pattern is generally to move along the east coast of Australia, as far west as the eastern slopes and tablelands of the Great Divide. Birds have been known however to sometimes take the shortest route inland during their migration (DAWE, 2022).

M. melanopsis prefers rainforest ecosystems and is unlikely to inhabit the Subject Site. There are no BioNet records within 10 km of the Subject Site. It cannot be discounted though that the species may fly through the Subject Site during migration although as stated above, movements are more commonly along the coast.

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

- ***Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species***

The area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape and impacts associated with the Project would be more related to wind turbine collision risk. Section 7.3.1 of the BDAR provides an assessment of the impacts from wind turbine strike. A review of Thaxter et al.'s (2017) fatality rates (from wind turbine collision) for different bird classification groups (by order) was included in this assessment. Thaxter et al. (2017) estimated that annual fatality rate of birds in the Passeriformes order (of which *G. picta* is in) to be 0.022 birds per turbine. Based on the Project's proposed 47 turbines, this would be 1.03 birds of the Passeriformes order per year. It is important to note that Thaxter et al.'s (2017) study was based on statistics from wind farms in Europe and North America and the statistics from these studies should be applied with caution to Australian conditions. To address these uncertainties, the Project proposes to develop a Bird and Bat Adaptive Management Program (BBAMP). The BBAMP will outline monitoring measures, key thresholds for determining permissible impacts and corrective actions that are required to achieve

the BBAMP objectives (which are essentially to minimise impacts on birds and bats during the operational phase). This is discussed in Section 7 of the BDAR.

Finally, it is noted that the proposed locations of the Project's turbines are mostly within existing cleared areas, or if not, within edge habitat or highly disturbed habitat. This would reduce collision risk for the species.

The Project is unlikely to substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for *M. melanopsis*.

- ***Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species***

It is unlikely that the Project would result in an invasive species that is harmful to *M. melanopsis* becoming established in an area of important habitat for *M. melanopsis*.

- ***Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species***

The Project's proposed wind turbine locations are mainly in existing cleared areas, which minimises vegetation removal and reduces turbine collision risk. The proposed BBAMP would ensure that the collision risk is managed appropriately throughout the operational phase. The Project is unlikely to seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of *M. melanopsis*.

Motacilla flava (Yellow Wagtail) – Migratory Species

M. flava inhabits wetland habitats with low vegetation, such as swamps, salt marshes, sewage ponds and grassy airfields. It breeds in temperate Europe and Asia. It is known to visit Australia rarely but regularly and is most commonly recorded in northern Australia (Morecombe & Stewart, 2010). The Subject Site may provide potential habitat for birds that may occasionally occur (although this would be rare). There are no BioNet records within 10 km of the Subject Site. *M. flava* is not likely to fly at RSA height and, as stated in the EPBC Act referral guidelines for migratory birds (Commonwealth of Australia, 2015), it is unlikely to be impacted by wind turbine strike.

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

- ***Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species***

The Subject Site may provide potential habitat for birds that may occasionally occur (although this would be very rare). The proposed area of habitat removal would be very insignificant. *M. flava* is not likely to fly at RSA height and, as stated in the EPBC Act referral guidelines for migratory birds (Commonwealth of Australia, 2015), it is unlikely to be impacted by wind turbine strike.

The Project is unlikely to substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for *M. melanopsis*.

- ***Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or***

The Project would be unlikely to result in the introduction of any invasive species that are harmful to *M. flava.*

- ***Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.***

For the reasons stated above, the Project is unlikely to seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of *M. flava*.

Myiagra cyanoleuca (Satin Flycatcher) – Migratory Species

M. cyanoleuca migrates north in autumn to spend winter in northern Australia and New Guinea, returning south in spring to spend summer in south-eastern Australia. It is found in tall forests, preferring wetter habitats such as heavily forested gullies, but not rainforests. Most records are in wet sclerophyll forest dominated by eucalypts such as *Eucalyptus fastigata*, *E. dalrympleana* and *E. viminalis*, and tall acacias like *Acacia melanoxylon* (DAWE, 2022; Morcombe & Stewart, 2010).

There are no BioNet records within 10 km of the Subject, however the species' occurrence in the Subject cannot be ruled out. The Subject Site's PCT 951 may provide potential habitat. *M. cyanoleuca* is not likely to fly at RSA height and, as stated in the EPBC Act referral guidelines for migratory birds (Commonwealth of Australia, 2015), it is unlikely to be impacted by wind turbine strike.

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

- ***Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species***

The proposed area of habitat removal would be very insignificant. *M. flava* is not likely to fly at RSA height and, as stated in the EPBC Act referral guidelines for migratory birds (Commonwealth of Australia, 2015), it is unlikely to be impacted by wind turbine strike.

The Project is unlikely to substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for *M. melanopsis*.

- ***Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or***

The Project is unlikely to result in the introduction of any invasive species that are harmful to *M. cyanoleuca*.

- ***Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.***

For the reasons stated above, the Project is unlikely to seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of *M. cyanoleuca*.

Rhipidura rufifrons (Rufus Fantail) – Migratory Species

R. rufifrons is found in rainforest, dense wet forests, swamp woodlands and mangroves, preferring deep shade, and is often seen close to the ground. During migration, it may be found in more open habitats or urban areas. Birds in south-east Australia generally spend winter in coastal lowlands and off-shore islands in south-east Queensland, north to Cape York Peninsula and Torres Strait Island.

There are no BioNet records within 10 km of the Subject, however the species' occurrence in the Subject Site cannot be ruled out. *R. rufifrons* is not likely to fly at RSA height and, as stated in the EPBC Act referral guidelines for migratory birds (Commonwealth of Australia, 2015), it is unlikely to be

impacted by wind turbine strike.

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

- ***Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species***

The proposed area of habitat removal would be very insignificant. *M. flava* is not likely to fly at RSA height and, as stated in the EPBC Act referral guidelines for migratory birds (Commonwealth of Australia, 2015), it is unlikely to be impacted by wind turbine strike.

The Project is unlikely to substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for *R. rufifrons*.

Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or

The Project is unlikely to result in the introduction of any invasive species that are harmful to *R. rufifrons*.

- ***Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.***

For the reasons stated above, the Project is unlikely to seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of *R. rufifrons*.

Anthus novaeseelandiae (Australasian Pipit) – Migratory Species

A. novaeseelandiae inhabits open habitats such as grassland, forest clearings and grassy woodland, semi-open scrub, beaches and hind dunes. It is a strongly terrestrial species that feeds, roosts and nests on the ground, although it may fly within RSA height during migration in the non-breeding season. It is known to undertake altitudinal migration; for instance, Tasmanian birds move to the mainland in winter (DAWE, 2022). *A. novaeseelandiae* was recorded in the Subject Site and it is considered that during migration it could fly anywhere within the Subject Site, without any predictable habitual flight path.

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

- ***Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species***

The area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape and impacts associated with the Project would be more related to wind turbine collision risk. Section 7.3.1 of the BDAR provides an assessment of the impacts from wind turbine strike. A review of Thaxter et al.'s (2017) fatality rates (from wind turbine collision) for different bird classification groups (by order) was included in this assessment. Thaxter et al. (2017) estimated that annual fatality rate of birds in the Passeriformes order (of which *A. novaeseelandiae* is in) to be 0.022 birds per turbine. Based on the Project's proposed 47 turbines, this would be 1.03 birds of the Passeriformes order per year. It is important to note that Thaxter et al.'s (2017) study was based on statistics from wind farms in Europe and North America and the statistics from these studies should be applied with caution to Australian conditions. To address these uncertainties, the Project proposes

to develop a Bird and Bat Adaptive Management Program (BBAMP). The BBAMP will outline monitoring measures, key thresholds for determining permissible impacts and corrective actions that are required to achieve the BBAMP objectives (which are essentially to minimise impacts on birds and bats during the operational phase). This is discussed in Section 7 of the BDAR.

The Project is unlikely to substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for *A. novaeseelandiae*.

Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or

The Project is unlikely to result in the introduction of any invasive species that are harmful to *A. pacificus*.

- ***Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.***

For the reasons stated above, the Project is unlikely to seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of *A. novaeseelandiae*.

Apus pacificus (Fork-tailed Swift) – Migratory Species

A. pacificus is a non-breeding visitor to all states and territories of Australia. The species is almost exclusively aerial, flying from <1 m to at least 300 m above ground. Breeding grounds are in Siberia. They leave these areas in August–September and pass through Korea, the Malay Peninsula and other areas of south-east Asia. Birds arrive in Australia in September-October. They are highly mobile whilst in Australia, with large flocks often following low pressure systems as they cross the country in search of food. They are common in any region of NSW from October–March.

There are no BioNet records within 10 km of the site; however, *A. pacificus* is difficult to detect in bird surveys and there is certainly potential for it to occur in the Subject Site. The habitat types that *A. pacificus* flies over is very broad and it may occur anywhere within the Subject Site, without any predictable habitual flight path.

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

- ***Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species***

The area of native vegetation removal required for the Project is very minor in the context of the surrounding landscape and impacts associated with the Project would be more related to wind turbine collision risk. Section 7.3.1 of the BDAR provides an assessment of the impacts from wind turbine strike. A review of Thaxter et al.'s (2017) fatality rates (from wind turbine collision) for different bird classification groups (by order) was included in this assessment. Thaxter et al. (2017) estimated that annual fatality rate of birds in the Apodiformes order (of which *A. pacificus* is in) to be 0.021 birds per turbine. Based on the Project's proposed 47 turbines, this would be 0.99 birds of the Apodiformes order per year. It is important to note that Thaxter et al.'s (2017) study was based on statistics from wind farms in Europe and North America and the statistics from these studies should be applied with caution to Australian conditions. To address these uncertainties, the Project proposes to develop a Bird and Bat Adaptive Management Program (BBAMP). The BBAMP will outline monitoring measures, key thresholds for determining permissible impacts and corrective actions that are required to achieve the BBAMP objectives (which are essentially to minimise impacts on birds and bats during the

operational phase). This is discussed in Section 7 of the BDAR.

The Project is unlikely to substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for *A. pacificus*.

Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or

The Project is unlikely to result in the introduction of any invasive species that are harmful to *A. pacificus*.

- ***Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.***

For the reasons stated above, the Project is unlikely to seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of *A. pacificus*.

APPENDIX H – EPBC PROTECTED MATTERS SEARCH TOOL RESULTS

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 05-Dec-2022

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	1
National Heritage Places:	1
Wetlands of International Importance (Ramsar	4
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	42
Listed Migratory Species:	12

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	19
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	4
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	4
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

World Heritage Properties		[Resource Information]
Name	State	Legal Status
Greater Blue Mountains Area	NSW	Declared property

National Heritage Places		[Resource Information]
Name	State	Legal Status
Natural		
The Greater Blue Mountains Area	NSW	Listed place

Wetlands of International Importance (Ramsar Wetlands)	[Resource Information]
Ramsar Site Name	Proximity
Banrock station wetland complex	800 - 900km upstream from Ramsar site
Hattah-kulkyne lakes	600 - 700km upstream from Ramsar site
Riverland	800 - 900km upstream from Ramsar site
The coorong, and lakes alexandrina and albert wetland	900 - 1000km upstream from Ramsar site

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text
Natural Temperate Grassland of the South Eastern Highlands	Critically Endangered	Community likely to occur within area
Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion	Endangered	Community likely to occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Callocephalon fimbriatum Gang-gang Cockatoo [768]	Endangered	Species or species habitat known to occur within area
Calyptorhynchus lathami lathami South-eastern Glossy Black-Cockatoo [67036]	Vulnerable	Species or species habitat likely to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Polytelis swainsonii Superb Parrot [738]	Vulnerable	Species or species habitat may occur within area
Pycnoptilus floccosus Pilotbird [525]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
FISH		
Maccullochella macquariensis Trout Cod [26171]	Endangered	Species or species habitat may occur within area
Maccullochella peelii Murray Cod [66633]	Vulnerable	Species or species habitat may occur within area
Macquaria australasica Macquarie Perch [66632]	Endangered	Species or species habitat may occur within area
FROG		
Litoria booroolongensis Booroolong Frog [1844]	Endangered	Species or species habitat may occur within area
Mixophyes balbus Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat likely to occur within area
INSECT		
Paralucia spinifera Bathurst Copper Butterfly, Purple Copper Butterfly, Bathurst Copper, Bathurst Copper Wing, Bathurst-Lithgow Copper, Purple Copper [26335]	Vulnerable	Species or species habitat may occur within area
Synemon plana Golden Sun Moth [25234]	Vulnerable	Species or species habitat may occur within area
MAMMAL		

Scientific Name	Threatened Category	Presence Text
Chalinolobus dwyeri		
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat may occur within area
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Petauroides volans		
Greater Glider (southern and central) [254]	Endangered	Species or species habitat known to occur within area
Petaurus australis australis		
Yellow-bellied Glider (south-eastern) [87600]	Vulnerable	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Endangered	Species or species habitat known to occur within area
Pseudomys novaehollandiae		
New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour may occur within area
PLANT		
Acacia bynoeana		
Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat may occur within area
Baloskion longipes		
Dense Cord-rush [68511]	Vulnerable	Species or species habitat likely to occur within area
Diuris aequalis		
Buttercup Doubletail [21588]	Endangered	Species or species habitat likely to occur within area
Dodonaea procumbens		
Trailing Hop-bush [12149]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Eucalyptus aggregata Black Gum [20890]	Vulnerable	Species or species habitat likely to occur within area
Kunzea cambagei [11420]	Vulnerable	Species or species habitat likely to occur within area
Lepidium aschersonii Spiny Pepper-cress [10976]	Vulnerable	Species or species habitat may occur within area
Lepidium hyssopifolium Basalt Pepper-cress, Peppercress, Rubble Pepper-cress, Pepperweed [16542]	Endangered	Species or species habitat may occur within area
Leucochrysum albicans subsp. tricolor Hoary Sunray, Grassland Paper-daisy [89104]	Endangered	Species or species habitat likely to occur within area
Rhizanthella slateri Eastern Underground Orchid [11768]	Endangered	Species or species habitat may occur within area
Senecio macrocarpus Large-fruit Fireweed, Large-fruit Groundsel [16333]	Vulnerable	Species or species habitat may occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area
Xerochrysum palustre Swamp Everlasting, Swamp Paper Daisy [76215]	Vulnerable	Species or species habitat likely to occur within area
REPTILE		
Aprasia parapulchella Pink-tailed Worm-lizard, Pink-tailed Legless Lizard [1665]	Vulnerable	Species or species habitat likely to occur within area
Delma impar Striped Legless Lizard, Striped Snake-lizard [1649]	Vulnerable	Species or species habitat may occur within area
Listed Migratory Species		[Resource Information]

Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Bubulcus ibis as Ardea ibis		
Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area overfly marine area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area overfly marine area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat may occur within area overfly marine area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Neophema chrysostoma Blue-winged Parrot [726]		Species or species habitat may occur within area overfly marine area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area overfly marine area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area

Extra Information

State and Territory Reserves [Resource Information]

Protected Area Name	Reserve Type	State
Abercrombie River	National Park	NSW
Blue Mountains	National Park	NSW
Bubalahla	Nature Reserve	NSW
Wiarborough	Nature Reserve	NSW

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed
INDIGO Central Submarine Telecommunications Cable	2017/8127	Not Controlled Action	Completed
Paling Yard Wind Farm	2005/2018	Not Controlled Action	Completed
Not controlled action (particular manner)			
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.

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