Theodore Wind Farm

Draft Bird and Bat Management Plan

PREPARED FOR

Theodore Energy Development Pty Ltd

DATE

31 March 2026

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SIGNATURE PAGE

Theodore Wind Farm

Bird and Bat Management Plan

0661076

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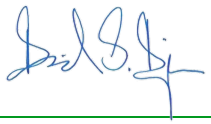

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CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

Acronyms	Description
ALA	Atlas of Living Australia
BACI	Before-After-Control-Impact
BBMP	Bird and Bat Management Plan
BESS	Battery Energy Storage Systems
BUS	Bird Utilisation Surveys
CEMP	Construction Environmental Management Plan
CRM	Collision Risk Modelling
DAWE (now DCCEEW)	Department of Agriculture, Water and the Environment
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DES	Department of the Environment and Science
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EoA	Evidence of Absence
ERM	Environmental Resources Management Australia Pty Ltd
GenEst	Generalised Estimator
ha	Hectare
HSEQ	Health, Safety, Environment Quality
MW	Megawatts
NC Act	*Nature Conservation Act 1992*
PMST	Protected Matters Search Tool
PVA	Population Viability Analysis
RE	Regional Ecosystem
RSA	Rotor Swept Area
SARA	State Assessment and Referral Agency
SPRAT	Species Profile and Threats Database
Suitably Qualified Ecologist	A person(s) who has professional qualifications, training, skills and / or experience relevant to area of expertise (bird and bat management).
TED	Theodore Energy Development Pty Ltd
VM Act	*Vegetation Management Act 1999*
WO	Wildlife Online
WTG	Wind Turbine Generator

GLOSSARY

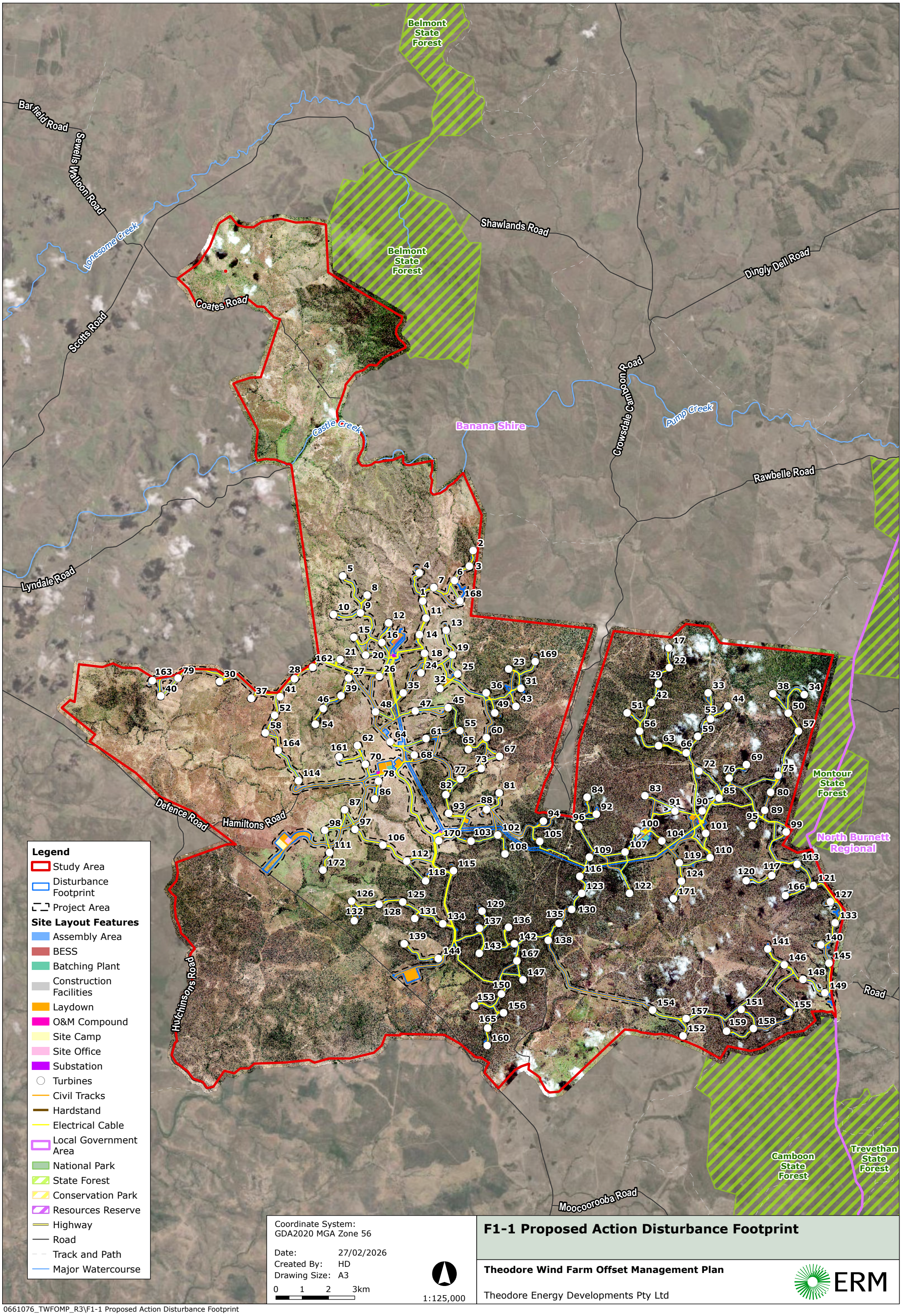
Term	Definition
Action	A project, development, an undertaking, or other activity, or series of activities. Under the EPBC Act, an 'action' can also include a change to any of these things.
Approval Holder	The person to whom the EPBC Act project approval is granted and is responsible for compliance with conditions (if any) applied to a project.
Disturbance Footprint	The area whereby the final layout and impacts have been considered and occupies an area of 1,590.1 ha.
EPBC Act	The *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) is Australia's national environmental law. It provides a legal framework to protect the environment, especially those aspects that are matters of national environmental significance.
Project Area	The corridor of land on which the Disturbance Footprint will be located, including a 100 metre buffer for micro-siting.
Proponent	Theodore Energy Development Pty Ltd.
Suitably Qualified Ecologist	Suitably Qualified Ecologist means a person who has relevant professional qualifications and at least three years' work experience designing and implementing flora and fauna surveys and management plans for the impacted MNES using relevant protocols, standards, methods and/or literature.
Study Area	The nine land parcels and road reserve areas, 46,830 ha, in which the Proposed Action will be located.
WTG	Wind Turbine Generator.

1. INTRODUCTION

Environmental Resources Management Australia Pty Ltd (ERM) has been engaged by Theodore Energy Development Pty Ltd (TED) / (the Proponent) to prepare a Bird and Bat Management Plan (BBMP) for the proposed Theodore Wind Farm located approximately 22 kilometres (km) east of the township of Theodore, Queensland (herein referred to as the Proposed Action).

The BBMP has been prepared for the area considered for the Proposed Action (herein referred to as the 'Study Area') (Figure 1-1).

The Proposed Action consists of up to 170 WTG and ancillary infrastructure including, foundations and hardstands, temporary infrastructure such as concrete batching plants, laydown areas, construction offices, parking and on-site accommodation, access tracks and electrical reticulation, switching stations and substations, Battery Energy Storage Systems (BESS), meteorological masts (met masts), and operation and maintenance facilities. The Proposed Action is being developed across nine freehold lots on three properties (Study Area). The Study Area is dominated by alluvial plains with non-remnant grasslands predominantly used for agricultural grazing (Figure 1-1).



0661076_TWFOMP_R3\F1-1 Proposed Action Disturbance Footprint

1.1 REGULATORY REQUIREMENTS

This BBMP has been prepared in accordance with the *Environmental Management Plan Guidelines* (DCCEEW, 2024). The Queensland *Planning guidance State code 23: Wind farm development* (August 2023) and *Onshore Wind Farm Guidance – Best practice approaches when seeking approval under Australia' national environment law* (DCCEEW, 2024) provide further detailed guidance on requirements of this BBMP for referral and provide the primary legislative guidelines for what is acceptable for assessment.

The Queensland *Planning guidance State code 23: Wind farm development* (August 2023) requires a detailed BBMP to be prepared prior to the commencement of operation of the Proposed Action. As part of the Development Application, this BBMP has been prepared to address the requirements of State Code 23 in demonstrating the impacts associated with bird and bat collisions. This BBMP has been prepared in accordance with the Planning Guidance that accompanies State Code 23 and contains:

- Results of a desktop assessment to identify potential at-risk bird and bat species;
- The results of field surveys to identify potential habitat for birds, including bird utilisation surveys (BUS) were completed in October 2022, February 2023, March 2023, June 2023, September and October 2023, December 2023, February 2024 and June 2024. Subsequent field surveys have been undertaken in September 2024 and February 2026; however, BUS were not undertaken. Therefore, this BBMP reflects the survey data of eight BUS events;
- The results of bat surveys completed in October 2022 and the February and March 2023 survey periods;
- Long-term impact risk assessment, including a collision risk assessment (CRA) and collision risk modelling (CRM) for listed and least concern species that have been assessed as having a risk of collision with operating WTG; and
- Management, mitigation and monitoring measures to be considered to reduce the potential impact of collision with WTG.

The Department of Climate Change, Energy, the Environment and Water (DCCEEW) released the draft *Onshore Wind Farm Guidance – Best practice approaches when seeking approval under Australia' national environment law* (DCCEEW, 2024) in May 2024. The BBMP has been prepared with consideration for this guidance in addition to that of State Code 23. In addition to the minimum requirements detailed above, this BBMP has been prepared to manage impacts to MNES protected under the EPBC Act 1999.

1.1.1 COMPLIANCE WITH SDA 2409-41961

This BBMP has been prepared and will be finalised in accordance with Condition 8 of SDA 2409-41961.

Item	SDA 2409-41961 Condition	BBMP Reference
8(a)	Prepare a Bird and Bat Management Plan prior to practical completion of the wind farm.	This document
8(b)(i)	The BBMP must be prepared by a suitably qualified ecologist.	Table 1-2

Item	SDA 2409-41961 Condition	BBMP Reference
8(b)(ii)	The BBMP must be based on the final location of the wind turbine generators.	This document will be updated with the final location of wind turbine generators.
8(b)(iii)	The BBMP must identify all 'at risk' bird and bat species (i.e. all threatened and common species), seasons, and areas within the development site which may attract high levels of mortality.	Section 2.2.3 Section 2.2.4
8(b)(iv)	The BBMP must incorporate baseline data, including where relevant, additional pre-operational surveys (including any prior bird and bat utilisation surveys that were carried out prior to this approval taking place), Collision Risk Modelling and Population Viability Analysis.	Section 2
8(b)(v)	The BBMP must identify threshold (trigger) levels for all at risk species.	Section 7.1.1 Section 7.2.1
8(b)(vi)	The BBMP must identify mitigation measures and implementation strategies to reduce impacts on bird and bat species include a decision—making framework and adaptive management approach, including triggers for mitigation measures which are monitored for effectiveness.	Section 6 Section 7
8(b)(vii)	The BBMP must include triggers for operational shutdown of relevant WTG during certain periods if the adaptive management measures implemented are determined to be ineffective and there are ongoing impacts.	Section 7.1.2 Section 7.2.2
8(c)	Undertake a post-operational bird utilisation survey. The survey must:	
(i)	Be certified by a suitably qualified ecologist.	Section 5.3
(ii)	Be undertaken over a wet season and a dry season after commencement of export of electricity from the wind farm.	Section 5.1
(iii)	Utilise baseline data in accordance with a Before-After-Control-Impact design.	Section 5.1

(iv)	Be undertaken, at a minimum, in accordance with the following procedures:
	• Utilise a sub-set of survey points that were adopted from the previous surveys documented in the BBMP;
	• Utilise survey points that were adopted from the previous surveys documented in the BBMP;
	• Include 15-minute point-based surveys counting and documenting the distance and flight height of each observed bird in accordance with a BACI sampling design;
	• Include two counts of each site in each of four periods of the day (early morning, late morning, early afternoon and late afternoon) corresponding to different period of bird activity (a total of eight surveys per site);
	• Within the 15-minute point-based survey
	  ◦ All bird species and numbers of individual birds observed within 200 meters will be recorded;
	  ◦ The species, the number of birds and the height of the bird when first observed will be documented;
	  ◦ For species of concern (threatened species, waterbirds and raptors), the minimum and maximum heights will be recorded;
		Section 2.2.1

Item	SDA 2409-41961 Condition	BBMP Reference
	• Each survey point will be counted eight times each survey over the two survey period (one wet season and one dry season) at different times of the day; and • Compilation of a bird species lists for the site from formal counts and incidental observations, and mapping of the location (and recording of behaviours) of any rate or threatened species.	
(d)	Prepare a post-operational utilisation report. The report must:	
(i)	Be prepared by a suitably qualified ecologist.	Section 6
(ii)	Demonstrate whether the site continues to be utilised by the range of species identified during surveys conducted before construction and assess any changes in abundance or behaviour.	Section 6
(iii)	Include a recommendation on the need for additional surveys.	Section 6
(e)	Make any necessary updates to the final BBMP based on the findings and recommendations of the post-operation utilisation report outlined in (d) above.	Section 1.2
(f)	Submit the final BBMP to the Department of State Development, Infrastructure and Planning.	Table 1-2
(g)	Implement measures and operate the development in accordance with the BBMP.	Table 1-2

1.1.2 COMPLIANCE WITH PER GUIDELINES

Compliance with requirements of the PER Guidelines is shown in Table 1-1.

TABLE 1-1 EPBC ACT PER GUIDELINES RELEVANT TO THE BBMP

Item	EPBC PER Guideline	BBMP Reference
C1. Pre-commissioning requirements		
C1.1	Desktop assessment To predict the potential for listed threatened and migratory bird and bat species to be using the project area and its surrounds, the BBMP must include the process and outcomes of a preliminary site characterisation (desktop and/or initial site visit) for each species to identify all drivers of presence on the project area and utilisation of the project area. This characterisation must include, at a minimum, the consideration of: • site characteristics: focal habitat features, topography, prevailing wind and weather patterns, wetlands (including adjacent to project area), and distance to potential nesting, roosting and foraging areas. • species characteristics: behaviour, flight or demographic factors (e.g. species presence [ongoing, transitory/migratory]), site use (e.g. transit, roosting, breeding and/or foraging), flight paths (including migratory flight paths), flight heights, soaring, flocking, and population numbers.	Section 2.1
C1.2	Site-specific assessment To validate the outcomes of the desktop assessment, the BBMP must include a site-specific assessment of how at-risk listed threatened and migratory bird and bat species are using, or likely to use, the project area and surrounds. This assessment must be informed by site-specific and species-	Section 2.2 Appendix B

Item	EPBC PER Guideline	BBMP Reference
	specific site utilisation surveys (undertaken by a suitably qualified expert) and supported by other relevant scientific evidence. At least 24 months of site utilisation surveys must be undertaken to provide sufficient baseline data about a relevant species' potential to utilise the project area and its surrounds. This means that site utilisation surveys must be undertaken for each relevant season over a minimum two years (up to 8 survey events). Each site utilisation survey must be of an appropriate duration and spatial coverage (including taking into consideration the potential turbine layout and visibility) to adequately evaluate site utilisation. At a minimum, each site utilisation survey must record the relevant information specified in 'Species characteristics' of the desktop assessment (Section C1.1 above). The BBMP must include the site utilisation survey methodology for each relevant species. Discussion must be provided that includes detailed information on: • How the design of the site utilisation surveys for each relevant species has been informed by its drivers of presence on the project area and utilisation of the project area (as determined through the preliminary site characterisation). • How site utilisation surveys for each relevant species have been designed to improve understanding of site utilisation on the project area and its surrounds, and support an ongoing Before-After, Control Impact (BACI) framework in the BBMP.	

C1.3	<u>Long-term impact risk assessment</u>
	To enable a robust assessment of the potential impacts of the proposed action on listed threatened and migratory bird and bat species, the BBMP must include, at a minimum:
	• An assessment of the potential impact pathways on each relevant species (based on the desktop assessment [Section C1.1 above] and site utilisation surveys [Section C1.2 above]) including, at a minimum:
	  ◦ direct mortality from turbine collision and barotrauma
	  ◦ potential changes to species utilisation of the project area and surrounds during construction and operation of the proposed action.
	• Identification of potential impacts to each relevant species from direct mortality, including but not limited to:
	  ◦ analysis and mapping of suitable habitat, territories and activity/utilisation patterns/rates (e.g. 'heat maps') in the project area and its surrounds
	  ◦ flight path analysis of relevant birds and bats including heights and speeds.
	• a collision risk assessment, which must incorporate:
	  ◦ an assessment of the project area and surrounds to identify any high risk WTG
	  ◦ baseline data collected during the minimum 24 months of site utilisation surveys
	  ◦ a statement of all assumptions and uncertainties.
	The BBMP must include a map for each relevant species that identifies area/s in the project area and its surrounds determined to be 'high risk' based on the collision risk assessment.
	The BBMP must clearly demonstrate how relevant departmental policies and guidelines, and the SPRAT Database, have been used to assess the above potential impacts on listed threatened and migratory bird and bat species.
		Section 2.3
		Section 3

Item	EPBC PER Guideline	BBMP Reference
C2. Post-Commissioning requirements		
C2.1	Environmental outcomes To enable a robust long-term approach to mitigate and manage potential impacts from turbine collision and barotrauma, and potential changes to species utilisation of the project area and its surrounds, the BBMP must include specific environmental outcomes to be achieved by the implementation of the BBMP. This may include, but is not limited to: • an improved understanding of the risk of turbine collision and barotrauma impacts on listed bird and bat species. • an improved understanding of whether or how project area usage changes as a result of wind farm construction and operation. • an improved monitoring approach for the timely identification of turbine collisions and the timely collection and analysis of data. • an improved approach to the timely and regular validation and update to the collision risk assessment using monitoring data, to support a robust adaptive management approach. • the development and implementation of tangible, on-ground management measures and corrective actions to promote a long-term reduction in the risk of turbine collision and barotrauma impacts on listed bird and bat species.	Section 1.2
C2.2	Long-term site utilisation surveys To detect potential long-term changes to species utilisation of the project area and its surrounds as a result of operations, the BBMP must include a long-term site utilisation survey program (prepared by a suitably qualified expert) for each relevant species. The program must, at a minimum: • be designed to ensure that species behavioural responses can be detected, including avoidance of WTG and changes to site utilisation • be designed to support a BACI monitoring framework • include site utilisation survey methodologies, and proposed timings, which are consistent with the pre-commissioning site utilisation survey methodologies • be undertaken by a suitable qualified expert • be statistically reliable • be able to inform adaptive mitigation and management measures, and corrective actions, to ensure environmental outcomes will be achieved and impacts are minimised to the greatest extent reasonably possible.	Section 2.2 Section 8
C2.3	Long-term turbine collision and barotrauma monitoring To manage potential long-term mortality impacts on relevant species as a result of turbine collision and barotrauma, the BBMP must include a long-term monitoring and collision risk assessment update approach. The approach must, at a minimum: • include details of the nature, timing and frequency of monitoring to inform progress against achieving the environmental outcomes, and be sufficient to determine whether the BBMP is likely to achieve those environmental outcomes in adequate time to implement all necessary corrective actions • demonstrate how species-specific factors (e.g., size, colour) and site-specific factors (e.g., terrain, ground cover, seasonality, obstructions) have been incorporated into the design of monitoring programs (i.e., turbine selection, feasibility of conducting searches etc.) • include a proposed timeframe for the regular validation and update of the collision risk assessment using site-specific data collected through ongoing monitoring activities • include a commitment to DNA test carcasses, where identification of a carcass based upon morphology is inconclusive and cannot rule out a potential listed species	Section 5

Item	EPBC PER Guideline	BBMP Reference

	• include a commitment for carcass persistence trials and searcher efficiency trials to maximise the accuracy of total mortality estimates by determining the appropriate correction factor.
	  ◦ For carcass persistence trials, ensure carcass type and placement around the site is appropriate.
	  ◦ For searcher efficiency trials, ensure trials are completely blind.
	• include a commitment to determine whether there is variation in detection and persistence rates due to seasonality, substrate, or location at windfarm.
	The BBMP must take into account the following paper in the development of a long-term monitoring program, including the survey data requirements set out in Appendix 2:
	Moloney, P.D., Lumsden, L.F. and Smales, I. (2019). Investigation of existing post-construction mortality monitoring at Victorian wind farms to assess its utility in estimating mortality rates. Arthur Rylah Institute for Environmental Research Technical Report Series No. 302. Department of Environment, Land, Water and Planning, Heidelberg, Victoria.	

C2.4	<u>Reporting requirements to the department</u>
	The BBMP must include, at a minimum, the following reporting commitments (and proposed timeframes) for the provision of site-specific and species-specific information to the department:
	• Annual turbine strike reports, comprising:
	  ◦ raw strike data and strike notifications
	  ◦ survey methodologies
	  ◦ results of detection/persistence trials
	  ◦ environmental/meteorological conditions
	  ◦ associated statistical analysis.
	• Estimations of annual mortality rate for each relevant species, comprising:
	  ◦ supporting evidence from case studies of listed species carcass size classes
	  ◦ results of persistence trials and searcher efficiency trials
	  ◦ annual probability of detection and monthly strike monitoring
	  ◦ collision monitoring protocol and survey effort.
	• Species occurrence records for all listed threatened and migratory species recorded during surveys in accordance with the department's Guidelines for biological survey and mapped data (2018) using the species observation data template on the department's website (sensitive ecological data must be identified and treated in accordance with the department's Sensitive Ecological Data – Access and Management Policy V1.0 (2016)).
		Section 6

C2.5	<u>Adaptive management framework</u>
	To ensure the environmental outcomes will be achieved for relevant species, the BBMP must include an adaptive management framework. The adaptive management framework must, at a minimum:
	• Be designed to clearly demonstrate the linkages between:
	  ◦ environmental outcomes
	  ◦ implementation of mitigation and management measures
	  ◦ monitoring, reporting and investigations
	  ◦ implementation of corrective actions to ensure environmental outcomes will be achieved.
	• Be designed to incorporate site-specific data collected through ongoing monitoring activities (see requirement C2.4 above) and take into account changes to turbine risk ratings based on the collision risk assessment.
	• Identify, with proposed timeframes for implementation, tangible, on-ground corrective actions to be implemented if monitoring activities indicate the environmental outcomes have not been achieved.
		Section 7
		Section 8

Item	EPBC PER Guideline	BBMP Reference
C2.6	Offset requirements and shutdown procedures The BBMP must include a framework for the ongoing assessment of impacts on protected matters as a result of turbine strike and/or barotrauma. Annual impact triggers (informed by scientific literature and relevant departmental guidelines) must be tracked and reported to the department. Incremental impact triggers must be tracked that, if reached or exceeded, require: • the implementation of additional/alternative mitigation measures (including curtailment) • the provision of environmental offsets • shutdown procedures – the wind turbine/s that contributed to reaching or exceeding an impact trigger would be required to cease operation.	Section 7

1.2 ROLES AND RESPONSIBILITIES

The roles and responsibilities of personnel critical to the successful implementation of this BBMP are outlined in Table 1-2.

TABLE 1-2 ROLES AND RESPONSIBILITIES

Role	Responsibilities	Contact Details
Theodore Energy Development Pty Ltd (TED) / (the Proponent)	Document owner and responsible for implementing al management actions outlined in this BBMP and initiating monitoring events. Responsible for delivering annual compliance reports and regulator liaison.	TBA
Fauna-spotter catcher	Fauna spotter-catchers undertaking spotter catcher works during the construction phase of the Proposed Action will hold a valid Rehabilitation Permit (Spotter Catcher Activity) issued by the Queensland government.	TBA
Suitably qualified ecologist	The suitably qualified ecologist will be responsible for implementation of ecological surveys and monitoring require in all phases of the Proposed Action. They will contribute to reporting, as required and directly by Theodore Wind Farm staff. A suitably qualified ecologist will have experience in fauna ecology, hold relevant professional qualifications, training, skills or experience relevant to threatened species management.	TBA

1.3 BIRD AND BAT MANAGEMENT PLAN ENVIRONMENTAL OUTCOMES

Through the implementation of the BBMP, the following environmental outcomes will be achieved.

- An improved understanding of the risk of Wind Turbine Generator (WTG) collision and barotrauma impacts on listed bird and bat species;

- An improved understanding of whether or how Study Area usage changes as a result of wind farm construction and operation;
- An improved monitoring approach for the timely identification of WTG collisions and the timely collection and analysis of data;
- An improved approach to the timely and regular validation and update to the collision risk assessment using monitoring data, to support a robust adaptive management approach; and
- The development and implementation of tangible, on-ground management measures and corrective actions to promote a long-term reduction in the risk of WTG collision and barotrauma impacts on listed bird and bat species.

These environmental outcomes will enable a robust long-term approach to mitigate and manage potential impacts from WTG collision and barotrauma, and potential changes to species utilisation of the Study Area and its surrounds.

This BBMP is a live document and will be continuously adapted in response to the outcomes of monitoring, detection of potential species triggers, as a result of, identified impacts to bird and bats from WTG collisions. This BBMP will involve consultation with DCCEEW for management responses following the identification of species mortality considered to meet trigger levels for at-risk species.

1.4 STUDY AREA AND CONTEXT

The Study Area is approximately 46,830 ha in size and is located 22 km to the east of the township of Theodore, and approximately 50 km south of Biloela in the Banana Shire Council Local Government Area (LGA), Central Queensland. The Study Area lies adjacent to and within the locality (10 km) of several state forests including Belmont State Forest to the east, Montour State Forest to the north and Trevethan State Forest to the south of the Study Area (Figure 1-1).

The Study Area is comprised of 9 lots on 3 properties. The lot on plans are outlined below in Table 1-3 and displayed on Figure 1-1.

TABLE 1-3 RELEVANT STUDY AREA LAND PARCELS

Property	Lot on Plan
Landowner 1	Lot 4 on SP131475 Lot 2 on RP617749 Lot 1 on RP617748 Lot 8 on DW2
Landowner 2	Lot 17 on DW49 Lot 18 on DW550
Landowner 3	Lot 11 on DW446 Lot 19 on DW551 Lot 20 on SP100500
Road Reserves	Part of Defence Road Part of Crowsdale Camboon Road Unnamed Road Reserves
Total Study Area	46,830 ha

The Study Area occurs within the Banana Shire Council LGA and is zoned as Rural under the Banana Shire Council Planning Scheme 2017. Cattle grazing is the dominant land use in the Study Area, with largely cleared areas associated with lower slopes dominating the landscape.

From a bioregion perspective, the Study Area is located within the Southern Brigalow Belt bioregion as defined by the Interim Biogeographic Regionalisation for Australia (IBRA) framework. Ecological and topographical features observed within the Study Area are typical of the region and include eucalypt dominated open forest and woodlands on alluvial plains and igneous rock. Open forests and woodlands consistent with this bioregion are generally observed in the south of the Study Area. In the north, the landscape is characterised by non-remnant grasslands with historic land clearing and severe dieback.

Access to the Study Area is primarily from Defence Road, with crossings and smaller access from Crowsdale-Camboon Road in the centre of Study Area. Throughout the duration of the construction and operational phases of the Proposed Action, host properties are able to continue to use land for agricultural activities throughout the life of the Proposed Action and it is anticipated that tracks established during construction of the Proposed Action will aid in continued agricultural activities.

2. PRE-OPERATIONAL BIRD AND BAT INFORMATION

Ten field investigations have been undertaken within the Study Area between October 2022 and February 2026. The field effort undertaken during each survey event are described below:

- Four ecologists undertook a six-day ecological survey within the Study Area from 17th of October to the 22nd of October 2022, with a total of 240 person hours on the ground. The surveys involved completing vegetation assessments, RE and TEC ground truthing and validation, habitat assessments, targeted threatened species surveys, spotlighting, call playback, deploying camera traps and Anabats, and Bird Utilisation Surveys (BUS).
- Two ecologists undertook a five-day bird and bat survey within the Study Area from 13th of February to the 17th of February 2023, with a total of 100 person hours on the ground, completing assessment of threatened fauna, deploying Anabats, and BUS.
- Four ecologists undertook a five-day ecological survey within the Study Area from 27th of March to the 31st of March 2023, for a total of 200 person hours, completing vegetation assessments, RE and TEC ground truthing and validation, habitat assessments, targeted threatened species surveys, deploying Anabats, and BUS.
- Four ecologists undertook a five-day ecological survey within the Study Area from 5th of June to the 9th of June 2023, for a total of 200 person hours, completing vegetation and habitat assessments, targeted threatened species surveys, and BUS.
- Two ecologists undertook a five-day ecological survey within the Study Area from 25th of September to the 29th of September 2023, then another five-day ecology survey from the 9th of October to the 13th of October 2023, for a total of 200 person hours, completing habitat assessments, vegetation assessments, and BUS (survey period spread across two weeks due to site access issues).
- Two ecologists undertook a five-day ecology survey within the Study Area from the 4th of December to the 8th of December 2023, for a total of 100 person hours, completing BUS.
- Two ecologists undertook a five-day ecology survey within the Study Area from the 19th of February to the 23rd of February 2024, for a total of 100 person hours, completing BUS.
- Four ecologists undertook a four-day ecology survey within the Study Area from the 10th of June to the 14th of June 2024, for a total of 160 person hours, completing BUS, RE and TEC ground truthing and validation, vegetation and habitat assessments.
- Four ecologists undertook a six-day ecology survey within the Study Area for the 23rd of September to the 28th of September 2024, for a total of 240 person hours, completing MHQA and BioCondition Assessments, targeted flora transects, and targeted threatened species surveys.
- Four ecologists undertook a five-day ecology survey within the Study Area for the 17th of February to the 21st of February 2026, for a total of 120 person hours, completing MHQA and BioCondition Assessments, and targeted threatened species habitat assessment surveys.

Field investigations focussed on bird and bat surveys, in order to identify at-risk species required for consideration during the operation of the Proposed Action. Desktop information was utilised to inform an understanding of the at-risk species ecology and biology to support the development of management measures, as defined in this BBMP.

2.1 PRE-OPERATIONAL SURVEY METHODS

Prior to conducting field investigations, a review of desktop sources was undertaken to identify the ecological values of the Study Area, including Commonwealth, State and public information sources, as per Table 2-1.

The desktop analysis further guided the development of the field survey techniques and effort best suited to the ecological matters identified within the Study Area. Desktop information was utilised to assess and document the likelihood of occurrence (LoO) for threatened bird and bat species within the Study Area.

TABLE 2-1 DATABASES REVIEWED FOR DESKTOP ANALYSIS

Information Source	Name	Data Description
Department of Climate Change, Energy, the Environment and Water (DCCEEW)	Protected Matters Search Tool (PMST) *The PMST report for assessment was generated 19th March 2024*	The search tool provides predictive results of matters of national environmental significance based on mapping of known and potential species distribution, habitat, ecological communities and wetlands. The outputs are based on modelling results and do not necessarily reflect known records of species or communities. The features highlighted by the search are considered further through a likelihood of occurrence assessment (Appendix A). The PMST is available as Appendix B. Search area: Study Area Boundary .shp file (with a 10 km buffer, referred to as the Locality, around this area drawn in the PMST interactive search map).
Department of Resources (DoR)	Regional Ecosystem (RE) Version 13 mapping	This product maps remnant and regrowth vegetation communities across Queensland and identifies communities listed as Endangered, Of Concern or Least Concern status as defined by the VM Act.
DoR	Property Maps of Assessable Vegetation mapping (published 4 May 2017)	This product provides certified property scale maps indicating where landholders can clear regrowth in 'Category X' areas without further approval.
Queensland Government	MSES version 4.1 mapping	This product maps areas of MSES as defined under the Qld State Planning Policy.
DoR	Queensland Globe	A Queensland Government based product that allows viewing of spatial data and imagery covering Queensland.
Department of Environment, Science and Innovation (DESI)	WildNet records (WN) – Through Environmental Reports	A database that contains records of wildlife sightings including threatened flora and fauna species (protected under the NC Act) that have been provided to the agency by Government departments and external organisations. Search area: all Lots of the Study Area
ala.org.au	Atlas of Living Australia (ALA)	Australia national biodiversity database (supported by the National Collaborative Research Infrastructure Strategy, CSIRO). Database contains records accessed through an interactive spatial portal. Threatened species are searched to identify known records in proximity to the Study Area.

Information Source	Name	Data Description
DCCEEW	Species Profile and Threats Database (SPRAT)	The SPRAT profiles and associated conservation advice documents were consulted as they provide detailed information for the likelihood of occurrence assessment on: • Species distribution; and • Species habitat (preferred and general). The conservation advice documents are particularly important for assessing TECs found in field surveys, against the listed TEC guidelines.

2.1.1 LIKELIHOOD OF OCCURRENCE

Consistent with the accepted approach for ecological assessment, a preliminary likelihood of occurrence assessment was undertaken informed by desktop sources and database searches, results of which are available in Appendix B. The LoO criteria is presented in Table 2-2. The preliminary output was refined using site-specific and specific-species habitat information obtained from field surveys to produce a final likelihood of occurrence (refer to Appendix B).

TABLE 2-2 LIKELIHOOD OF OCCURENCE CRITERIA

	Preferred habitat exists	General habitat exists[1]	Habitat does not exist[2]
Records within the Study Area (based field investigations)	Known	Known	Known
Recent[3] records in the Locality[4]	Likely	Potential	Unlikely
No records in the Locality, but the Study Area is within the known distribution	Potential	Potential	Unlikely
No records in the Locality, and the Study Area is outside of the known distribution	Unlikely	Unlikely	Unlikely

1. *Habitat may be considered general, but not preferred because: some desired habitat features may be present, but not all; habitat may have poor connectivity; or habitat may be known to be disturbed.*
2. *Based on sources reviewed and/or field survey results.*
3. *'Recent' means records within the previous 20 years.*
4. *'Locality' refers to a 10 km radius centred on the Study Area.*

2.1.2 SURVEY TECHNIQUES AND EFFORT

A summary of the survey effort conducted throughout all 10 field investigation events is provided in Table 2-3.

The field investigations focussed primarily on targeting listed threatened and migratory species which were assessed as known, likely or having the potential to occur within the Study Area (as per the LoO assessment; Appendix B) and were conducted in accordance with the following survey guidelines:

- Survey Guidelines for Australia's Threatened Birds (DEWHA, 2010a);
- Draft referral guideline for 14 birds listed as migratory species under the EPBC Act (DoE, 2015);

- Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (DES, 2018);
- National Recovery Plan for the Grey-headed Flying-fox *Pteropus poliocephalus* (DAWE, 2021); and
- Survey Guidelines for Australia's Threatened Bats (DEWHA, 2010b).

A survey adequacy assessment was completed following each survey event to identify whether the survey techniques and effort adhered to the above listed guidelines. This survey adequacy assessment is provided in Appendix C.

A summary of the survey techniques and effort for each targeted assessment, for each survey period is presented in Table 2-3.

TABLE 2-3 BIRD AND BAT SURVEYS UNDERTAKEN WITHIN THE STUDY AREA

Dates	Target	Techniques	Survey Effort
17 – 22 October 2022	Vegetation and habitat assessment (including targeted threatened species surveys)	• Assessment of habitat features present relating to relative cover and abundance of nesting/shelter/basking sites, presence of aquatic habitats, presence of foraging resources, dominant canopy species, connectivity and disturbances. • Representative sampling for RE verification using quaternary vegetation sampling (Neldner et al., 2022). • Targeted surveys for threatened species identified with potential to occur, as described in the likelihood of occurrence analysis (Appendix B).	• 36 individual survey locations.
	Targeted fauna surveys	• Deployment of baited camera traps to target terrestrial mammals.	• 4 camera traps deployed for 4 consecutive nights, totalling 16 trap nights. • 2 nights, 8 hours survey effort, spotlighting transects along Defence Road
	Bird surveys	• BUS using the Fixed-Point Survey.	• 23 bird surveys including BUS and roaming surveys.
	Bat surveys	• Bat detection via the use of ultrasonic devices (Anabats).	• 2 Anabats locations recording for 4 consecutive nights, totalling 8 trap nights.
13 – 17 February 2023	Bird surveys	• BUS using the Fixed-Point Survey. • Roaming bird surveys between survey areas.	• 32 bird surveys including BUS and roaming bird surveys.
	Bat surveys	• Bat detection via the use of ultrasonic devices (Anabats).	• 4 Anabat locations recording for 4 consecutive

Dates	Target	Techniques	Survey Effort
			nights, totalling 16 trap nights.
27 – 31 March 2023	Vegetation and habitat assessment (including targeted threatened species surveys)	• Assessment of habitat features present relating to relative cover and abundance of nesting/shelter/basking sites, presence of aquatic habitats, presence of foraging resources, dominant canopy species, connectivity and disturbances. • Representative sampling for RE verification using quaternary vegetation sampling (Neldner et al., 2022) • Targeted surveys for threatened species identified with potential to occur, as described in the likelihood of occurrence analysis (Appendix B), with techniques outlined in Section 2.2.	• 60 individual survey locations.
	Bird surveys	• BUS using the Fixed-Point Survey. • Roaming bird surveys between survey areas.	• 27 bird surveys, including BUS and roaming bird surveys.
	Bat surveys	• Bat detection via the use of ultrasonic devices (Anabats).	• 4 Anabat locations recording for 4 consecutive nights, totalling 16 trap nights.
5 – 9 June 2023	Vegetation and habitat assessment (including targeted threatened species surveys)	• Assessment of habitat features present relating to relative cover and abundance of nesting/shelter/basking sites, presence of aquatic habitats, presence of foraging resources, dominant canopy species, connectivity and disturbances. • Representative sampling for RE verification using quaternary vegetation sampling (Neldner et al., 2022) • Targeted surveys for threatened species identified with potential to occur, as described in the likelihood of occurrence analysis (Appendix B), with techniques outlined in Section 2.2.	• 48 individual survey locations
	Targeted fauna surveys	• Targeted spotlighting transects as well as koala SATs.	• 4 spotlighting nights totalling 12 hours survey effort. • 7 koala SATs
	Bird surveys	• BUS using the Fixed-Point Survey. • Roaming bird surveys between survey areas.	• 24 bird surveys, including BUS and roaming bird surveys.

Dates	Target	Techniques	Survey Effort
25 September – 13 October 2023 (Survey period split over two weeks)	Habitat quality assessments	• Modified Habitat Quality Assessment (MHQA) and BioCondition Assessments	• 17 transects
	Bird surveys	• BUS using the Fixed-Point Survey. • Roaming bird surveys between survey areas.	• 26 BUS
4 – 8 December 2023	Bird surveys	• BUS using the Fixed-Point Survey. • Roaming bird surveys between survey areas.	• 40 BUS
19 – 23 February 2024	Bird surveys	• BUS using the Fixed-Point Survey. • Roaming bird surveys between survey areas.	• 27 BUS
10 – 14 June 2024	Vegetation assessments	• Representative sampling for RE verification using quaternary vegetation sampling (Neldner et al., 2022)	• 31 individual survey locations
	Habitat quality assessments	• Modified Habitat Quality Assessment (MHQA) and BioCondition Assessments	• 8 transects
	Bird surveys	• BUS	• 18 BUS
23 – 28 September 2024	Habitat quality assessments	• MHQA and BioCondition Assessments.	• 13 transects
	Targeted Flora Transects	• Targeted flora transects within impact areas for potentially occurring threatened flora.	• 17 transects in impact areas ranging from 30 minutes to an hour.
	Habitat assessment (including targeted threatened species surveys)	• Assessment of habitat features present relating to relative cover and abundance of roosting/shelter/basking sites, presence of aquatic habitats, presence of foraging resources, dominant canopy species, connectivity and disturbances. • Targeted surveys for threatened species identified with potential to occur, as described in the likelihood of occurrence analysis. Surveys focused on the presence of suitable habitat for threatened reptiles and white-throated needletail roosting/foraging habitat.	• 4 assessments in impact areas for reptiles. • 6 assessments atop ridgelines for white-throated needletail.
	Additional targeted fauna surveys	• Targeted spotlighting transects. • Call playback.	• 2 spotlighting nights totalling 8 hours survey effort. • 9 call playback sessions for yellow-bellied glider and koala.

Dates	Target	Techniques	Survey Effort
			• 3 call playback sessions for diamond firetail.
17 – 21 February 2026	Four ecologists undertook a five-day ecological survey within the Study Area, for a total of 120 person hours.	Habitat quality and quaternary assessments (targeted for yellow-bellied glider)	• 22 habitat quality and quaternary assessments to verify the extent of habitat for yellow-bellied glider within the Study Area. • This included refinement based on expert guidance advice, focusing on species identification, floristic diversity and composition, and identification of areas to be excluded from habitat mapping including poplar box communities, areas of sparse vegetation (including regrowth) and disconnected vegetation patches.
		Habitat quality assessments	• 19 MHQA and BioCondition Assessments.

2.1.3 SURVEY CONDITIONS

During all field investigation periods, the weather typically remained dry (with the exception of the October 2022 and September 2024 survey periods). Moderate wind conditions and temperatures were typical for the periods that each survey took place. A summary of the daily weather observations for each survey period is presented in Table 2-4 to Table 2-14.

It should be noted that creek flooding occurs within the Study Area during the October 2022 survey period, and thus, impacting levels of access across survey sites.

Weather observations were sourced from the Thangool weather station (station number 039089), located approximately 50 km north-east of the Study Area.

TABLE 2-4 DAILY WEATHER OBSERVATIONS OCTOBER 2022 - THANGOOL QUEENSLAND

	Daily Temp		Rain	9:00AM				3:00 PM			
	Min °C	Max °C	mm	Temp °C	RH %	Dir	Spd km/hr	Temp °C	RH %	Dir	Spd km/hr
17/10/22	16.6	29.3	7	22.5	79	NW	7	24.5	71	SE	13
18/10/22	14.8	28.9	0	25.5	65	NNE	20	26.8	53	N	20
19/10/22	19	23.9	1.4	21.5	89	NE	7	23.1	78	NNE	9
20/10/22	19.3	25.5	24.2	21.2	93	WNW	6	24.2	73	NE	15
21/10/22	17.1	29.5	14.6	25.4	72	NNE	11	28.3	52	NNE	22
22/10/22	17.6	27.2	23.2	18.2	99	ESE	13	25.2	59	ESE	13

Dir = wind direction; Spd = wind speed; RH = relative humidity
Blue denotes the lowest daily temperature; Red denotes the highest daily temperature.
Source: Australian Government Bureau of Meteorology, www.bom.gov.au

TABLE 2-5 DAILY WEATHER OBSERVATIONS FEBRUARY 2023 - THANGOOL QUEENSLAND

	Daily Temp		Rain	9:00 AM				3:00 PM			
	Min °C	Max °C	mm	Temp °C	RH %	Dir	Spd km/hr	Temp °C	RH %	Dir	Spd km/hr
13/02/23	19.4	37.9	0	29.4	58	NW	11	37.5	31	NNW	9
14/02/23	19	38.1	0	30.8	57	N	19	37.3	28	NNW	22
15/02/23	20.4	32.4	9.6	28.1	66	E	13	31	49	NNE	11
16/02/23	19	33.3	0.2	25.9	58	E	17	32	36	SE	11
17/02/23	15	32.2	0	25.9	53	E	6	31.2	38	SSE	13

Dir = wind direction; Spd = wind speed; RH = relative humidity
Blue denotes the lowest daily temperature; Red denotes the highest daily temperature.
Source: Australian Government Bureau of Meteorology, www.bom.gov.au

TABLE 2-6 DAILY WEATHER OBSERVATIONS MARCH 2023 - THANGOOL QUEENSLAND

	Daily Temp		Rain	9:00 AM				3:00 PM			
	Min	Max	mm	Temp	RH	Dir	Spd	Temp	RH	Dir	Spd
	°C	°C		°C	%		km/hr	°C	%		km/hr
27/03/23	17	33.7	0	26	63	NE	4	33.4	38	WNW	13
28/03/23	16.6	34.6	0	26.6	70	ENE	2	33	37	NE	7
29/03/23	18.6	32	0	25.7	71	N	11	30.8	48	W	6
30/03/23	21.1	33.3	0	25.8	73	NW	13	31.7	44	SW	13
31/03/23	15.4	32.4	2.2	25	46	ESE	9	31.4	23	W	9

Dir = wind direction; Spd = wind speed; RH = relative humidity
Blue denotes the lowest daily temperature; Red denotes the highest daily temperature.
Source: Australian Government Bureau of Meteorology, www.bom.gov.au

TABLE 2-7 DAILY WEATHER OBSERVATIONS JUNE 2023 - THANGOOL QUEENSLAND

	Daily Temp		Rain	9:00 AM				3:00 PM			
	Min	Max	mm	Temp	RH	Dir	Spd	Temp	RH	Dir	Spd
	°C	°C		°C	%		km/hr	°C	%		km/hr
05/06/23	14	26.8	0	21.1	66	ESE	22	25.5	41	ENE	22
06/06/23	12.1	24.9	0	18.8	74	ESE	17	22.5	54	ESE	17
07/06/23	9.4	26.4	0	19.2	68	ESE	15	25.6	38	ESE	9
08/06/23	4.7	26.4	0	16	82	SE	6	25.3	34	NNW	9
09/06/23	7.9	27.7	0	17.6	69	E	7	24.9	40	SSW	13

Dir = wind direction; Spd = wind speed; RH = relative humidity
Blue denotes the lowest daily temperature; Red denotes the highest daily temperature.
Source: Australian Government Bureau of Meteorology, www.bom.gov.au

TABLE 2-8 DAILY WEATHER OBSERVATIONS SEPTEMBER 2023 - THANGOOL QUEENSLAND

	Temp		Rain	9:00 AM				3:00 PM			
	Min	Max	mm	Temp	RH	Dir	Spd	Temp	RH	Dir	Spd
	°C	°C		°C	%		km/hr	°C	%		km/hr
25/09/2023	8.1	27.9	0	20.9	51	ESE	17	26.0	30	ESE	7
26/09/2023	6.9	29.8	0	21.0	53	SSE	7	29.2	19	SW	6
27/09/2023	8.2	31.4	0	21.6	58	NNW	9	29.3	22	NNE	15
28/09/2023	9.3	32.9	0	21.7	58	NNW	7	31.9	18	ESE	9
29/09/2023	13.5	31.9	0	23.3	54	NNE	9	29.5	28	ESE	11

Dir = wind direction; Spd = wind speed; RH = relative humidity
Blue denotes the lowest daily temperature; Red denotes the highest daily temperature.
Source: Australian Government Bureau of Meteorology, www.bom.gov.au

TABLE 2-9 DAILY WEATHER OBSERVATIONS OCTOBER 2023 - THANGOOL QUEENSLAND

	Temp		Rain	9:00 AM				3:00 PM			
	Min	Max	mm	Temp	RH	Dir	Spd	Temp	RH	Dir	Spd
	°C	°C		°C	%		km/hr	°C	%		km/hr
09/10/2023	8.3	28.9	0	23.1	35	E	13	26.6	26	SE	11
10/10/2023	8.1	30.0	0	22.0	54	S	7	27.0	31	ENE	7
11/10/2023	9.5	31.9	0	23.2	48	ENE	9	31.3	21	E	11
12/10/2023	11.0	32.2	0	23.7	52	WSW	9	30.6	25	NNW	9
13/10/2023	10.5	33.2	0	23.8	53	NNW	15	32.5	21	SSW	9

Dir = wind direction; Spd = wind speed; RH = relative humidity
Blue denotes the lowest daily temperature; Red denotes the highest daily temperature.
Source: Australian Government Bureau of Meteorology, www.bom.gov.au

TABLE 2-10 DAILY WEATHER OBSERVATIONS DECEMBER 2023 - THANGOOL QUEENSLAND

	Temp		Rain	9:00 AM				3:00 PM			
	Min	Max	mm	Temp	RH	Dir	Spd	Temp	RH	Dir	Spd
	°C	°C		°C	%		km/hr	°C	%		km/hr
04/12/2023	20.7	38.7	0	31.1	53	NE	7	36.6	27	SW	6
05/12/2023	19.4	35.8	0	28.9	55	N	13	34.1	33	WNW	17
06/12/2023	17.5	38.4	0	29.3	47	WSW	6	36.5	18	ESE	17
07/12/2023	14.9	38.6	0	26.8	49	SE	7	37.1	16	NE	31
08/12/2023	15.1	37.7	0	28.5	45	SE	15	36.3	22	E	20

Dir = wind direction; Spd = wind speed; RH = relative humidity
Blue denotes the lowest daily temperature; Red denotes the highest daily temperature.
Source: Australian Government Bureau of Meteorology, www.bom.gov.au

TABLE 2-11 DAILY WEATHER OBSERVATIONS FEBRUARY 2024 - THANGOOL QUEENSLAND

	Temp		Rain	9:00 AM				3:00 PM			
	Min	Max	mm	Temp	RH	Dir	Spd	Temp	RH	Dir	Spd
	°C	°C		°C	%		km/hr	°C	%		km/hr
19/02/2024	17.6	34.5	0	27.0	63	ESE	20	34.4	34	SE	11
20/02/2024	19.8	34.4	0	27.4	58	SE	9	32.4	37	S	7
21/02/2024	20.2	34.2	0	27.5	62	W	4	31.4	46	NE	20
22/02/2024	19.1	34.3	0	27.7	63	W	4	32.1	43	NNW	11
23/02/2024	19.4	35.6	0	28.1	66	N	4	34.5	35	SE	9

Dir = wind direction; Spd = wind speed; RH = relative humidity
Blue denotes the lowest daily temperature; Red denotes the highest daily temperature.
Source: Australian Government Bureau of Meteorology, www.bom.gov.au

TABLE 2-12 DAILY WEATHER OBSERVATIONS JUNE 2024 – THANGOOL QUEENSLAND

	Temp		Rain	9:00 AM				3:00 PM			
	Min	Max	mm	Temp	RH	Dir	Spd	Temp	RH	Dir	Spd
	°C	°C		°C	%		km/hr	°C	%		km/hr
11/06/2024	2.6	26.1	0	14.8	57	SE	11	25.9	19	NW	6
12/06/2024	2.3	26.2	0	13.6	60	SSE	2	25.5	19	SSW	17
13/06/2024	0.9	24.0	0	14.7	51	SE	13	22.7	19	SSE	9
14/06/2024	1.6	24.0	0	12.6	47	E	7	23.3	17	N	11

Dir = wind direction; Spd = wind speed; RH = relative humidity
Blue denotes the lowest daily temperature; Red denotes the highest daily temperature.
Source: Australian Government Bureau of Meteorology, www.bom.gov.au

TABLE 2-13 DAILY WEATHER OBSERVATIONS SEPTEMBER 2024 – THANGOOL QUEENSLAND

	Temp		Rain	9:00 AM				3:00 PM			
	Min	Max	mm	Temp	RH	Dir	Spd	Temp	RH	Dir	Spd
	°C	°C		°C	%		km/hr	°C	%		km/hr
23/09/2024	5.0	29.9	0	22.3	57	SE	11	28.6	26	NE	13
24/09/2024	8.0	30.0	0	22.4	49	ESE	6	28.8	24	NE	19
25/09/2024	7.1	29.5	0	22.8	49	NNE	13	28.1	29	N	17
26/09/2024	9.3	30.6	0	23.1	51	NNW	13	29.7	36	NNW	15
27/09/2024	17.7	27.2	12.2	20.3	81	S	9	26.6	30	SW	15
28/09/2024	9.0	26.7	0	20.7	50	SE	9	25.9	27	SW	17

Dir = wind direction; Spd = wind speed; RH = relative humidity
Blue denotes the lowest daily temperature; Red denotes the highest daily temperature.
Source: Australian Government Bureau of Meteorology, www.bom.gov.au

TABLE 2-14 DAILY WEATHER OBSERVATIONS FEBRUARY 2026 – THANGOOL QUEENSLAND

	Temp		Rain	9:00 AM				3:00 PM			
	Min	Max	mm	Temp	RH	Dir	Spd	Temp	RH	Dir	Spd
	°C	°C		°C	%		km/hr	°C	%		km/hr
17/02/2026	21.1	30.3	0	25.3	65	ESE	17	29.5	52	E	13
18/02/2026	18.8	32.6	0	26.5	63	S	7	31	48	NE	9
19/02/2026	20.9	34.2	0	28.3	64	SE	4	32.7	39	E	15
20/02/2026	16.6	31.8	0	25.2	65	ESE	17	31.2	37	E	19
21/02/2026	17.8	32.5	0	26.9	62	ESE	17	31.2	43	E	11

Dir = wind direction; Spd = wind speed; RH = relative humidity
Blue denotes the lowest daily temperature; Red denotes the highest daily temperature.
Source: Australian Government Bureau of Meteorology, www.bom.gov.au

2.1.4 DESKTOP SITE CHARACTERISTICS ASSESSMENT

The ecological condition of the Study Area is majorly influenced by historical land clearing and cattle grazing, with large patches of cleared land featuring no remnant vegetation occurring throughout. This is the most prominent in the centre and north of the Study Area, though some large swathes of cleared land also occur in the southeast of the Study Area. These areas have current grazing leases. The Study Area is broadly connected to the surrounding landscapes and vegetation by a regional terrestrial corridor, which is situated in a north to south alignment throughout the Study Area.

The Study Area is topographically characterised by rolling hills and flat plains. Across the Study Area the landscape features vary in geology, from torsdale volcanic mixed with camboon volcanics, to rocky outcrops of large boulders, open flat areas on tops of ridges, and sedimentary stratigraphy on the western extent of the Study Area. Topography of the site is shown in Figure 2-4 and further described in Section 3.3.

Central Queensland benefits from relatively strong, consistent winds rather than localised breezes, with the region typically experiencing stronger westerly winds. The Section 3.3 further describes the wind patterns within the Study Area, including the presence of updrafts in association with topological features.

The Study Area is located in the Fitzroy catchment, with the most notable of the waterways within the proposed Study Area being Castle Creek, classified as Stream Order 5 under the Strahler system of stream order. Castle Creek intersects the Study Area in the north. Other notable waterways include Oxtrack Creek, a Stream Order 4 waterway in the south of the Proposed Action, and several Stream Order 3 waterways situated throughout the Study Area (Boam Creek, South Creek, Keen Creek, and Six Mile Creek). Several other ephemeral Stream Order 1 and 2 tributaries of Castle Creek (and other surrounding waterways) flow through the Study Area. Based on the topography and the Strahler system of stream order, Castle Creek flows east to west where it joins the nearby Dawson River approximately 30 km west of the Study Area just south of the township of Theodore. No wetlands of international importance associated with the Study Area.

No protected areas occur within the boundary of the Study Area, however, the following State Forests are located within the locality (10 km):

- The Belmont State Forest is located on the northern boundary of the Study Area and has an area of approximately 8,550 ha;
- The Montour State Forest is located to the eastern boundary of the Study Area and has an area of approximately 4,222 ha;
- The Camboon State Forest is located on the southern boundary of the Study Area and has an area of approximately 11,874 ha; and
- The Trevethan State Forest is located approximately 3 km south of the Study Area and has an approximate area of 3,618 ha.

2.2 SITE SPECIFIC ASSESSMENTS

2.2.1 BIRD SURVEY METHODS

The BUS involve 20-minute fix point surveys to provide data based on the species present and their height, speed and direction of flight as stipulated by the Band Model (SNH 2012, Band 2007).

Each fixed-point survey site was located to provide a search radius of at least 100 m for small birds and up to 800 m for large birds with range finders used to determine distances. Searches primarily focused on birds most likely to be affected by the development, such as raptors (birds of prey) and large flocks of birds. This technical requirement for BUS is outlined in AusWind's Report, *Wind Farms and Birds: Interim Standards for Risk Assessment* (AusWEA, 2006), draft *Onshore Wind Farm Guidance* (DCCEEW, May 2024) and Appendix 1 – Ecological assessment methodology and bird and bat studies of the draft *Planning guidance State code 23: Wind farm development* (DSDILGP, August 2023).

The survey guidelines for diurnal bird surveys and their requirements are as follows:

- *Survey Guidelines for Australia's threatened birds* (DEWHA, 2011)
    - Point surveys involve recording the presence, and usually number of individuals, of each taxon detected at a series of specified locations. The sampling points are usually pre-determined and selected either randomly or systematically within the Study Area; and
    - Point surveys typically involve an allocated survey time of 20-minutes.

As surveys commenced in October 2022, the BUS design was implemented with reference to the *Onshore Wind Farms – interim guidance on bird and bat management* by DAWE dated 2021 which required bird utilisation surveys (BUS) to be completed over each relevant season over a minimum of 24 months prior to commissioning of a wind farm.

This survey effort is also consistent with the requirements of the updated draft *Onshore Wind Farm Guidance* (DCCEEW, 2024), which requires site utilisation surveys to be undertaken for each relevant season over at least two years (up to 8 survey events).

There are two distinct seasons in Queensland, wet season and dry season. The Study Area experiences a higher mean rainfall and higher mean temperatures between November and February (often extending into March). This also coincides with the season for migratory birds, including wetland birds.

To inform species use across the Study Area as part of the risk assessment for threatened birds with the potential to be impacted by WTG strike, eight BUS survey trips have been conducted to date across these two seasons (four surveys in the wet season and four surveys in the dry season), over a 20-month period. It is noted that the Proponent has committed to further survey events prior to commissioning of the Proposed Action, meeting the 24 month requirement.

BUS points were dispersed across the Study Area during the first two sampling events in October 2022 and February 2023, with the same sites subject to repeat visits in both the morning and afternoon period during all subsequent sampling events. A summary of the BUS survey effort is described in Table 2-15.

TABLE 2-15 SUMMARY OF BUS EFFORT

BUS Survey Event	BUS survey effort
October 2022 Dry season	23 surveys, 12 morning and 11 afternoon
February 2023 Wet season	32 surveys, repeat visits to BUS points including 16 morning and 16 afternoon surveys
March 2023 Wet season	28 surveys, repeat visits to BUS points including 14 morning and 14 afternoon surveys
June 2023 Dry season	24 surveys repeat visits to BUS points including 12 morning and 12 afternoon surveys
September/October 2023 Dry season	26 surveys, repeat visits to BUS points including 12 morning and 14 afternoon surveys
December 2023 Wet season	40 surveys, repeat visits to BUS points including 20 morning and 20 afternoon surveys
February 2024 Wet season	27 surveys, repeat visits to BUS points including 13 morning and 14 afternoon surveys
June 2024 Dry season	18 surveys, repeat visits to BUS points including 9 morning and 9 afternoon surveys

Survey Guidelines for Australia's threatened birds (DEWHA, 2011) outlines steps that aid in determining survey effort and timing, noting a particular focus on optimal timing for surveys of 'target' taxa. With the timing of surveys critical to species detection, it is important that surveys be timed to maximise potential detection across the year. As such, eight BUS events have been completed over the two distinct seasons observed within Central Queensland (wet and dry).

State Code 23 details the requirement for BUS for wind farm developments. Such surveys identify avian species, numbers present, height flown and site utilisation. The field investigations undertook BUS at waterbodies and in open areas for birds of prey. Thus, the survey effort was performed in accordance with State Code 23 requirements.

The updated DCCEEW draft guidelines on the management of bird and bat species in onshore wind farms details the need to undertake a risk assessment for birds and bats following BUS for the Study Area (DCCEEW, 2024). This risk assessment has taken into account the likelihood and consequences of events including collision with WTG and the impact of construction and operation on the Proposed Action causing changes in site utilisation by bird and bat species. The findings of this risk assessment for 'low' and 'moderate' risk species is provided in Section 3.2 with findings for all species assessed provided in Appendix F.

State Code 23 also recommends Before-After-Control-Impact (BACI) design principle for surveys where the Study Area is determined to support significant bird species. The aim of the BACI design is to compare environmental variables before and after a human activity and between the areas affected by the development (impact site) and areas unaffected by the development (control sites) (Stewart-Oaten, 1986). In this instance, this would compare control and impact BUS sites, before and after the construction of the Proposed Action, to determine if there are any avian impacts as a result of the development. For the Proposed Action, impact sites are generally located within 1 km of the proposed WTG locations.

Control sites are defined as sites that are placed at a sufficient distance from the proposed WTG locations to obtain data outside the zone of influence of the WTG (as defined in *State code 23: Wing farm development* (DSDILGP, 2022).

Twenty potential impact sites and eighteen potential control sites were visited over the eight BUS events between October 2022 and June 2024 (Figure 2-1). These areas will be revisited and resurveyed during construction and after construction (operation phase) of the Proposed Action development, following the Proposed Actions Bird and Bat Management Plan (BBMP).

State Code 23 also requires Collision Risk Modelling (CRM) and Population Viability Analysis be conducted when a collision risk assessment identifies a risk to significant species, such as threatened birds, raptors and wetland birds. Following surveys conducted to date, no threatened species have been observed flying at heights considered at risk of collision and so collision risk for these species is not able to be modelled (see section 3.4.1.4). The Proponent has committed to further survey events prior to commissioning of the Proposed Action, meeting the 24-month requirement. Should suitable site utilisation data for listed threatened and/or migratory species, and any non-listed species, become available following these additional site assessments, updates to collision risk modelling and this BBMP will be undertaken. This will only be possible if the BACI designed surveys collect sufficient data to undertake this analysis. New draft guidance from DCCEEW on the management of birds and bats for onshore wind farms has detailed how CRM needs to be undertaken for listed threatened species (MNES) where risks from the Proposed Action, particularly collision risks, have been identified (DCCEEW, 2024). This CRM should consider a Study Area-wide assessment and identify high risk WTG as well as results from pre-commissioning surveys from a minimum period of 24 months.

In addition to the BUS, targeted threatened species surveys were also completed following the methods described below. All bird survey locations can be found on Figure 2-1.

2.2.1.1 POINT SURVEYS

Point surveys were conducted to target diurnal woodland and riparian bird species. Four ecologists during the October 2022 surveys, two ecologists during the February 2023 surveys, four ecologists during the March and June 2023 surveys, two ecologists during the September, October, December 2023 surveys and February 2024 and four ecologists during June 2024 survey traversed suitable woodland and riparian habitats and conducted 20-minute timed surveys for all birds in the area. This survey effort was targeted for listed threatened birds, and is additional to the BUS effort.

2.2.1.2 TRANSECT SURVEYS

Transect surveys were conducted in order to diurnal woodland and riparian bird species. Two ecologists during the February 2023 surveys, four ecologists during the March 2023 surveys and four ecologists during the June 2023 surveys traversed suitable riparian habitats and conducted transect walks for all birds in the area. This survey effort was targeted for listed threatened birds and is additional to the BUS effort.

2.2.1.3 WATERBODY SURVEYS

Waterbody surveys were conducted in order to target aquatic species and woodland species utilising the waterbody. Observations were made from a stationary position, and birds were identified by call detection and visual observations. The Study Area contained several artificial

waterbodies, likely to act as important water sources in the landscape, particularly during dry conditions. This survey effort was targeted for listed threatened birds, and is additional to the BUS effort.

2.2.1.4 BIRDS OF PREY SURVEYS

Birds of prey surveys were undertaken to target the listed threatened species as well birds of prey with potential to be impacted by the Proposed Action. Bird of prey surveys were undertaken at vantage points (i.e. large plateaus and extensively cleared areas) at mid-morning when birds of prey become increasingly active.

2.2.2 BAT SURVEY METHODS

Microbat surveys were conducted to determine the presence/absence of bats within and surrounding the Study Area, with four ultrasonic bat detectors (Anabats) placed throughout the relevant properties in the Study Area. The four Anabat devices were placed in 10 total locations throughout the Study Area over the October 2022, February and March 2023 field surveys. Anabats were not deployed during the June 2023 winter surveys. These devices were used to detect ultrasonic signals from bat species in the Study Area, for either two or four consecutive survey nights.

The bat detectors were placed across representative remnant vegetation/habitat types. This included riparian woodlands and eucalypt or acacia open forest or woodlands. The detectors were specifically placed in areas that were in close proximity to potential flight paths/water sources (farm dams) and in relative proximity to proposed turbine locations. The survey locations were selected on the basis that they provided the greatest likelihood of detecting an abundance and diversity of bat species.

The detectors were secured onto trees at approximately 1.8 m above the ground. They were collected and the information recorded on the Anabats was then analysed by a specialist to determine the species recorded.

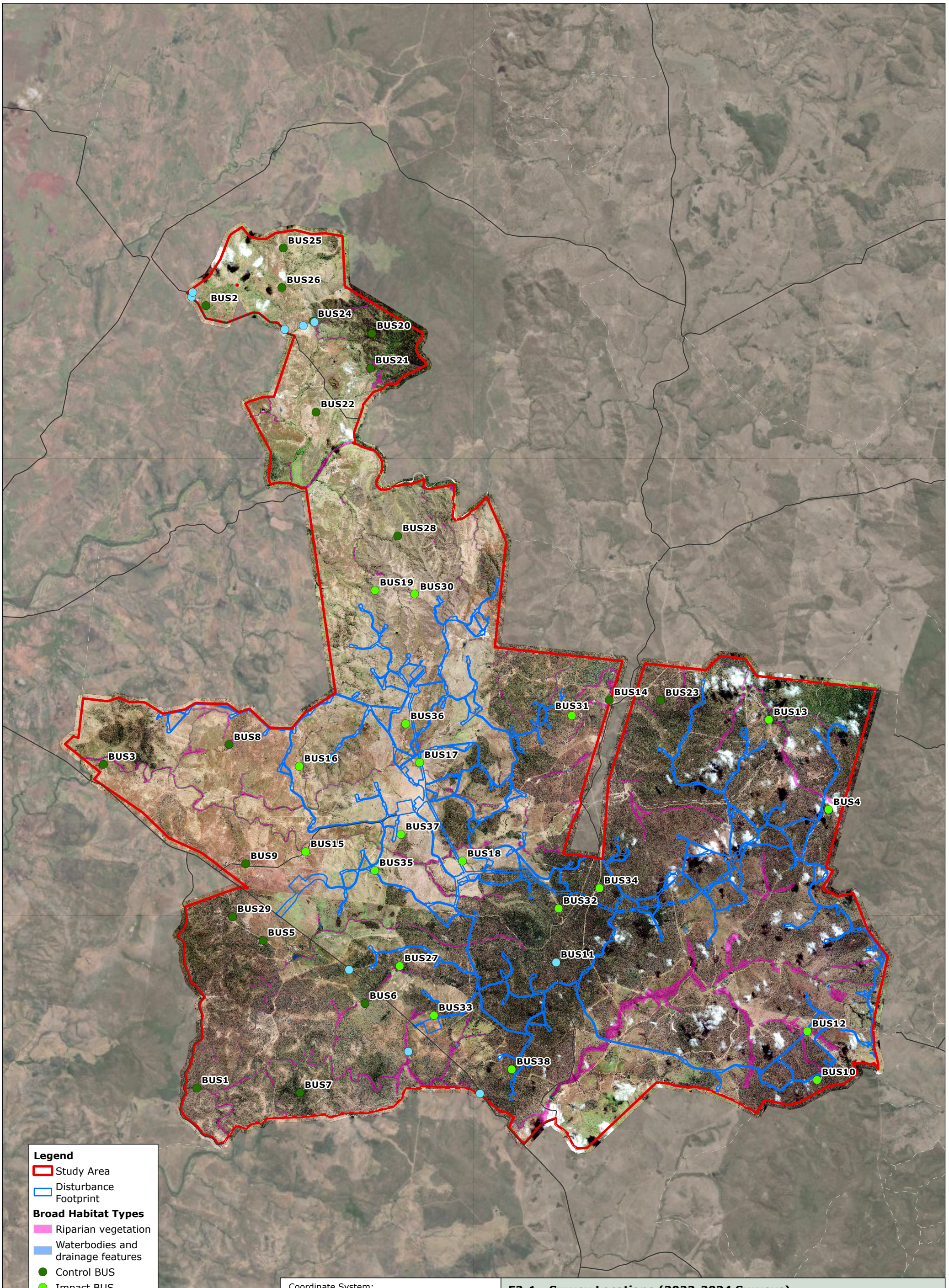
The BACI design has also been implemented for bat surveys (explained in Section 2.2.1), in order to identify any impacts on bats as a result of the Proposed Action, with control sites determined based on the current preliminary design and locations of WTGs.

The survey requirements and recommended survey effort and methods for bats is as follows:

- *Survey guidelines for Australia's threatened bats* (DEWHA, 2010)
    - Trapping methods such as harp traps are recommended. Such effort is not precisely stated, but studies have found that the use of 20 or more traps a night a good for detection (Schulz, 1999). Harp trapping was not utilised as the target species, ghost bat (*Macroderma gigas*), can be detected via various other methods including however not limited to acoustic monitoring and spotlighting.
    - Echolocation call detection to be carried out for a recommended 30-60 minutes per night for four to five survey nights Detectors were deployed to exceed these minimum requirements and set to record from dusk through to dawn during each sampling event.
    - Recommended that a variety of trapping and call detection methods are used together, where possible.

State Code 23 identifies that methods must be carried out to determine which bat species occur on the Study Area. It recommends the use of survey techniques including mist nets and/or bat detection systems that record and analyse echolocation calls of bats. The survey efforts involved the use of Anabats and spotlighting, thus meeting the State Code 23 requirement as well as the DEHA survey guidelines for Australia's threatened bats.

The full echolocation analyses for the Anabats deployed during the October 2022, February and March 2023 field investigations can be found in Appendix E, with a summary of species recorded in Appendix D. The bat survey locations are shown in Figure 2-1.



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2.2.3 BIRD SITE UTILISATION

A combined total of 127 species, including one listed threatened species, squatter pigeon (southern) (*Geophaps scripta scripta*) (EPBC Act listed, and NC Act listed), were identified across the 10 field surveys. Birds were recorded in a variety of habitats including non-native grasslands, eucalypt woodlands, riparian corridors and waterbodies. However, bird abundance was regarded as generally low across the Study Area. Additionally, field investigations confirmed the presence of numerous active and abandoned small and medium-sized nests within the Study Area.

Satin flycatcher (*Myiagra cyanoleuca*, known to occur in the Study Area) and rufous fantail (*Rhipidura rufifrons*, potentially occurring) were originally included in the referral information and assessed for potential impacts of the Proposed Action. Following recent changes to the EPBC Act Migratory Species list (*List of Migratory Species Amendment (1) Instrument 2024*, dated 11/09/2024), these species no longer require assessment under the EPBC Act as MNES and are therefore not assessed as part of this BBMP.

A detailed discussion of bird utilisation across the Study Area, and how this relates to the Proposed Action with regards to CRM, is provided in Section 3.2.

It is noted that the results of future bat surveys and any evidence of threatened, migratory or raptor species in the Study Area, will be incorporated into future risk assessments and CRM within the BBMP. Therefore, the principle of adaptive management will be applied to ensure that any future risks identified are adequately reported, analysed, and subsequently managed as per the framework in the BBMP.

2.2.3.1 LISTED THREATENED SPECIES KNOWN TO OCCUR

Squatter Pigeon (southern)

The squatter pigeon (southern) is listed as Vulnerable, under the EPBC Act, as of 16th July 2000. This species has been concluded as known to occur within the Study Area, as per the likelihood of occurrence (Appendix B). This species was successfully identified on three occasions during field surveys in October 2022, September 2023 and December 2023. All observations were made in the north to north-west section of the Study Area outside the Development Footprint.

Squatter pigeon is a ground-dwelling pigeon and can be differentiated from the northern subspecies by its larger body, and the skin around the eyes being predominantly blue-grey compared with yellowy-orange to orange-red in the northern subspecies (Crome, 1976; Ford, 1986; Higgins & Davies, 1996; Squatter Pigeon Workshop, 2011). The squatter pigeon inhabits open forests to sparse, open woodlands and scrub mostly dominated in the overstorey by *Eucalyptus, Corymbia, Acacia* or *Callitris* species, on sandy or gravelly soils, within approximately 3 km of a suitable, permanent or seasonal waterbody. Retention of these woodland canopy species which provide shelter from predatory birds is an important habitat factor for the squatter pigeon and is a notable distinction between the habitat value of open woodland compared to cleared land, which does not constitute important or critical habitat for the species.

Additional to presence of woodland canopy species, squatter pigeon conservation guidelines identify proximity to water as the most important determinant of habitat suitability, with open ground cover that permits ease of movement also crucial:

> *It is nearly always found near permanent water such as rivers, creeks and waterholes. Sandy areas dissected by gravel ridges, which have open and short grass cover allowing easier movement, are preferred (DCCEEW, 2015).*

Specifically in Queensland, foraging and breeding habitat is known to occur on well-draining, sandy or loamy soils on low, gently sloping, flat to undulating plains and foothills, and lateritic (duplex) soils on low 'jump-ups' and escarpments within 1 km of watercourses. The squatter pigeon nests on the ground where it forages for seeds among ground layers where these is sparse and low density grass cover. Suitable low grass cover for foraging will vary across the year in the Study Area, with cover reducing during dry the dry season. It roosts in low trees at night.

Habitat for the squatter pigeon has been delineated, based on the habitat requirements for the species, using the following broad habitat types (BHT) that delineate species habitat across the Study Area:

- Foraging And Dispersal Habitat:
  - Eucalypt woodland and open forest dominated by *E. crebra* with a grassy understorey; and
  - Brigalow woodlands, within 3 km of permanent or seasonal waterbodies.
  - Riparian woodland and open forests dominated by E*. tereticornis* often associated with stream channels, within 3 km of permanent or seasonal waterbodies.
- Breeding Habitat:
  - Eucalypt woodland and open forest dominated by *E. crebra* with a grassy understorey; and
  - Brigalow woodlands, within 1 km of permanent waterbodies.
  - Riparian woodland and open forests dominated by *E. tereticornis* often associated with stream channels, within 1 km of permanent waterbodies.
- Generally unsuitable habitat:
  - Vine forest/thickets and dry rainforest;
  - Waterbodies and drainage features; and
  - Grasslands and cultivated agricultural land.

There is a total of 9,575.4 ha of breeding habitat, 2,333.5 ha foraging and dispersal habitat and 34,864.6 ha generally unsuitable habitat within the Study Area. A habitat summary for the squatter pigeon (southern) is provided in Table 2-15, and habitat mapping is provided on Figure 2-2.

TABLE 2-16 SQUATTER PIGEON (SOUTHERN) HABITAT TYPES IN THE STUDY AREA

	Breeding Habitat	Foraging And Dispersal Habitat	Generally Unsuitable Habitat
Description	Low, open eucalypt woodland on well-draining, gravelly, sandy or loamy soils and escarpments within 1 km of permanent dams, watercourses and waterbodies.	Low, open eucalypt woodland on well-draining, gravelly, sandy or loamy soils and escarpments within 3 km of dam, watercourses and waterbodies.	Not suitable habitat includes areas either bereft of suitable roosting and shelter sites or areas that are too dense for movement.
Presence within the Study Area	Within 1 km of permanent waterbodies; • Eucalypt woodland and open forest dominated by *E. crebra* with a grassy understorey; • Brigalow woodlands; and • Riparian woodland and open forests dominated by *E. tereticornis* often associated with stream channels	Within 3 km of permanent and seasonal waterbodies; • Eucalypt woodland and open forest dominated by *E. crebra* with a grassy understorey; • Brigalow woodlands; and • Riparian woodland and open forests dominated by *E. tereticornis* often associated with stream channels	• Vine forest/thickets and dry rainforest; • Waterbodies and drainage features; and • Grasslands and cultivated agricultural land.
Total in the Study Area	9,575.4	2,333.5	34,864.6
Total in the Project Area	625.5	255.3	5,794.1

Legend

- Study Area
- Disturbance Footprint
- Project Area
- Squatter Pigeon (Southern) Observation

Squatter Pigeon (Southern) Habitat

- Breeding
- Foraging and Dispersal Habitat
- Road
- Track and Path

Coordinate System:
GDA2020 MGA Zone 56

Date: 27/05/2025
Created By: SP/HD
Drawing Size: A3

0 1 2 3km

1:125,000

F2-2 - Squatter Pigeon (Southern) Habitat and Occurrence in the Study Area

Theodore Wind Farm

Theodore Energy Development Pty Ltd

ERM

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2.2.3.2 LISTED THREATENED AND MIGRATORY BIRD SPECIES WITH POTENTIAL TO OCCUR

Five EPBC Act listed threatened or migratory species have been assessed as having the potential to occur within the Study Area as a result of the likelihood of occurrence (Appendix B). No signs or observations of these species were made within the Study Area during field surveys. However, species' presence within the Study Area cannot be ruled out due to overlapping distribution and suitable habitat occurring within the Study Area. Threatened and migratory species with potential to occur within the Study Area and their appropriate habitat are outlined in Table 2-17 mapped habitat for each potentially occurring threatened bird species is shown in Figure 2-3.

The two migratory species (white-throated needletail and fork-tailed swift) are considered to only utilise the arial space across the Study Area for foraging if they were to occur. As demonstrated in Figure 2-4, landscape features within the north of the Study Area (extending to the north and east outside of the Study Area) contain higher slope gradients, which may present a terrain that promotes the occurrence of suitable updrafts that might support foraging. The use of this landscape feature for potential foraging by these species cannot be ruled out, and as a result this area is considered to have the highest potential value for foraging for these species.

TABLE 2-17 EPBC ACT LISTED THREATENED AND MIGRATORY SPECIES WITH POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Species Name	Common Name	EPBC Act Status	Potential Habitat Mapped within the Study Area
Hirundapus caudacutus	White-throated needletail	V, Mi	Suitable foraging habitat occurs above the Study Area, as the species forages almost exclusively aerially. Due to the lack of elevated areas with dense canopy foliage and tall hollow-bearing trees and the general undulating nature of the landscape, with limited large and distinct areas of elevational change, the habitat in the Study Area is not deemed suitable for the species for roosting. As such, no habitat mapping has been completed for the white-throated needletail within the Study Area.
Turnix melanogaster	Black-breasted buttonquail	V	277.4 ha of Potential Foraging and Roosting Habitat is present within the Study Area, in the form of rainforest or closed forest ecosystems with presence of leaf litter.
Rostratula australis	Australian painted snipe	E	There is a total of 56.0 ha of Potential Foraging Habitat for the species in the Study Area, in the form of shallow terrestrial freshwater wetlands, waterbodies and drainage features.
Stagonopleura guttata	Diamond firetail	V	There is a total of 7899.3 ha of Potential Breeding and Foraging Habitat for the species in the Study Area, which consists of eucalypt, acacia or casuarina woodlands, open forests and other lightly timbered habitats.
Apus pacificus	Fork-tailed swift	Mi	Potential aerial foraging habitat over dry open habitats present. There is a lack of preferred coastal and riparian heathland for foraging and roosting. No habitat has been mapped due to the species likely being a flyover visitor only.

Status listing per EPBC Act: CE = Critically Endangered; V= Vulnerable; Mi = Migratory.
For the full reasoning for the potential outcomes for such species, refer to Appendix B.

2.2.3.3 RAPTORS

A total of seven (7) raptor species were observed during the field surveys, of which none are listed under the EPBC Act or NC Act:

- Brown falcon (*Falco berigora*);
- Black-shouldered kite (*Elanus axillaris*);
- Nankeen kestrel (*Falco cenchroides*);
- Spotted harrier (*Circus assimilis*);
- Whistling kite (*Haliastur sphenurus*);
- Peregrine falcon (*Falco peregrinus*); and
- Wedge-tailed eagle (*Aquila audax*).

Raptors are also known to utilise updrafts and variable air currents to support foraging behaviour. Therefore, the undulating landscape extending to the north and east outside of the Study Area (see Figure 2-4) is also considered to have a high value for foraging raptor species.

2.2.3.4 MIGRATORY FLYWAYS

The East Asia/Australasia Flyway is the most common and frequented flyway travelled by migratory shorebirds *en route* to, and within, Australia (BirdLife International, 2020). This flyway occurs over a total of 84,765,020 km^2 and occurs through 37 countries, including Australia (BirdLife International, 2020). This flyway extends from Arctic Russia and North America to the southern extents of Australia and New Zealand (BirdLife International, 2020). This flyway predominantly traverses the coastal extents of Australia, occasionally travelling inward through parts of South Australia and Western Australia (BirdLife International, 2020). When examining the records of the listed migratory shorebirds species from desktop searches, the vast majority of incidental records are consistent with the coastal routes of the East Asia/Australasia Flyway. Additionally, when examining the records of non-shorebird migratory birds, these species also generally traverse coastal areas.

Migratory flyways are known to correspond with the vast majority of Important Bird and Biodiversity Areas (IBAs). Such IBAs are globally known for their importance in bird conservation, particularly due to the number of migratory and/or threatened species that are found there. The East Asia/Australasia Flyway triggers a total of 1,184 migratory IBAs (BirdLife International, 2020), none of which occur within, or in close proximity to, the Study Area.

Therefore, it is concluded that the Study Area does not fall within an important flyway or IBA for migratory birds.

Legend

- Study Area
- Disturbance Footprint
- Potential Diamond Firetail Foraging Habitat
- Potential Australian Painted Snipe Foraging Habitat.
- Potential Black-breasted Buttonquail Foraging and Roosting Habitat
- Road
- Track and Path

Coordinate System:
GDA2020 MGA Zone 56

Date: 01/07/2025
Created By: SP
Drawing Size: A3

0 1 2 3km

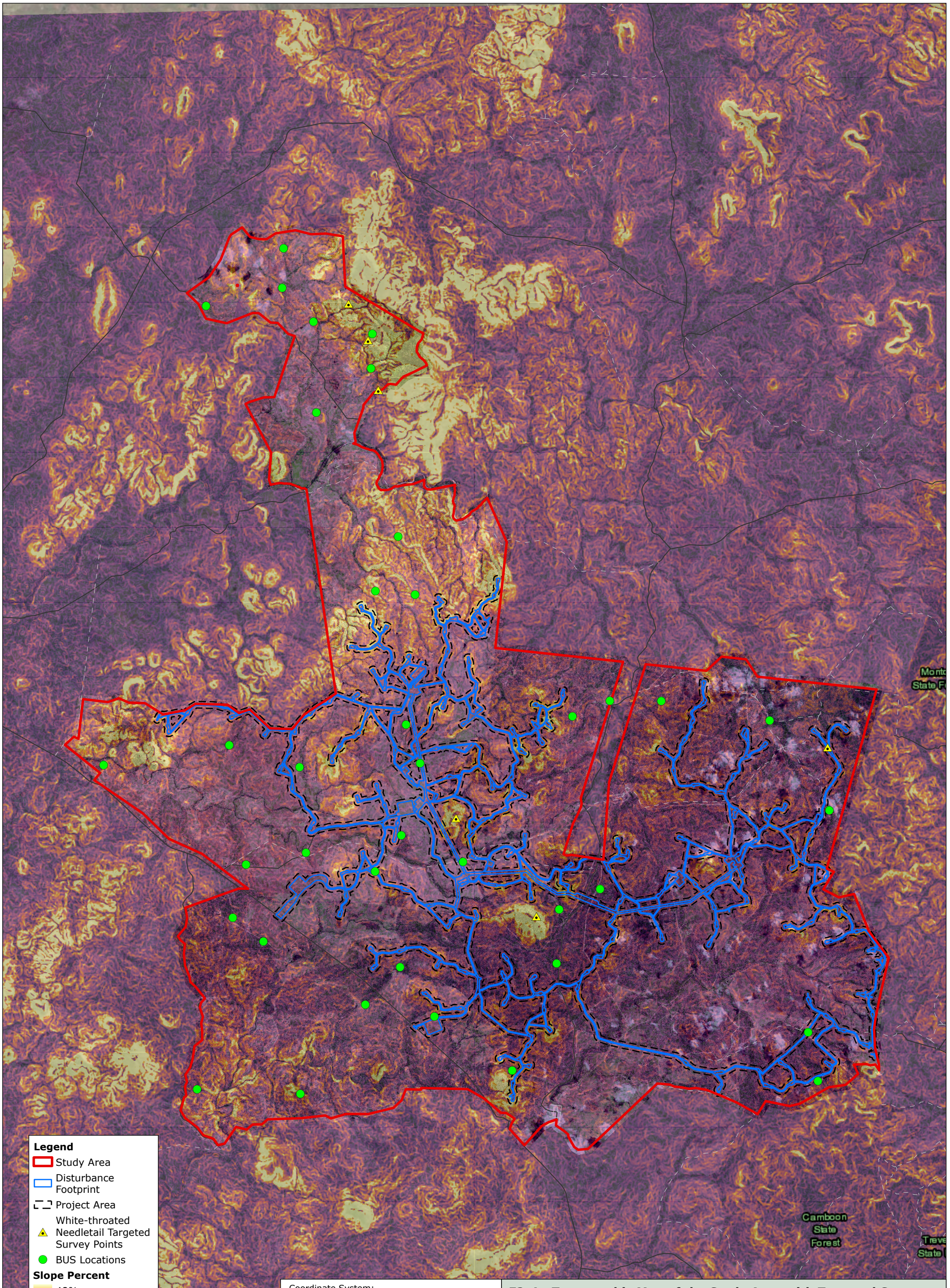
1:125,000

F2-3 - Potential Habitat For EPBC Act Listed Threatened Species Within the Study Area

Theodore Wind Farm BBMP

Theodore Energy Development Pty Ltd

ERM



F2-4 - Topographic Map of the Study Area with Targeted Survey Locations for the White-Throated Needletail and BUS Locations

Theodore Wind Farm

Theodore Energy Development Pty Ltd

ERM

2.2.4 BAT SITE UTILISATION

2.2.4.1 THREATENED BAT SPECIES SITE UTILISATION

In May 2024, the draft *Onshore Wind Farm Guidance - best practice approaches when seeking approval under Australia's national environment law* was published and opened for consultation (DCCEEW, 2024), which considers best practice to undertake at least 24 months of site utilisation surveys (for birds and bats) before assessment of a proposed wind farm can be completed and an approval decision made. Consultation was completed in July 2024, and the department advises it is currently reviewing all feedback received.

Considering the guidelines and recommendations available at the commencement of the Proposed Action's survey program, the field survey methodology and effort in potential habitat is considered adequate to detect the presence of threatened and at-risk bats, and subsequently map species habitat and conduct an accurate impact assessment.

The full echolocation analyses for the Anabats deployed during the October 2022, February and March 2023 field investigations can be found in Appendix E, with a summary of species recorded in Table 2-18. A total of 17 microbat species, and two microbat families (could not be identified to species level) were recorded in the Study Area. Call identification for this dataset was based on call keys and descriptions published for Queensland (Reinhold et al., 2001) and New South Wales (Pennay et al., 2004).

Species' identification was further refined using the probability of occurrence of each species based on their geographic distribution, with reliability of identification defined as:

- Definite - one or more calls where there is no doubt about the identification of the species;
- Probable - most likely to be the species named, low probability of confusion with species that use similar calls; and
- Possible - call is comparable with the named species, with a moderate to high probability of confusion with species of similar calls.

As outlined in the analysis of echolocations calls in Appendix B, where ambiguity occurs between species/families calls, further justification of species identification is provided. For example, probable *Nyctophilus* species were identified, and subsequent assessment indicated that they were likely to be the calls of *N. geoffroyi* and *N. gouldii*, neither of which are listed threatened species under the EPBC Act or NC Act. Further, the report also indicated that such calls are often confused with *Myotis macropus* microbats, which have been recorded in the Study Area.

There are three listed threatened bat species identified in the PMST (Appendix A) as *species or species habitat may occur*, which are:

- Large-eared pied bat (*Chalinolobus dwyeri*);
- Corben's long-eared bat (*Nyctophilus corbeni*); and
- Ghost bat (*Macroderma gigas*).

As a result of the likelihood of occurrence assessment (Appendix B), ghost bat and Corben's long-eared bat are considered unlikely to occur. Ghost bat is considered unlikely to occur as the Study Area does not contain suitable breeding, roosting or foraging habitat, being deep cervices with stable temperatures and relatively high humidity. Additionally, the Study Area does not provide suitable roosting habitat for the Corben's long-eared bat, and as such, the

species is considered unlikely to occur. The LoO assessment did assess the large-eared pied bat as likely to occur. Audio detection is the preferred method of detection for each of the three species. Audio detection was recorded as "probable" for the large-eared pied bat, with no other listed species calls confirmed from the Anabat data analysis.

TABLE 2-18 SUMMARY OF ECHOLOCATION ANALYSIS RESULTS

Scientific Name	Common Name	EPBC Act Status	NC Act Status	Survey Period Identified	Reliability of identification
Austronomus australis	White-striped free-tailed bat	-	LC	October 2022, February and March 2023	Definite
Chaerephon jobensis	Northern free-tailed bat	-	LC	October 2022, February and March 2023	Definite (March) Probable (October and February)
Chalinolobus dwyeri	Large-eared pied bat	V	VU	February and March 2023	Probable
Chalinolobus gouldii	Gould's wattled bat	-	LC	October 2022, February and March 2023	Definite (one Anabat with Probable)
Chalinolobus morio	Chocolate wattled bat	-	LC	February and March 2023	Probable (one Anabat with definite)
Chalinolobus nigrogriseus	Hoary wattled bat	-	LC	October 2022, February and March 2023	Definite
Miniopterus australis	Little bent-wing bat	-	LC	March 2023	Probable
Miniopterus orianae[1]	Large bent-wing bat	-	LC	October 2022, February and March 2023	Probable
Myotis macropus	Southern myotis	-	LC	October 2022, February and March 2023	Possible
Nyctophilus sp	Long-eared bat species	-	LC	October 2022, February and March 2023	Possible
Ozimops lumsdenae	Molossid bat	-	LC	October 2022, February and March 2023	Possible
Ozimops ridei	Molossid bat	-	LC	October 2022, February and March 2023	Definite (October 2022, February 2023) Probable (March 2023)
Rhinolophus megaphyllus	Smaller horseshoe bat	-	LC	October 2022, February and March 2023	Definite
Saccolaimus flaviventris	Yellow-bellied sheathtail bat	-	LC	March 2023	Definite
Scotorepens balstoni	Inland broad-nosed bat	-	LC	October 2022, February and March 2023	Definite

Scientific Name	Common Name	EPBC Act Status	NC Act Status	Survey Period Identified	Reliability of identification
Scotorepens greyii	Little broad-nosed bat	-	LC	October 2022, February and March 2023	Probable
Scotorepens sp.	Broad-nosed bat species	-	LC	October 2022, February and March 2023	Probable
Setirostris eleryi	Bristle-faced free-tailed bat	-	LC	October 2022, February and March 2023	Probable
Taphozous troughtoni	Troughton's sheathtail bat	-	LC	October 2022, February and March 2023	Definite
Vespadelus troughtoni	Eastern cave bat	-	LC	October 2022	Probable
Vespadelus vultumus	Little forest bat	-	LC	October 2022, March 2023	Possible

The free-tailed bats recorded (family *Molossidae*) include white-striped free-tailed bat (*Austronomus australis*), northern free-tailed bat (*Chaerephon jobensis),* mossolid bats (*Ozimops ridei* and *Ozimops lumsdenae*), bristle-face free-tailed bat (*Setirostris eleryi*). Australian molossids have been recorded in a variety of habitats, including form closed forest to deserts. To be suitable habitat for free-tailed bats, habitat must supply roosting sites which can including buildings, hollow trees or rock crevices in rocky outcrops, riverbanks or stones. Free-tailed bats feed on a range of insects from moths to hard-shelled beetles (Allison, 1989).

The wattled bats recorded, including Gould's wattled bat (*Chalinolobus gouldii*), chocolate wattled bat (*Chalinolobus morio*) and hoary wattled bat (*Chalinolobus nigrogriseus*), occupy a wide range of habitats, including forests and woodlands and typically roost in tree hollows. Wattled bats prefer a diet of moths and beetles, however, they will feed on other insects if available (Churchill, 2008).

The bent-winged bats recorded, including little bent-wing bat (*Miniopterus australis*) and large bent-wing bat (*Miniopterus orianae)*, occupy well-timbered habitats, often in wetter areas or in close proximity to water features. Bent-winged bats species typically roost in caves or other man-made structures and show a dietary preference for moths (Churchill, 2008).

Nyctophilus species are found over a variety of habitats. The lesser long-eared bat (*Nyctophilus geoffroyi*) occupies tropical to alpine woodlands, mangroves, urban areas, wet and dry sclerophyll forests and rain forests (Churchill, 2008). Corben's long-eared bats (*Nyctophilus corbeni*) are found within semi-evergreen vine thicket, dry sclerophyll forests, Callitris forest and open forests with poplar box (Churchill, 2008). The Study Area does not provide suitable roosting habitat for the Corben's long-eared bat, and as such, the species is considered unlikely to occur. The eastern long-eared bats (*Nyctophilus bifax*) reside under the loose bark of melaleuca, in tree hollows as well amongst dense foliage of vegetation. Gould's long-eared bat (*Nyctophilus gouldi*) is a generalist and resides across a range of wet and dry sclerophyll forests and woodlands, roosting under loose bark and in tree hollows (Menkhorst, 2011).

The large-eared pied bat habitat requirements have been discussed in the following section and Appendix E.

The yellow-bellied sheathtail bat (*Saccolaimus flaviventris*), has a diet preference for beetles, and is found in nearly all habitats, utilising large tree hollows for roosting (Armstrong & Lumsden, 2017). Very little is known about Troughton's sheathtail bat (*Taphozous troughtoni*), this species is only found in Australia (Tate, 1952). The species roosts in caves and mines and the species is highly vulnerable to disturbance from human visitors as well as habitat clearing and land degradation as a result of agricultural practices (Tate, 1952).

The little forest bat (*Vespadelus vultumus*) was recorded in the Study Area. Forest bats live predominantly in eucalypt forests which are present in the Study Area and can also be found in subalpine woodland to alpine moors, where they feed upon insects and spiders and may roost in hollows of old eucalypts (Hall, 2008).

Broad nosed bats have been detected by the Anabats within the Study Area. The little broad-nosed bat (*Scotorepens greyii*) roosts in hollows in old, unused buildings, inside hollow fence posts. Broad-nosed bats are insectivores (Churchill, 2008).

The southern myotis (*Myotis macropus*) roost in tree hollows, caves, mines, culverts and under bridges, often close to water (Law & Anderson, 1999).

The eastern cave bat (*Vespadelus troughtoni*) lives in caves that occur along Australia's east coast as well as caves that are found next to inland ranges (Ellis, 2001).

Large-eared pied bat

The large-eared pied bat is listed as Endangered under the EPBC Act, as of 15th November 2023. This species has been concluded as likely to occur within the Study Area as per the likelihood of occurrence (Appendix B), due to 'probable' recordings of the species that were produced from Anabats deployed in four locations throughout the Study Area across multiple survey events.

A total of 10 Anabats were deployed over three of the eight surveys for a total of 40 trapping nights. A total of 175 habitat and vegetation assessments were completed over the eight surveys and identified suitable habitat of ironbark woodlands close to a waterbodies where 'probable' large-eared pied bat calls were recorded. Additionally, the Study Area is within the range for the species and contains habitat suitable for large-eared pied bat survival (as evidenced by species presence), as further explained below.

The large-eared pied bat is a medium-sized bat that is found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland, down south to Bungonia in the NSW Southern Highlands (DERM, 2011). Large-eared pied bat prefers a specific intersection of habitat traits which makes habitat for the species both uncommon and susceptible to clearing-related impacts. Per the conservation guidelines for the species:

> *Large-eared pied bat has close association with the presence of sandstone escarpment (for roosts) and fertile valleys (for foraging), particularly where the valleys support box gum woodland. This is a relatively restricted combination of habitat factors, and the extent of woodlands on fertile soils within its range has been greatly diminished by clearing (Pennay, 2008*).

Escarpments provide roosting habitat for this species, with the availability of diurnal roost options an important indicator of habitat suitability. Large-eared pied bat prefers rhyolite cliffs and caves for roosting purposes, although geology is secondary to presence of suitably deep and high caves and overhangs which provide shelter from natural disturbances (DCCEEW, 2021). There are no deep caves or overhangs within the Study Area, so there is an absence of roosting and breeding habitat, however the species may utilise habitats for foraging.

Fertile valleys and vegetated areas provide foraging habitat for large-eared pied bat, with riverine and riparian corridors being identified as favourable for the insectivorous species. The species has been recorded foraging in canopied vegetation communities of various descriptions including dry and wet sclerophyll forest, grassy woodland, *Callitris* dominated forest, tall open eucalypt forest with a rainforest sub-canopy, subtropical rainforest and small clearings adjacent to rainforest (DCCEEW, 2021).

Though not confirmed, the majority of records in canopied woodland indicates a sensitivity to broadscale land clearing. However, narrow connecting riparian strips in otherwise cleared habitat are sometimes quite heavily used (DCCEEW, 2024). Habitat within the Study Area for this species can likely be defined as woodland foraging habitat within a proximity of several kilometres to potential roosting habitat as it is stated that that "Almost all records are within several kilometres of cliff lines or rocky terrain and it is likely that critical foraging resources are also located in these areas" (DAWE, 2021).

There are areas of potential steep, rocky terrain located to the north of the Study Area around Belmont State Forest, to the west of the Study Area at Isla Gorge and to the east at Kroombit Tops National Park. Belmont State Forest is located adjacent to the Study Area, while Isla Gorge is located over 40 km to the west and Kroombit Tops National Park over 60 km to the north-east from the Study Area. Potential bat roost caves and cliffs at Isla Gorge National Park and Kroombit Tops National Park are located beyond the likely distance the species will move during nightly foraging activities. Due to the proximity of Belmont State Forest to the northern boundary of the Study Area, there is a potential that areas of steep terrain may support roosting bats in this location that utilise the Study Area for foraging.

Habitat for the large-eared pied bat has been delineated, based on the habitat requirements for the species, using the following broad habitat types (BHT) that delineate species habitat across the Study Area:

- Foraging Habitat:
  - Eucalypt woodland and open forest dominated by *E. crebra* with a grassy understorey; and
  - Riparian woodland and open forest dominated by *E. tereticornis* often associated with stream channels.
- Generally unsuitable habitat:
  - Vine forest/ thickets and dry rainforest;
  - Waterbodies and drainage features;
  - Grasslands and cultivated agricultural land; and
  - Brigalow woodlands dominated by *Acacia harpophylla*.

As specific roosting habitat has not been directly observed within or surrounding the Study Area despite surveys, determining a specific distance from roosting habitat to define potential

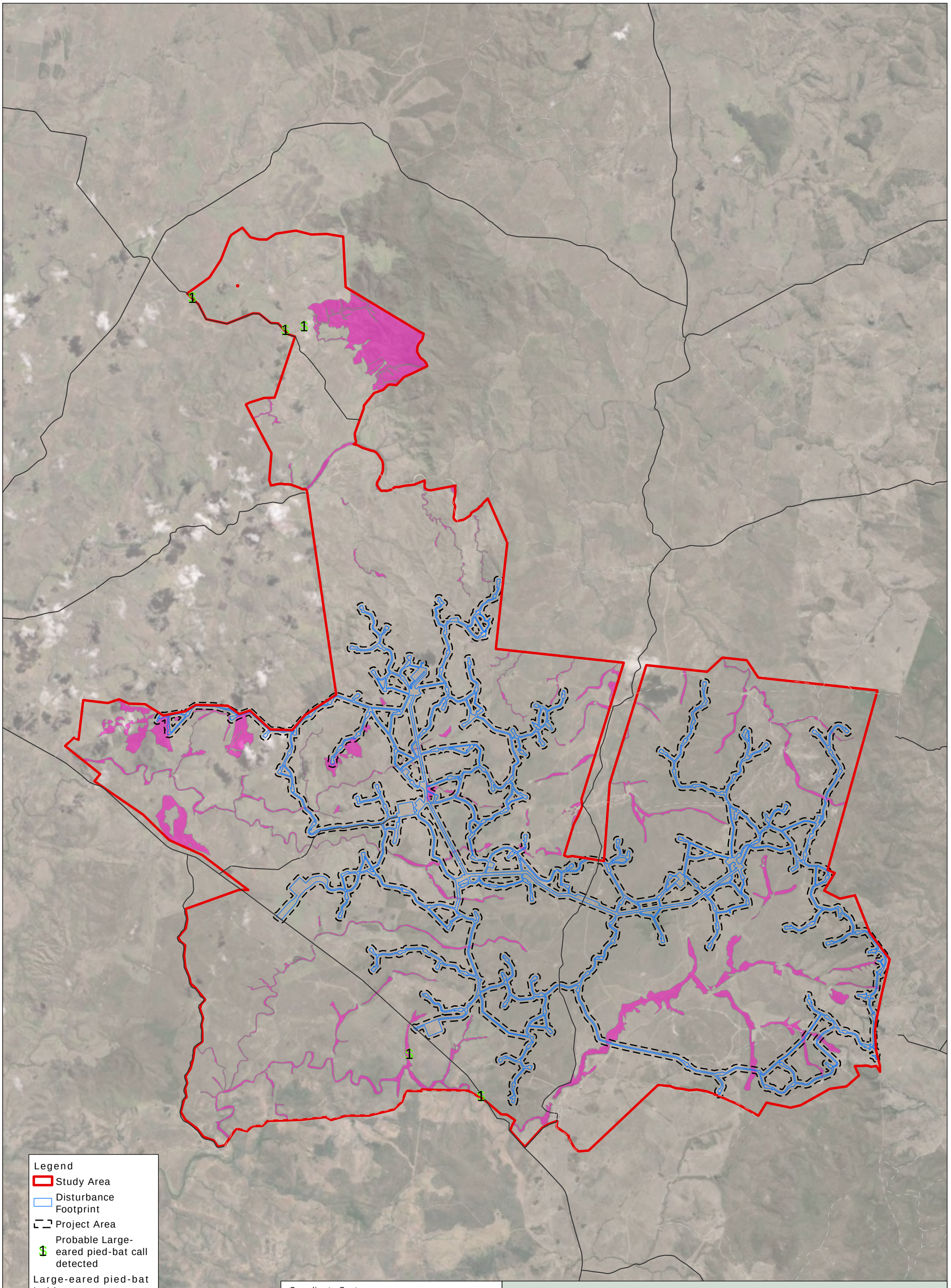
foraging habitat cannot be undertaken. To be conservative, the preferred riverine and riparian corridor habitat of the species has been mapped across the entire Study Area as potential foraging habitat.

Additionally, one location within the north of the Study Area has been identified to potentially contain suitable roosting habitat for the species due to the potential for cliff lines and steep, rocky terrain (as shown in Figure 2-4). It should be noted that although no suitable roosting habitat features were observed within the Study Area during field surveys, this identified higher slope area extends to the east and north of the Study Area where surveys did not occur and therefore the utilisation of this area as potential roosting habitat cannot be discounted. As such, the open eucalypt forest habitat within this identified area in the north that may contain potential roosting habitat has also been included within the species habitat mapping.

There is a total 2,856.1 ha Foraging Habitat, and 43,917.3 ha of generally unsuitable habitat, within the Study Area. No roosting habitat for this species was identified within the Study Area, however there is potential for such habitat to occur in the Locality. Mapped habitat for the large-eared pied bat is shown on Figure 2-5, with habitat types summarised below in Table 2-19.

TABLE 2-19 LARGE-EARED PIED BAT HABITAT SUMMARY IN THE STUDY AREA

	Foraging Habitat	**Generally Unsuitable Habitat**
Description	Fertile valleys and vegetated areas, riverine and riparian corridors, dry and wet sclerophyll forest and grassy woodland.	Cleared areas are likely to constitute unsuitable habitat, with Acacia woodland also not suitable within the Study Area. Though the species has been recorded foraging in subtropical and dry rainforest, vegetation communities within the Study Area are of generally low quality and do not form suitable habitat.
Presence within the Study Area	• Riparian woodland and open forest dominated by *E. tereticornis* often associated with stream channels; and • Eucalypt woodland and open forest dominated by *E. crebra* with a grassy understorey on steep slope gradients within the north of the Study Area.	• Vine forest/ thickets and dry rainforest; • Waterbodies and drainage features; • Grasslands and cultivated agricultural land; • Brigalow woodlands dominated by *Acacia harpophylla*; • All other areas of Eucalypt woodland and open forest dominated by *E. crebra* with a grassy understorey.
Total in the Study Area	2,856.1 ha of Foraging Habitat	43,917.3 ha of generally unsuitable habitat



F2-5 Large-eared Pied Bat Habitat and Occurrence in the Study Area

Theodore Wind Farm PER

Theodore Energy Development Pty Ltd

ERM

2.3 IMPACTS TO LISTED THREATENED AND MIGRATORY SPECIES

2.3.1 IMPACTS TO SQUATTER PIGEON (SOUTHERN)

The squatter pigeon (southern) is listed as Vulnerable, under the EPBC Act, as of 16th July 2000, and is known to occur within the Study Area. This species was successfully identified on one occasion during field surveys in October 2022 survey at a farm dam located in the northern section of the Study Area, on one occasion during the September/October 2023 survey in the north-western section of the Study Area, and on one occasion during December 2023 survey.

The breeding, foraging and dispersal habitat requirements for the species, as well the habitat presence within the Study Area has been detailed as part of Section 1.3. Habitat mapping is presented on Figure 2-2.

Squatter pigeons are commonly observed foraging on roadsides and dirt tracks (DCCEEW, 2024). It is expected that 33.3 ha of impacted Foraging and Dispersal Habitat will be revegetated after the construction phase. Revegetation is expected to return the functionality required for the squatter pigeon in Foraging and Dispersal Habitat and therefore this impact is considered temporary. The direct impact to squatter pigeon (southern) has been detailed in Table 2-20.

TABLE 2-20 DIRECT IMPACTS TO THE SQUATTER PIGEON (SOUTHERN)

	Breeding Habitat	Foraging and Dispersal Habitat
Total Amount of Habitat to be Impacted (ha)	128.3	57.6
% Amount of Total Habitat to be Impacted	0.8%	0.7%
Permanent Impact (Operations Footprint) (ha)	128.3	24.2

Quality of Habitat to be Impacted	It is important to note that habitat for this species is differentiated between breeding and foraging and dispersal habitat only from the aspect of 'distance from water' (i.e., the habitat for all functions is the same, however breeding habitat is mapped closer to water).
	Quality of habitat for this species varies in condition across the Study Area. Mapped as the associated vegetation communities within 3 km to water:
	• *Eucalyptus crebra*. +/- *Corymbia* spp. dominated open woodland associated with plateaus
	  ◦ Condition of this habitat varies across the Study Area. Areas with more living trees, more juvenile trees and a thicker ground cover are of good condition. Other areas with a higher amount of stags and a degraded ground cover were of poor condition.
	• *Acacia cambagei* +/- *Acacia* spp. dominated open forest or woodland
	  ◦ Quality of this habitat is typically moderate due to its steep and rocky nature preventing it from being over grazed like other habitat types.
	• *Astrebla* spp. dominated grassland
	  ◦ Higher rates of degradation due to high pressures from cattle grazing, therefore quality is poor.
	Quality and quality of habitat is less relevant to this species, as it shows a preference for degraded and impacted areas and its requirement to be close to a water source.	

2.3.1.1 SIGNIFICANT IMPACT ASSESSMENT

The Proposed Action in the Study Area is likely to result in a significant impact to the squatter pigeon (southern).

A total of 11,908.9 ha of squatter pigeon habitat has been mapped to occur within the Study Area, including 9,575.4 ha of Breeding Habitat and 2,333.5 ha of Foraging and Dispersal Habitat. A total 152.5 ha of habitat is expected to be permanently impacted as a result of the Proposed Action, which includes:

- 128.3 ha of Breeding Habitat; and
- 24.2 ha of Foraging and Dispersal Habitat.

A significant impact assessment based on the guidance provided in the SIG 1.1 is presented in Table 2-21. It has been concluded that the Proposed Action is **likely** to have a significant impact on the squatter pigeon.

TABLE 2-21 SIGNIFICANT IMPACT ASSESSMENT FOR THE SQUATTER PIGEON (SOUTHERN)

Criteria	Description	Criteria Triggered?
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;	Squatter pigeon (southern) is known to occur within the Study Area. The species' SPRAT profile (DCCEEW, 2024b) outlines that all sub-populations occurring south of the Carnarvon Ranges in Central QLD are considered important sub-populations of the subspecies. This includes, but is not limited to: • Populations occurring in the Condamine River catchment and Darling Downs of southern Queensland; • Populations known to occur in the Warwick-Inglewood-Texas region of southern Queensland; and • Any populations potentially occurring in northern NSW. The Study Area is situated in relatively close proximity to the Carnarvon Ranges and the conservation-significant southern extent of the subspecies occurrence. Based on a conservative approach, the population utilising habitat within the Study Area is considered an important population. A total of 128.3 ha (0.8%) of squatter pigeon Breeding Habitat and 57.6 ha (0.7%) of Foraging and Dispersal Habitat is expected to be disturbed during construction. After post-construction rehabilitation, which is expected to return the functionality required for the squatter pigeon foraging and dispersal, the Proposed Action is expected to impact only 0.3% of all available Foraging and Dispersal Habitat within the Study Area. Further to this, squatter pigeon has an observed tendency to inhabit disturbed and partially disturbed areas. Therefore, the Proposed Action is unlikely to lead to a long-term decrease in the size of an important population.	Unlikely

Criteria	Description	Criteria Triggered?
Reduce the area of occupancy of an important population;	Squatter pigeon (southern) has an area of occupancy that is roughly estimated at 10,000 km^2, with a presumed low reliability in this figure (Garnett & Crowley, 2000). All sub-populations occurring south of the Carnarvon Ranges in Central QLD are considered important sub-populations of the subspecies, which includes populations occurring in the Condamine River catchment, Darling Downs region, Warwick-Inglewood-Texas region, and northern NSW (DCCEEW, 2024b). The Proposed Action will lead to a permanent impact to 0.8% of all available Breeding Habitat and 0.3% of all available Foraging and Dispersal Habitat within the Study Area, resulting in the disturbance to <0.01% of the sub-species total area of occupancy. Three individual observations of the species have been made across the Study Area. Additionally, based on a conservative approach, the Study Area falls within the conservation-significant southern extent of the species occurrence south of the Carnarvon Ranges, making the impacted population an 'important sub-population.' The linear nature of the Proposed Action and the retention of the majority of the squatter pigeon habitat in the Study Area will allow the persistence of the species. Therefore, it is likely with implemented mitigation measures such as pre-clearance surveys and micro-siting (see Section 7), impacts associated with the Proposed Action are unlikely to reduce area of occupancy for an important population of this species.	Unlikely
Fragment an existing important population into two or more populations;	Clearing associated with the Proposed Action will largely occur within small, isolated WTG locations, or narrow linear areas within the Disturbance Footprint. The nature of the proposed clearing will ensure that southern squatter pigeon remains connected, both within and outside of the Study Area. Permanent disturbance to 0.8% of all available Breeding Habitat and 0.3% of all available Foraging and Dispersal Habitat within the Study Area are unlikely to fragment populations of this species due to southern squatter pigeon's comfort dispersing through disturbed areas.	Unlikely
Adversely affect habitat critical to the survival of a species;	A total of 11,908.9 ha of squatter pigeon habitat has been mapped to occur within the Study Area. Based on a conservative approach, the Study Area falls within the conservation-significant southern extent of the species occurrence south of the Carnarvon Ranges, making the impacted population an 'important sub-population.' Additionally, this habitat provides foraging and breeding function to the species. Due to the identified foraging and breeding habitat, and that the population of squatter pigeon within the Study Area potentially constitutes an 'important sub-population,' it has been considered likely the Study Area supports habitat critical to the survival of the species.	Likely

Criteria	Description	Criteria Triggered?
	Therefore, the projected permanent impact to 128.3 ha (or 0.8%) of all available Breeding Habitat and 24.2 ha (or 0.3%) of all available Foraging and Dispersal Habitat is considered likely to adversely affect habitat critical to the survival of the species.	
Disrupt the breeding cycle of an important population;	A total of 128.3 ha (or 0.8%) of all available squatter pigeon Breeding Habitat is expected to be impacted within the Study Area during construction. Considering the retention of connectivity values, the species' ability to breed throughout the year (DCCEEW, 2024b), and the implementation of micro-siting at planned infrastructure sites, it is unlikely that the breeding cycle of southern squatter pigeon will be disrupted by the Proposed Action.	Unlikely
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;	A total of 128.3 ha (or 0.8%) of southern squatter pigeon Breeding Habitat and 57.6 ha (or 0.7%) of Foraging and Dispersal Habitat is expected to be disturbed during construction. After post-construction rehabilitation, which is expected to return the functionality required for the squatter pigeon foraging and dispersal, the Proposed Action is expected to impact only 0.3% of all available Foraging and Dispersal Habitat within the Study Area. It is expected that the small areas of disturbance in the larger context of the landscape will not remove, isolate or decrease the quality of habitat to an extent that would result in species decline.	Unlikely
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;	Invasive species such as feral cats (*Felis catus*) and European red foxes (*Vulpes vulpes*) are common pests encountered in Queensland and are particularly harmful to native threatened birds. These invasive species are known to occur in the Study Area. The Proposed Action will adopt and follow a Biosecurity Plan, as outline in Section 7. The activities related to the Proposed Action, both during construction and operation, will implement and follow biosecurity measures to reduce the risk of introducing new invasive species and to prevent the further spread of existing invasive species.	Unlikely
Introduce disease that may cause the species to decline; or	There is currently limited evidence of diseases causing detrimental effects on southern squatter pigeon populations in Queensland. There is also no evidence to suggest the proposed disturbance would introduce a disease that would cause the species to decline. Additionally, precautions will be taken to ensure that the spread of disease does not occur. This includes following biosecurity measures as part of a Biosecurity Plan (see Section 7).	Unlikely
Interfere substantially with the recovery of the species.	The Proposed Action is expected to result in permanent impacts to 128.3 ha (0.8%) of Breeding Habitat and 24.2 ha (0.3%) of Foraging and Dispersal Habitat within the Study Area.	Unlikely

Criteria	Description	Criteria Triggered?
	There are no formally adopted recovery plans for this species. However, it is considered that the mostly linear nature of disturbance of habitat within the Study Area will not affect the recovery of this species. Clearing will not adversely affect retained areas of suitable habitat, and mitigation measures such as micro-siting and pre-clearance surveys will be utilised. This will enable the species to continually traverse the landscape, ensuring genetic viability of the population. The Proposed Action is also unlikely to restrict access or limit the availability of current breeding habitat adjacent to known waterbodies such as farm dams and watercourses. While there is potential the population within the Study Area constitutes an 'important sub-population' of squatter pigeon, with the above avoidance and mitigation measures enacted, it is unlikely the Proposed Action will interfere substantially with the recovery of the species.	
Significant Impact: Likely		

2.3.2 IMPACTS TO LARGE-EARED PIED BAT

The large-eared pied bat is listed as Endangered, under the EPBC Act. This species has been concluded as likely to occur within the Study Area as per the likelihood of occurrence (Appendix B) due to several 'probable' recordings of the species that were produced from Anabats deployed throughout the Study Area.

The habitat requirements for the species, as well the habitat presence within the Study Area has been detailed as part of Section 2.2.4.1. Habitat mapping is presented on Figure 2-5.

Table 2-22 shows that direct impacts will result in a reduction in the total amount of habitat available for the species in the Development Footprint. Therefore, such direct impacts will be considered as part of the significant impact assessment for this species.

TABLE 2-22 DIRECT IMPACTS TO THE LARGE-EARED PIED BAT

	Foraging Habitat
Total Amount of Habitat within Study Area	2,856.1 ha
Total amount of Habitat to be Impacted	16.5 ha
% Amount of Total Habitat to be Impacted	0.6%
Quality of Habitat to be Impacted	• Riparian woodland and open forest dominated by *Eucalyptus populnea*, E. *tereticornis* often associated with stream channels. ○ This habitat was generally of moderate to poor condition due to presence of weedy species of grasses and shrubs such as L*antana camara* and erosion caused by cattle, high grazing pressures.

	Foraging Habitat
	• Eucalypt woodland and open forest dominated by *E. crebra* with a grassy understorey ○ The trees present may provide habitat for birds and mammals. However, habitat for arboreal mammals is likely to be sparse due to the limited amount of hollow bearing and mature trees observed within the Study Area. ○ The ground layer largely consists of natives such as *Aristida* spp. (wire grass)*, Heteropogon* sp. grass), and *Bothriochloa decipiens.*

2.3.2.1 SIGNIFICANT IMPACT ASSESSMENT

The Proposed Action is considered unlikely to result in a significant impact to the large-eared pied bat.

There is a total of 2,856.1 ha large-eared pied bat Foraging Habitat within the Study Area. A total of 16.5 ha of large-eared pied bat habitat is expected to be permanently impacted as a result of the Proposed Action. No roosting habitat was identified, however due to the proximity of Belmont State Forest and Mount Tam to the northern boundary of the Study Area, there is potential that areas of steep terrain may support roosting bats in this location that utilise the Study Area for foraging. No record of the species occurs within the Study Area or the Locality, with the closest record occurring within Presho State Forest, over 100 km to the west of the Study Area (ALA, 2024).

A significant impact assessment based on the guidance provided in the SIG 1.1 is presented in Table 2-24. It has been concluded that the Proposed Action is unlikely to have a significant impact on the large-eared pied bat.

TABLE 2-23 SIGNIFICANT IMPACT ASSESSMENT FOR THE LARGE-EARED PIED BAT BASED ON GUIDANCE PROVIDED IN THE SIG 1.1

Criteria	Description	Criteria Triggered?
An action is likely to have a significant impact on an 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 Study Area likely provides foraging resources to support large-eared pied bat, however there is an absence of suitable caves for roosting. The species is considered likely to occur within the Study area due to the detection of 'probable' recordings of the species by Anabat recording devices deployed across the Study Area during multiple field surveys. A total of 2,856.1 ha of Foraging Habitat for large-eared pied bat (6.1% of the Study Area) has been identified and mapped within the Study Area, with a total of 16.5 ha of Foraging Habitat (0.6% of all Foraging Habitat within the Study Area) projected to be impacted as a result of the Proposed Action. Given the 'probable' recording locations of the species within the Study Area, there is potential for large-eared pied bat to occur within the Locality, with roost sites outside the Study Area. As no roosts sites were identified within the Study Area, impacts as a result of the Proposed Action are limited	Unlikely

Criteria	Description	Criteria Triggered?
	to loss of foraging habitat only. As no known roosts are likely to be impacted, and the large availability of foraging habitat retained in the Study Area, impacts to habitat associated with the Proposed Action are considered unlikely to lead to a long-term decrease in the size of the population. The total population size for large-eared pied bat likely ranges between 10,000 and 20,000 individuals (DCCEEW, 2023a). The Indicative Significant Impact Threshold (0.1% of population) for large-eared pied bat adopted for the Proposed Action is 20 mortalities over a five-year period. If this threshold is reached, adaptive management outlined in the BBMP will be implemented to determine the contribution factors and mitigate risk to large-eared pied bat associated with the operation of the Proposed Action's WTGs. It is therefore considered unlikely that the operational phase of Proposed Action will lead to a long-term decrease in the size of the population.	
Reduce the area of occupancy of the species;	The estimated area of occupancy of large-eared pied bat is 1,500 km^2 (150,000 ha), of which the Study Area occurs at the northern-most extent (DCCEEW, Conservation Advice for Chalinolobus dwyeri (large-eared pied bat), 2023a). Area of occupancy for the species is determined by total area of know maternity roost sites, which provide an essential roosting, sheltering and breeding function for the species (DCCEEW, 2023). No roosting habitat is mapped to occur within the Study Area, however likely recordings of the species across multiple locations and multiple survey events indicate the possibility for large-eared pied bat roosting habitat within the Locality. Vegetation clearance in the proximity of roosts is identified as a key threat to large-eared pied bat in the species' conservation advice (DCCEEW, 2023). The Proposed Action is projected to impact a total of 16.5 ha of Foraging Habitat (0.6% of all Foraging Habitat within the Study Area). The retention of approximately 99% of large-eared pied bat Foraging Habitat within the Study Area means the Proposed Action is unlikely to reduce the area of occupancy of the species.	Unlikely
Fragment an existing population into two or more populations;	The Proposed Action is expected to impact a total of 16.5 ha of Foraging Habitat (0.6% of all Foraging Habitat within the Study Area). This impact will only remove small, linear patches of habitat and as the large-eared pied bat is a highly mobile species, it is considered unlikely that the Proposed Action will fragment an existing important population into two or more populations.	Unlikely
Adversely affect habitat critical to the survival of a species;	Large-eared pied bat conservation advice identifies that, due to loss, degradation and fragmentation of habitat, especially foraging habitat, all suitable habitat for the species likely constitutes habitat critical to the survival. Specifically, the presence of foraging habitat within close proximity to roosting sites should be considered habitat critical to the survival of the large-eared pied bat (DCCEEW, 2023).	Unlikely

Criteria	Description	Criteria Triggered?
	A total of 16.5 ha of large-eared pied bat Foraging Habitat (0.6% of all Foraging Habitat within the Study Area) is projected to be impacted as a result of the Proposed Action. Multiple 'probable' large-eared pied acoustic records were made within the Study Area across multiple survey events, indicating the potential for suitable roosting sites within the Locality. However, no roosting habitat, which is essential for the species, has been identified during field surveys and therefore, no roosting habitat has been mapped to occur within the Study Area. Given that no roosting habitat has been identified within the Study Area and the Proposed Action will result in <1% of the available habitat within the Study Area being directly impacted, it is considered unlikely that the Proposed Action will adversely affect habitat critical to the survival of the species.	
Disrupt the breeding cycle of a population;	Large-eared pied bats utilise roosting habitat for breeding function. This includes cliffs, escarpments, overhangs, cracks or rocky ledges (DCCEEW, 2023). The Proposed Action is estimated to impact 16.5 ha of Foraging Habitat (0.6% of all Foraging Habitat within the Study Area), however no roosting habitat has been identified within the Study Area. Therefore, it is unlikely the Proposed Action will disrupt the breeding cycle of an important population of large-eared pied bat.	Unlikely
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;	A total of 2,856.1 ha of large-eared pied bat Foraging Habitat has been identified and mapped within the Study Area, with 16.5 ha (0.6% of all Foraging Habitat within the Study Area) of this habitat projected to be impacted by the Proposed Action. The species displays fidelity to established foraging habitat (DCCEEW, 2023). Foraging resources in proximity of established diurnal roosts are of high ecological value for large-eared pied bat, however no essential roosting habitat in the Study Area has been identified, and while there is potential for roosting habitat in the Locality, that cannot be confirmed. Given this, it is considered unlikely that impacts associated with the Proposed Action will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Unlikely
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically	Predation by introduced predators (such as feral cats (*Felis catus*), European red foxes (*Vulpes vulpes*) and rats (*Rattus sp.*)) has been suggested as a potential threat to cave roosting microbats in Australia. Additionally, roosting habitat disturbance by feral goats (*Capra hircus)* is considered a major risk to the species (DCCEEW, 2023). No feral goats were observed within the Study Area. The Proposed Action will adopt and follow a Biosecurity Plan, as outline in Section 7. The activities related to the Proposed Action, both during construction and operation, will implement and follow biosecurity measures to reduce the	Unlikely

Criteria	Description	Criteria Triggered?
endangered species' habitat	risk of introducing new invasive species and to prevent the further spread of existing invasive species.	
Introduce disease that may cause the species to decline; or	The impact of diseases, including but not limited to, white-nose syndrome is a potential threat to the species. White-nose syndrome is caused by the fungus *Pseudogymnoascus destructans* and leads to death through an infection of the muzzle and other parts of the body. The disease has not yet been detected in Australia but is a threat to cave-dwelling bats in other parts of the world and could have a significant impact on this species if it is introduced (DCCEEW, 2023). Precautions will be taken to ensure that the spread of disease does not occur, as will be detailed in the Biosecurity Plan (see Section 7). This includes following biosecurity measures and ensuring proper personal protection equipment is worn by construction workers and vehicle washdowns before entering identified habitats.	Unlikely
Interfere with the recovery of the species.	The recovery objectives outlined within the *National Recovery Plan for the Large-eared Pied Bat Chalinolobus dwyeri* (DERM, 2011), include: 1. Identify priority roost and maternity sites for protection; 2. Implement conservation and management strategies for 3. priority site; 4. Educate the community and industry to understand and participate in the conservation of the large-eared pied bat; 5. Research the large-eared pied bat to augment biological and ecological data to enable conservation management; and 6. Determine the meta-population dynamics throughout the distribution of the large-eared pied bat. It is noted that the population structure of this species within QLD is poorly known (DCCEEW, 2023) and there are likely roosting sites located within the locality of the Study Area. However, as no roosting habitat was identified within the Study Area, it is considered unlikely that an impact to 16.5 ha of Foraging Habitat (0.6% of all Foraging Habitat within the Study Area) will interfere with the recovery of the species.	Unlikely
Significant Impact: Unlikely		

2.3.3 IMPACTS TO MNES POTENTIAL SPECIES

Avian species with the potential to occur within the Study Area as identified through LoO are identified in Table 2-24. This assessment of impacts has been undertaken in accordance with the guidance provided in the SIG 1.1. Habitat mapping has been undertaken for each of these species based on a combination of ground-truthed habitat and vegetation data. A calculation of the total area of permanent impacts to species habitat by the proposed action is presented in relation to the total area of habitat present within the Study Area.

TABLE 2-24 MNES (POTENTIAL SPECIES) SIGNIFICANT IMPACT ASSESSMENT SUMMARY

Species	Habitat within Study Area	Permanent impacts of the Proposed Action	Comments	SIA Result
Fauna species				
White-throated needletail	N/A, species considered to only utilise the arial space above the Study Area for foraging if it were to occur		This species underwent a Significant Impact Assessment as both a vulnerable and migratory species. The species mapped habitat is potential foraging habitat, and if the species were to occur, it is thought to occur as an aerial flyover visitor only. Additionally, an important population or ecologically significant proportion of the species is not considered likely to occur in the Study Area. However, considering the species nature as an aerial species in Australia, and proclivity to fly at RSA heights and above, there is a risk of WTG collision risk should the species occur. Therefore, should the species be observed in the Study Area, adaptive management measures as outlined in the Bird and Bat Management Plan will be undertaken to further avoid any impact to this species. These measures will be informed by operational phase bird monitoring to detect any listed threatened species impacted. A full significant impact assessment in accordance with SIG 1.1 (DoE, 2013) is presented in Appendix H.	Unlikely
Black-breasted buttonquail	277.4 ha	5.0 ha	A total of 277.4 ha of Potential Foraging and Roosting Habitat for the species is mapped to occur within the Study Area, which is considered habitat critical to the survival of the species. 5.0 ha of this Potential Foraging and Roosting Habitat (1.8% of this habitat type within the Study Area) is expected to be disturbed as a result of the Proposed Action. Considering the negligible area of impact compared to the extent of available habitat in the Study Area, the impact is unlikely to result in a significant impact to the species, especially considering that there is no important population within the Study Area. Additionally, project-specific management measures (Section 4) will mitigate impacts to the species. A full significant impact assessment in accordance with SIG 1.1 (DoE, 2013) is presented in Appendix H.	Unlikely

Species	Habitat within Study Area	Permanent impacts of the Proposed Action	Comments	SIA Result
Australian painted snipe	56 ha	1.3 ha	A total of 56.0 ha Potential Foraging Habitat is mapped to occur within the Study Area, which is not considered habitat critical to the survival of the species due to its degraded nature. 1.3 ha of Potential Foraging Habitat (2.4% of this habitat type within the Study Area) is expected to be disturbed as a result of the Proposed Action. There is no breeding habitat mapped in the Study Area as it doesn't contain the required habitat features to constitute Australian painted snipe breeding habitat (such as canopy cover in proximity to wetlands, low vegetation, isolated islands in shallow wetlands). The Potential Foraging Habitat subject to impact is a small impact in the greater context of the Study Area. This, the lack of breeding habitat in the Study Area, and the absence of any records of the species in the Study Area means that the Proposed Action is unlikely to result in a significant impact to the species. Additionally, project-specific management measures (Section 4) will further mitigate impacts to the species. A full significant impact assessment in accordance with SIG 1.1 (DoE, 2013) is presented in Appendix H.	Unlikely
Diamond firetail	7,899.3 ha	95.8 ha	A total of 7,899.3 ha of Potential Breeding and Foraging Habitat for the species is mapped to occur within the Study Area, which is considered habitat critical to the survival of the species. After post-construction rehabilitation, 95.8 ha of this potential habitat (1.2% of this habitat type within the Study Area) is expected to be permanently disturbed as a result of the Proposed Action. Considering the Proposed Action will result in a permanent impact to 95.8 ha of habitat critical to the survival of the species, the Proposed Action has the potential to result in a significant impact to the species. A full significant impact assessment in accordance with SIG 1.1 (DoE, 2013) is presented in Appendix H.	Potential
Fork-tailed swift	N/A, species considered to only utilise the arial space above the Study Area for foraging if it were to occur		The species mapped habitat is potential foraging habitat, and if the species were to occur, it is thought to occur as an aerial flyover visitor only. Additionally, an important population or ecologically significant proportion of the species is not	Unlikely

Species	Habitat within Study Area	Permanent impacts of the Proposed Action	Comments	SIA Result
			considered likely to occur in the Study Area. However, considering the species nature as an aerial species in Australia, and proclivity to fly at RSA heights and above, there is a risk of WTG collision risk should the species occur. Therefore, should the species be observed in the Study Area, adaptive management measures as outlined in the BBMP will be undertaken to further avoid any impact to this species. These measures will be informed by operational phase bird monitoring to detect any listed threatened species impacted. A full significant impact assessment in accordance with SIG 1.1 (DoE, 2013) is presented in Appendix H.	

2.4 OFFSET REQUIREMENTS

A SIA was undertaken for relevant MNES against the SIG 1.1 (DoE, 2013). The SIA concluded that there is likely to be a significant impact to the habitat of two bird or bat species:

- Squatter pigeon (southern); and
- Diamond firetail.

Where significant impacts to MNES cannot be avoided, the Proponent is committed to offsetting these impacts. A Draft Offset Management Plan (OMP) (ERM, 2025) has been prepared that presents the Proposed Actions offset requirements for significant impacts to MNES, developed in accordance with the *EPBC Act Environmental Offsets Policy* (DSEWPC, 2012) and the Proposed Action-specific requirements outlined in the PER Guidelines. A full assessment of the offset requirements for significantly impacted species is provided within the Draft OMP, with the offset requirements, based on the permanent impact, for the squatter pigeon and diamond firetail summarised in Table 2-25.

TABLE 2-25 BIRD AND BAT OFFSET REQUIREMENTS SUMMARY

Species	EPBC Act Status	Permanent Impact (ha)	Habitat quality score (Impact area)	Total quantum of Impact as calculated by OAG (ha)
Squatter pigeon (southern) (*Geophaps scripta scripta*)	V	152.5	7	106.75
Diamond firetail (*Stagonopleura guttata*)	V	95.8	6	57.48

Status listing per EPBC Act: E= Endangered; V = Vulnerable

As no EPBC Act listed species have been observed within the Proposed Actions RSA, no offsets are currently required with relevance to WTG strike related impacts (see Section 3). However, if a significant impact is to occur from collision over the course of the Proposed Actions life, adaptive management will be applied. See Section 7 for further detail on adaptive management, species-specific impact triggers, assessment of significant residual impact from WTG collision and the potential related offset requirements.

3. COLLISION RISK ASSESSMENT AND MODELLING

3.1 COLLISION RISK MODEL LITERATURE REVIEW

Australia has been increasingly adopting renewable energy projects, with the Federal Government aiming to achieve 82% renewable energy generation by 2030 (Clean Energy Council, 2024). More than 300 wind farms projects (>1MW) were in operation, under construction or proposed in Australia as of 2023 (Australian Energy Infrastructure Commissioner, 2023) and that number is predicted to grow exponentially in the coming years.

Collision risk is a factor that needs to be considered from an environmental impact perspective which looks to the collision risk to avian species if they were to fly within the Rotor Swept Area (RSA) of a wind farm. Increase in WTGs has resulted in adverse effects on many avian species, through both direct fatalities as a result of the collision with WTG rotor blades as well as secondary impacts such as the result of habitat alteration and loss and the changes in normal flight paths as a result of WTG presence/habitat loss (Drewitt and Langston, 2006, Madders and Whitfield, 2006).

Collision risk is particularly important to determine and account for in proposed wind farm areas where bird species present at a higher risk of decline, such as those of conservation significance. This is such that even a few fatalities can grossly alter the maturing and reproductive rates of a species, thus potentially result in regional and national declines (Drewitt and Langston, 2006; Loss et al., 2013). Other species that are vulnerable to collision with WTGs include high-flying, soaring birds of prey, such as raptors (Martin et al., 2022). Collision-related mortality is spread unevenly among species where few species often account for a large proportion of collisions (Madders and Whitfield, 2006, de Lucas et al., 2008, Watson, 2018). Collision risk will also vary dependent on each species, based on factors such as foraging behaviour, flight height, flock sizes, morphology and flight speed (Drewitt and Langston, 2006, de Lucas et al., 2008, Barrios and Rodríguez, 2004). WTG collision rates will vary based on variables such as time of day and time of year, based on the number of birds present in an RSA (Murgatroyd et al., 2018, May et al., 2010).

Raptors are known to utilise thermal soaring (slow circle-soaring flight on thermals) which is highly dependent on weather conditions. Under less favourable conditions for the species to gain altitude, WTG collision risk may be increased with the birds not tending to engage in active flight (Barrios and Rodríguez, 2004; Johnston et al., 2014b; Marques et al., 2014). This is such that the bird is soaring and not actively flapping through an airspace. This may prolong the amount of time it is present within the risk window of a WTG. It has been studied in a wind farm that most raptors will spend little time in a defined collision risk zone, but will often intersect in and out of the risk window (Linder et al., 2022a)

Important predictors of collision risk for raptors have been studied and some of the main findings include that active flight can lead to a higher risk of collision with the tendency for a bird to dissect the path of multiple WTGs in an area (Linder et al., 2022a). Furthermore, track tortuosity can also impact collision risk, such that less tortuosity increases collision risk. This is important as tortuous tracks can be a result of raptors utilising thermal soaring, and thus, thermal soaring may actually reduce collision risk, which is consistent with other studies having been conducted on the topic (Péron et al., 2017; Janss, 2000).

Collision risk models (CRM) have been developed to assess the risk of impact to species as a result of wind farms. It is noted that such models are only able to assess the risk as a result of direct mortality from WTG hits, and not as a result of other impacts like habitat loss and flight redirection. A study by Masden and Cook (2016) reviewed 10 models that have been used broadly to assess the probability of bird species colliding with WTGs during passage through a Project dependent RSA. The methods that were assessed were divided into those based on observational flight data, where flight behaviour, habitat use and flux of birds are analysed, as well as those that focus primarily on collisions based on theoretical parameters in the absence of bird data. The study by Masden and Cook (2016) explained that all collision risk models involve the following:

- To calculate the probability of a collision occurring assuming no evasive action – which requires information on bird morphometrics, flight speed and WTG rotor speed and size; and
- To measure the of the number of birds within a risk window in a given year – which is formulated based on actual observational data, or theoretical behavioural flight data for species in a given wind farm Study Area.

Table 3-1 shows a summary review of four of the main models mentioned in Masden and Cook (2016), including the Band Model, which was used for the Proposed Action. For each model, this table presents the objective of the model, inputs required as well as the limitations or main assumptions of the model.

TABLE 3-1 COMPARISON OF COLLISION RISK MODELS

Collision Risk Model	Objective and Benefits of the Model	Limitations and Assumptions of the Model
Tucker Model (Tucker, 1996a, Tucker, 1996b).	• The model analyses the motions and dimensions of both birds and propeller-type rotor blades and predicts the probability of a collision when the bird flies through the RSA (Tucker, 1999a). • This model can account for upwind and downwind flights of birds.	• Does not measure a likely number of collisions as a measure of bird density; • Blades are 1 or 3 dimensional which consist of length, chord and twist; • Bird always considered to be gliding, and never flapping in flight behaviour; • Bird dimensions are always rectangular with a wingspan that always exceeds length; • Does not consider the collision with the WTG tower; and • Avoidance behaviour is mainly left out of this model.
Band Model (Band 2007; and Band 2012).	• The model was developed to take into considered the probability of a WTG blade that occupies the same space as a bird, and the time taken for the bird to pass through the rotor swept volume (RSV) of the area occupied by this WTG. • It has two stages for estimating collisions per year: 1) number of birds flying through the rotor and 2) the probability of collision from a single transit of a rotor.	• In this model the bird is assumed to be a cruciform shape; • The thickness of the WTG blade still not included into this model; • This model only assumes the bird is flying parallel to the wind, such that it is flying perpendicular to the rotation of the WTG; • Assumes effects of approaching WTG at oblique angles will cancel out, although this may underestimate collision risk; and

Collision Risk Model	Objective and Benefits of the Model	Limitations and Assumptions of the Model
	• This model accounts for avoidance or evasive behaviour by implementing an avoidance rate often between 95-99%. • Bird specific parameters are included into this model such as bird length, wingspan, height and flight activity (diurnal/ nocturnal/ migratory). • WTG parameters considered such as diameter, length, operational time, rotor speed, hub height. • Considers bird both when flapping and gliding. • Updates as part of 2012 were made to consider offshore wind farms (not applicable to the Proposed Action).	• Does not consider the collision with the WTG tower. • Can be observational data heavy, when normally in Projects the data can be quite limited.
Monte Carlo Model (McAdam, 2005)	• This model is based upon the original Band Model however includes stochastic modifications to account for variation in flight height and the effects of wind. • This model calculate the probability of bird being struck given it has passed through the plane of the WTG at a given height and distance less than the rotor length from the centre. • This model considers the effect of wind variation on collision variation through the variance of bird speed as well as changes in the direction of the WTG.	• Includes same limitations of Band Model. • This model includes oblique angles but not bird orientation relative to WTG.
Biosis Propriety Limited (Smales et al., 2013).	• This model has been developed to provide a prediction of the number of collisions between WTGs and a local or migratory group of birds. • This model acknowledges that birds won't only approach WTG at a perpendicular angle, but flights can occur from any direction. • Considers the moving and stationary parts of the WTG – including the WTG tower that may be a factor to consider for bird collisions. • Considers bird parameters and WTG parameters considered as in the Band Model. • Considers avoidance rates of birds.	• This model does not consider when the collisions will occur. • Due to statistically minor numbers of collisions that are concluded from the model – it is unlikely that they will be evenly distributed in time. • Can be observational data heavy, when normally in Projects the data can be quite limited.

Section 3.3 is formulated based on the Collision Risk Model literature review undertaken by Masden and Cook (2016). It is noted that not all models reviewed in Masden and Cook (2016) are included in Section 3.1. However, the main ones that are most commonly adopted in current CRM have been considered.

In addition to the above limitations, the following are considered limitations for all of the models:

- Most models assume that avoidance behaviour is constant across all individuals within a species, and this is unlikely;
- Can overestimate bird collisions;
- Data incorporated is often count data of number of individuals in the species – the same individual may be counted more than once, however it can only be used in the model once, assuming collision equates to mortality – distinguishing individuals of a species is difficult (Eichhorn et al., 2012) circumvents above limitation by using an agent-based model to describe movements of individuals through a landscape and applying collision risk to each individual but this is specific to a single species, the red kite; and
- Species-specific behaviours, topography and wind parameters not considered for majority of the models.

Whilst there are other models available (refer to Table 3-1), the CRM that was chosen for this Proposed Action was the Band Model, also known as the Scottish Natural Heritage (SNH) Model. The Band Model was chosen based on its ability to calculate an estimate of collisions per year for a bird species which is a pre-construction assessment of collision impacts on local and national populations (SNH, 2016). It considers bird species sighted and WTG model parameters, that ensure that it is project specific and situation dependent.

Further to those discussed in Table 3-1, the limitations of the Band Model as discussed in Band et al. (2007) include the following:

- Birds may be more evident and prominent in some habitats;
- Birds may be easier to identify when flying at different elevations;
- Detection rate may differ for different species;
- Plotting routes of flying birds is difficult due to parallax and can be a skill that takes time to develop; and
- For gliding species such as eagles, it can be hard to tell their correspondence to landscape, however this can be circumvented by having knowledge of the species expected to be seen and knowledge of terrain; and
- Effects of flight direction are not able to be assessed.

Parameters such as flight direction are of particular importance to identifying higher risk areas within the Study Area, however are not able to be considered for their effects on the likelihood of collision using the current model. Nonetheless, this information is accounted for within the risk assessment and identifies areas of high bird activity that will require further surveying in future. Such limitations are all relevant to the Proposed Action and the CRM undertaken for the species relevant to the Study Area. All species identification parameters and detection rates are going to be the same across all CRM types as this comes down to survey effort rather than the model itself. It is noted that the 95% avoidance rate is dealt with within the Proposed Action Model through accounting for 98 and 99% avoidance rates as a result of research done by SNH (2016).

There is constant research going into collision risk, especially with the expansion of renewable energy into new countries and areas, including offshore windfarms. Due to the limited records of listed threatened species (none of which occur within the RSA) that occur within the RSA, as

well as the limited raptors within the RSA, the use of the Band Model is considered an adequate model to assess the collision risk associated impacts of the Proposed Action on bird and bat species. Furthermore, the parameters entered into this model are based on field observations as well as information from literature, and therefore considers a conservation estimate of the collision risk to species which does not limit the data or the outcomes.

3.2 BIRD AND BAT RISK ASSESSMENT

The DCCEEW interim guidance on bird and bat management has detailed how CRM needs to be undertaken for listed threatened species (MNES) where risks from the Proposed Action, particularly collision risks, have been identified (DCCEEW, then DAWE, 2021). State Code 23 has listed that CRM be undertaken for listed threatened and migratory species, or species of interest such as raptors, that occur within the RSA and that are identified as at risk from the Proposed Action. Therefore, the risk assessment has identified species at risk of collision with WTG, and those which occur within the RSA have been included in the CRM.

The potential impacts to listed threatened and/or migratory species as a result of the Proposed Action are:

- Direct mortality through WTG collision, and barotrauma (bats only); and
- Changes in how relevant bird species utilise the Study Area.

The introduction of WTGs and associated infrastructure has the potential to lead to changes in how relevant bird species utilise the Study Area. Habitat mapping has been provided for each listed threatened species that has been observed within the Study Area across the 10 field surveys (see Figure 2-2 and Figure 2-5).

This Section of the BBMP will demonstrate how the potential impacts to each relevant species, including their risk of impact and site utilisation, have been analysed as part of the bird and bat risk assessment. The species covered in this risk assessment have been informed by the likelihood of occurrence assessment based on desktop review and field survey results conducted between 2022 – 2026.

3.2.1 COLLISION RISK ASSESSMENT APPROACH AND ASSUMPTIONS

Wind farms are known to impact birds and bats through collision with operating WTG. Such impacts include the direct collisions with WTGs as well as indirect impacts such as the deterrence of migratory flightpaths. This section provides a detailed risk assessment for listed threatened and migratory birds and bats, using field data from surveys, desktop sources of historical records and literature on the ecology and characteristics of the species, to assess collision risk during the operational phase of the Proposed Action. This includes incorporating data and information provided within the recently published *Impacts on birds and bats from onshore wind farms in Australia* (Reid & Baker, 2025).

The risk assessment was based on the Risk Evaluation Matrix Model which complies within the *AS/NZS ISO 31000 Risk Assessment Standard: 2018*. This risk assessment considers the likelihood of an event (collision with WTGs and impact to site utilisation) (Table 3-2, and the consequences should the event occur (Table 3-3). Through calculating the likelihood and the consequence, an overall risk rating is assigned to each species and the risk of potential impact to a species because of the operation of the Proposed Action (Table 3-4).

TABLE 3-2 LIKELIHOOD OF EVENT CRITERIA

Likelihood	Description
Very Likely	*Very High* likelihood of WTG strike based on a combination of the following: • Species known to occur within the Study Area; • High amounts of species-specific critical breeding and/or foraging habitat known to be present within the Subject Land and likely to impacted by the Proposed Action; • More than half of species observations occurred within the RSA; • Flying heights of species are known to occur within the RSA and species exhibits flight characteristics more susceptible to collision (soaring, circling at height etc.); • The Proposed Action is located within known avian migratory or habitual flight pathways; • Landscape feature(s) likely to increase avian activity are present within the Study Area (including woody canopy, waterbodies, riparian corridors, updraft locations, caves etc.).
Likely	*High* likelihood of WTG strike based on a combination of the following: • Species likely to occur within the Study Area based on an analysis of recent (≤ 20 years old) records within 20 km of the Study Area; • Moderate amounts of suitable breeding or foraging habitat present within the Study Area and likely to be impacted by the Proposed Action; • Less than half the species observations are within the RSA; • Flying heights of species may occur within the RSA and species exhibits flight characteristics more susceptible to collision (soaring, circling at height etc.); and • Landscape feature(s) likely to increase avian activity are present within the Subject Land (including woody canopy, waterbodies, riparian corridors, updraft locations, caves etc.).
Moderately Likely	*Moderate* likelihood of WTG strike based on a combination of following: • Species has the potential to occur within the Study Area based on an analysis of records (≤ 20 years old) within 100 km of the Study Area; • Low amounts of suitable breeding or foraging habitat present within the Study Area and likely to be impacted by the Proposed Action; • Species not observed within the RSA or only once during survey effort • Species occasionally flies at heights within the RSA; and • Landscape feature(s) likely to increase avian activity are present within the Study Area (including woody canopy, waterbodies, riparian corridors, updraft locations, caves etc.), but only in small areas.
Less Likely	*Low* likelihood of WTG strike based on a combination of the following: • Species not detected or is considered unlikely to occur based on based on an analysis of records within 100 km of the Study Area • No suitable breeding or foraging habitat is present within the Study Area • Species is very unlikely to fly at heights within the RSA • Landscape feature(s) likely to increase avian activity are not present within the Study Area (including woody canopy, waterbodies, riparian corridors, updraft locations, caves etc.).

TABLE 3-3 CONSEQUENCE OF EVENT CRITERIA

Minor	Moderate	Major	Severe
Protected (non-threatened) species OR Occasional individuals lost but no reduction in local or regional population viability OR Species and/or species habitat considered absent.	Species listed as vulnerable under NC Act or EPBC Act OR Species listed as migratory under EPBC Act OR Moderate loss of numbers of individuals leading to minor reduction in viability of localised population of species for up to five years.	Species listed as endangered under NC Act or EPBC Act OR Major loss in numbers of individuals, leading to a reduction in the viability of regional or state population between five and ten years.	Species listed as critically endangered under NC Act or EPBC Act OR Extreme loss in numbers of individuals, leading to a reduction in regional or state population viability for a period of at least ten years.

TABLE 3-4 RISK MATRIX OF RISK LEVEL BASED ON LIKELIHOOD AND CONSEQUENCE

Likelihood Criteria	Consequence criteria			
	Severe	Major	Moderate	Minor
Very Likely	High	High	High	Moderate
Likely	High	Moderate	Moderate	Low
Moderately Likely	High	Moderate	Low	Negligible
Less Likely	Moderate	Low	Negligible	Negligible

Only one listed bird or bat species, the squatter pigeon (southern), was recorded within the Study Area. The large-eared pied bat is considered likely to occur due to a 'probable' acoustic record in the Study Area via Anabat detection equipment. None of these species were recorded within the assessed RSA (87 – 250 m) for the Proposed Action.

Nonetheless, this risk assessment took a conservative approach to determine the risk level for:

- listed threatened and/or migratory species that is considered known, likely or has the potential to occur within the Study Area;
- Least concern species observed within the Study Area that are known to fly at typical RSAs have also had their potential risk assessed; and
- Cryptic listed threatened species with large home ranges (regardless of unlikely LoO assessment). This includes the grey falcon (*Falco hypoleucos*) and red goshawk (*Erythrotriorchis radiatus*).

This approach considered profiling species based on information obtained from the published literature and the following factors when considering the risk level:

- Whether species were, based on the LoO criteria, known, likely, potential or unlikely to occur within the Study Area;
- Existence of records in the Study Area and Locality;
- Existence of records in a broader Locality (with this broader Locality being a 100 km radius search area of the Study Area);
- Generation time for listed species;
- Flight heights inside or outside of RSA, based on literature and realistic observations for the Locality; and
- Amount of known or potential habitat in the Study Area.

Incorporating literature for species into the CRA allows the completion of an assessment where survey data is not present. The results of this approach are considered to provide a risk result as a 'worst-case' scenario, based on the use of literature and on-ground field observations during the field surveys.

3.2.2 COLLISION RISK ASSESSMENT RESULTS

As a result of the risk assessment, six listed threatened or migratory species and seven non-listed species were assessed as having a 'low' or 'moderate' risk of collision (Table 3-5). All other listed bird and bat species were considered to have 'negligible' risk of impact from collision with WTGs and any indirect impacts associated with the Proposed Action (e.g. barrier effects from WTGs).

Significant impact thresholds and impact triggers that trigger adaptive management have been provided for all species with a 'low' or 'moderate' risk of collision, including EPBC Act listed species (Section 7.1), and non-listed species (Section 7.2). Additionally, out of these species, those that were recorded within the RSA within the Study Area during BUSs (five species) have been included within the CRM presented within Section 3.4.

It is emphasised that this risk assessment assumes a worst-case, based upon literature and realistic observational expectations. Therefore, the final risk ratings assigned to species that have the potential to occur within the Study Area are conservative and enable this worst-case scenario to be considered. A full detailed risk assessment with conclusions can be found in Appendix F. This includes findings for those listed species found to have a 'negligible' collision risk rating.

TABLE 3-5 BIRD AND BAT RISK ASSESSMENT

Species	Threatened Species Status (EPBC Act, NC Act)	Likelihood of Event	Consequence of Event	Risk Rating
Threatened or Migratory Bird Species				
Grey falcon (*Falco hypoleucos*)	V, VU	Less likely	Major	**Low**
Red goshawk (*Erythrotriorchis radiatus*)	E, EN	Less likely	Major	**Low**
White-throated needletail (*Hirundapus caudacutus*)	V and Mi, VU	Moderately likely	Moderate	**Low**
Fork-tailed swift (*Apus pacificus*)	Mi, -	Moderately likely	Moderate	**Low**
Australian painted snipe (*Rostratula australis*)	E, EN	Moderately likely	Moderate	**Low**
Non-threatened Bird Species				
Black kite (*Milvus migrans*)	-, LC	Likely	Minor	**Low**
Black-faced woodswallow (*Artamus cinereus*)	-, LC	Likely	Minor	**Low**
Brown falcon (Falco berigora)	-, LC	Likely	Minor	**Low**
Galah (*Eolophus roseicapilla*)	-, LC	Likely	Minor	**Low**
Torresian crow (*Corvus orru*)	-, LC	Likely	Minor	**Low**
Wedge-tailed eagle (*Aquila audax*)	-, LC	Very likely	Minor	**Moderate**
Whistling kite (*Haliastur sphenurus*)	-, LC	Very likely	Minor	**Moderate**
Threatened Bat Species				
Large-eared pied bat (*Chalinolobus dwyeri*)	E, EN	Moderately likely	Major	**Moderate**

3.3 BIRD ACTIVITY HEAT MAPPING AND HIGH-RISK WTG

In general, the risk of collision across the entire Study Area (all WTG) is considered negligible to low. This is due to the paucity of data from multiple, targeted and repeated BUSs, with no listed threatened or migratory species observed within the RSA during field surveys, and that the Study Area does not fall within an important flyway or IBA for migratory birds (as discussed within Section 2.2.3.4).

However, it has been noted that areas across the Study Area associated with significant landscape features affecting air movement (i.e. topographic features), may create updrafts and therefore increased bird flight activity, particularly for soaring species (i.e. raptors) and white-throated needletails (considered to have a low risk of collision as assessed within the CRA (Section 3.2)). Therefore, a topographic heat map has been created (Figure 24) identifying areas of high slope intensity (shown in red) which have been identified as potential areas that may be associated with increased bird activity. Bird site utilisation is further discussed within Section 2.2.3.

WTG within close proximity to these areas of greater slope and elevation (WTG number 2, 3, 5, 8, 10, 31, 40, 49, 54, 105, 160, 163, 165 and 167, as identified within Figure 2-4) have therefore been identified as WTG that may have an elevated risk of collision compared to neighbouring WTG. These identified WTG may have slightly elevated risk profiles, and will be considered in the design of and targeted in the monitoring program presented within this BBMP (Section 5).

3.4 MATHEMATICAL COLLISION RISK MODELLING

3.4.1 COLLISION RISK MODELLING, DATA AND MORTALITY ESTIMATES

The recently updated Band Collision Risk Model (Band, 2024) has been used to predict the total number of collisions that may result from the development of the wind farm. The Band Model is routinely used in wind farm assessment studies across the world. This method of CRM requires the input of parameters that describe species-specific biometrics, flight speeds and characteristics and the expected amount of flight activity in the Study Area. Furthermore, the model requires the input of WTG specific information such as the WTG blade size and pitch, WTG height and rotor rotation period as well as the proportion of time the WTG will be operational (Band, 2024).

The CRM has used BUS data to determine the flight heights, frequency and flock size of a species, for those known to occur within the RSA. The Band (2024) CRM estimates the number of collisions through the following stages:

a. Flight activity: using bird survey data across eight survey periods (dry and wet season) to establish the density of flying birds in the vicinity of the WTG, and the proportion flying at a risk height, between the lowest and highest points of the rotors;
b. Number of flights through rotors: makes an estimate, based on the bird density and proportion at risk height, of the potential number of bird passages through rotors in the period in question (assumption that birds will continue to make flights within the area at the same intensity as before the construction);
c. Probability of collision for a single transit: calculates the probability of collision during a single bird rotor transit, depending on the characteristics of the bird (length, wingspan

and flight speed), as well as the parameters of the WTG (number of WTG, breadth and pitch of the WTG blades, rotation speed of the turbine etc).

d. Expected collisions per year: multiplies the outputs of stage B and C to yield the potential collision rate for the bird species in question, assuming current levels of bird use of the site but allowing for the proportion of time that WTG are not operational.

e. Allowing for avoidance and attraction: takes account of the proportion of birds likely to avoid the wind farm or its WTG, either because they have been displaced or because they take evasive action or are attracted to the wind farm, e.g. in response to changing habitats.

Draft *Onshore Wind Farm Guidance* (DCCEEW, 2024) and State Code 23 (SDAP version 3.0, February 2022) have listed that CRM only be undertaken for listed threatened and/or migratory species, or raptors, that occur within the RSA and that are identified as at risk from the Proposed Action. Therefore, the risk assessment has identified species at risk of collision with WTG, and those which occur within the RSA (Rotor Swept Area) have been included in the CRM. The following Sections detail the WTG and bird and bat species parameters relevant to the Study Area and the CRM.

3.4.1.1 COLLISION RISK MODEL INCLUSION CRITERIA

The species that were assessed as having a 'low' and 'moderate' risk of impact from the Proposed Action, as determined by the risk assessment (Section 3.2.2 and Appendix F) and were recorded in the RSA during BUS, were considered for the CRM. With this inclusion criteria, five species were included within the model:

- Wedge-tailed eagle (*Aquila audax*);
- Brown falcon (*Falco berigora*);
- Whistling kite (*Haliastur sphenurus*);
- Galah (*Eolophus roseicapilla*); and
- Torresian crow (*Corvus orru*).

Species not included within the model may still be at risk of collision throughout the life of the Proposed Action and will be monitored during further bird surveys. Additionally, such species will be considered for any potential impacts in the future if they are to occur within the RSA for the Proposed Action.

3.4.1.2 WINDFARM AND WTG PARAMETERS

The Proposed Action is a utility-scale wind farm of up to 170 WTGs with specifications outlined in Table 3-6. In order to facilitate connection to the electricity grid, TED is working with Powerlink to determine the optimal connection point to the existing network. The Proposed Action will include ancillary infrastructure including, but not limited to, access tracks, collector stations, overhead and underground electrical cabling, hardstands, and an operation and maintenance compound.

TABLE 3-6 TURBINE PARAMETERS FOR THE PROPOSED ACTION

WTG Parameter	General WTG Specifications
Number of WTG	Up to 170 WTG
Hub height	Up to 169 metres
WTG tip height	Up to 250 metres
WTG rotor radius	Up to 81 metres
Depth of rotor blade from front to back	3.4 metres
Max chord	4.4 metres
Average RPM	9.5 rpm
Rotor swept area range (noting that these heights will be determined by the hub height of the WTG, they may become lower)	87 – 250 metres
Number of blades	3 blades
Average pitch angle of rotor	Approximately 14.5 ° – dependent on conditions

3.4.1.3 SPECIES PARAMETERS

Seasonal monitoring of 38-point locations were undertaken and have been used in the calculations for the CRM. In total there were 4,020 minutes (or 67 hours) of bird survey time undertaken throughout the field investigation periods. A total of 13 species were recorded within the RSA during BUSs, however only five were considered to be at low risk or above within the CRA. The parameters required for the CRM for each of these five species is presented in Table 3-7.

The Band (2024) model requires bird flight times to be included in the model. Bird flight speeds from literature (as outlined within Table 3-7), was used to calculate the length of time that a single observation of a species would likely spend within the area of visibility of the survey. This resulted in all five species approximately being within the area of visibility for approximately 10% of each 20 minute survey.

TABLE 3-7 PARAMETERS OF SPECIES INCLUDED WITHIN THE CRM

Species	Wingspan (cm)	Length (cm)	Flight Speed (m/s)	Estimated time observed in flight per individual (minutes)
Wedge-tailed eagle (*Aquila audax*)	230	110	16.7	2
Brown falcon (*Falco berigora*)	115	45	13.6	2.4
Whistling kite (*Haliastur sphenurus*)	146	55	30	1.2
Galah	75	37	19.4	1.8

Species	Wingspan (cm)	Length (cm)	Flight Speed (m/s)	Estimated time observed in flight per individual (minutes)
(*Eolophus roseicapilla*)				
Torresian crow (*Corvus orru*)	100	50	20.1	1.6

Sources for measurements are: Smales et al. (2015); DCCEEW (2023); Cochran et al. (1986); Menkhorst et al. (2017); DES (2022); Marchant, S. et al (eds) (1990-2006); Cameron (2007).

3.4.1.4 COLLISION RISK MODELLING RESULTS

For the five species included in the CRM, collision risk has been calculated as the number of flights modelled to be at risk of collision per species per annum in Table 3-8. It is expected that birds in practice show a high level of avoidance of WTG (Band, 2024). However, avoidance rates have not been calculated for all species and research is necessary to determine each species-specific avoidance rates. For this CRM, 95% 98% and 99% avoidance rates have been used to calculate flights modelled to be at risk of collision per annum for the given species. These avoidance rates are typically used in CRM exercises (Band, 2024; Smales, 2005; SNH, 2000).

TABLE 3-8 MODELLED FLIGHTS AT RISK OF COLLISION PER ANNUM

Species	Avoidance Rate		
	95%	98%	99%
Wedge-tailed eagle (*Aquila audax*)	19.7	7.9	3.9
Brown falcon (*Falco berigora*)	0.7	0.3	0.1
Whistling kite (*Haliastur sphenurus*)	0.7	0.3	0.1
Galah (*Eolophus roseicapilla*)	1.2	0.5	0.2
Torresian crow (*Corvus orru*)	0.8	0.3	0.2
Total	**23.1**	**9.3**	**4.5**

In total, the CRM indicates that approximately five flights per year of the modelled species (99% avoidance rate) to 23 flights per year of the modelled species (95% avoidance rate), are at risk of collision with the WTG. If collisions were to occur, the resulting mortality would be expected to reduce the local flight activity density of the affected species, which in turn would decrease the future collision rate for the species. It is also important to note that the CRM represents a worst-case scenario and as a result, actual collision risks are expected to be lower than those predicted by this conservative model.

3.5 POLICIES AND GUIDELINES

WTGs are preferentially located in areas for best wind resources, however based on the field surveys that have been conducted, and further pre-clearance micro-siting surveys that will be conducted prior to commissioning, final layout will consider at risk species habitat presence and addressed so far as reasonably practicable. With respect to individual species, the following documents were considered:

- Consultation of SPRAT profiles to identify species distribution, behavioural characteristics and habitat information, which was then mapped for all potential, likely and known to occur species within the Study Area;
- Scientific literature to understand further parameters of bird and bat species of interest, including size, flight speed, average flock sizes; and
- Survey guidelines which determined relevant methodology for BUS and BACI monitoring principles.

The consultation of these policies and guidelines where then able to inform the bird and bat studies, which were:

- A risk assessment based on species characteristics and behaviours; and
- A CRM which considers such species characteristics and factors these into how they would be impacted by the WTG parameters relevant to the Proposed Action.

This Proposed Action has gone further to consider species which have not been observed in the Study Area or broader locality, to determine the 'potential impact' that would result from construction and operational activities.

The Proposed Action emphasises the importance of ongoing monitoring and as such, the BBMP has considered all relevant principles of BACI survey monitoring, and Adaptive Management to ensure that if any threatened species are to be found in future surveys, they are adequately considered, and impacts mitigated.

4. MITIGATION AND MANAGEMENT MEASURES

This section details the mitigation and management measures that will be implemented for potential significant impacts to listed threatened and at-risk species arising from the operation of the Proposed Action. Mitigation measures will be reviewed throughout the monitoring program, and at the end of every two-year monitoring period a suitably qualified ecologist will oversee and determine whether any adjustments should be made. Impact triggers and adaptive management framework, which are described in Section 7, act as a measure to determine when additional mitigation measures should be implemented.

The mitigation measures in Table 4-1 have been designed so that potential significant impacts to bird and bat species (locally abundant, least concern and listed species) are appropriately mitigated. If changes to the mitigation measures are likely to result in a new or increased impact to any EPBC Act listed species (i.e. beyond minor variations or updates to the BBMP), impacts may need to be referred to the Minister in accordance with Section 143A of the EPBC Act, following a self-assessment.

The potential causes of impact to listed and non-listed species arising from the operation of the Proposed Action are considered to be:

- Potential changes in species behaviour, flight patterns or site usage as a result of wind farm construction and operation.
- Collision of birds and bats with blades of operating WTGs, with non-listed species most at risk. This includes the impacts of barotrauma (for bats only).
- Lighting on WTGs and buildings causing an increase in bird and bat prey. This may result in increased bird and bat abundance in the vicinity of the WTGs and increase collision risk.
- Proposed Action infrastructure (e.g., powerlines, poles) provides perching or nesting resources close to WTGs, increasing collision risk.

Table 4-1 details the potential causes of impact, mitigation measures and controls and subsequent timing of such controls for this BBMP. It also details the measures of success for these controls, as well as corrective actions that will be implemented if the controls are not meeting success criteria. Specifically, the management objectives aim to minimise the impact of mortality associated with collisions with WTGs.

Implementation of the mitigation measures will reduce the risk of collisions. If, however, species impact triggers are observed, consultations with DCCEEW and DESI will occur to determine the appropriate adaptive management strategy in line with the measures outlined in Section 7.

TABLE 4-1 PROPOSED MITIGATION MEASURES, TIMINGS, PERFORMANCE CRITERIA AND CORRECTIVE ACTIONS

Potential Causes of Impact	Management Activities and Controls	Timing/Phase	Performance Criteria for Measurement of Success	Corrective Action
Potential changes in species behaviour, flight patterns or site usage as a result of wind farm construction and operation.	• Areas identified as MNES habitat will be avoided as much as possible at the design and micro-siting stages. • Micro-siting of infrastructure will utilise existing clearance areas and avoid habitat fragmentation and patch isolation, with consideration of whether avoidance areas would still be connected to habitat in the broader landscape. • WTG placement will maximise the use of areas that are less vegetated to avoid and minimise disturbance of key habitat. • Development and implementation of management plans to reduce the impact of construction and operation phase activities including preventing the introduction of invasive species, fire and altered hydrology. • Development and implementation of monitoring, mitigation and adaptive management measures outlined in this Bird and Bat Management Plan (BBMP).	• During design, construction and operational phases.	• No observed changes to bird/bat species presence in and utilisation of the Study Area as a result of the Proposed Action, identified following BACI monitoring principles.	• Where changes to bird/bat species presence in and utilisation of the Study Area are observed during the first two years of commencement of operation (following BACI monitoring principles), adaptive management will be applied to identify potential causes of the changes and propose additional mitigation measures to limit impacts. Potential mitigation measures that may be included within the corrective actions are provided within this table.

Potential Causes of Impact	Management Activities and Controls	Timing/Phase	Performance Criteria for Measurement of Success	Corrective Action
Collision of birds and bats with blades of operating WTGs.	• Design WTGs with RSA >40 m above ground level to provide a collision free foraging zone within, and 20 m above, the tree canopy. • Sightings and incidents reported in daily pre-starts during construction. • Carry out scientifically robust monitoring program for the detection/quantification of impacts on protected matters, including as a result of WTG strike and barotrauma. The monitoring program must be able to accurately and in a timely manner detect when impact triggers are reached. • All near misses and incidents will be investigated to establish root cause. Where necessary corrective actions will be developed to improve existing processes. • Injured, sick or dead fauna will be recorded and reported, for the duration of construction and operation phases.	• During design and operational phases.	• No significant amount of bird/bat mortality caused by operation of WTGs. No species significant impact threshold reached (see Section 7).	Species-specific corrective actions will be selected once an annual threshold has been detected during mortality monitoring. Potential corrective actions are detailed within the decision-making framework presented within Section 7.1.2.
Movement of water and foraging resources that may result in attracting birds and bats into the vicinity of the WTGs.	• Subject to agreement with landowners, determine a system which will allow for grain feeders and stock watering systems to be removed from the Project Area within a 200 m radius of the WTGs. • Monthly carcass searches (see Section 5) to include records of any stock or introduced species that may attract larger raptor species. ○ Such carcasses will be appropriately recorded with GPS locations, photos taken and then	• During operational phase.	• No notable increase or continuation of bird/bat mortality.	Where mortality of birds and bats due to presence of water, carcasses or grain is determined to be occurring, corrective actions will be undertaken to rectify the issue, including increasing methods to reduce water, grain and/or carcasses around WTGs. This may include:

Potential Causes of Impact	Management Activities and Controls	Timing/Phase	Performance Criteria for Measurement of Success	Corrective Action
	disposed of in a safe manner to avoid attracting raptors close to WTG (moved >200 from WTG or buried). ○ Carcass removal will be undertaken by suitably qualified personnel. This includes operation and construction staff, personnel conducting carcass searches and landowners if suitable training has been provided. ○ Reporting on carcass removal based on Proposed Action's carcass removal register/data sheets and included within an incident report (for non-bird and bat species). • Bird and bat carcasses/carrion to be removed when found and reported with bird and bat monitoring data (see Section 5). All measures taken to reduce risk will be recorded in the same report.			• Filling in/removing water sources close to problem WTGs (subject to landowner agreement). This may involve providing alternative arrangements for livestock watering (e.g., establish replacement water sources further from WTGs). • Additional consultation with landholders on moving grain-feeding locations further away from problem WTGs. • Where a large number of livestock carcasses are recognised as a problem near WTGs, stock exclusion options will be explored by the Proponent (subject to landowner agreement). • Where a large number of pest animal carcasses are recognised as a problem near WTGs, integrated pest management will be explored by the Proponent (subject to landowner agreement).

Potential Causes of Impact	Management Activities and Controls	Timing/Phase	Performance Criteria for Measurement of Success	Corrective Action

Lighting on WTGs and infrastructure causing an increase in bird and bat prey.	• Avoid the use of high intensity lighting within the Project Area.
	• Prioritise the use of red or yellow light (over white):
	  ◦ At entrance doors to each WTG, office buildings, substations etc.
	  ◦ As portable and temporary lighting required by on-site workers (where practicable and in line with safety standards).
	• Reduce aviation lights where supported by relevant authorities. The number of WTG to be lit will be established by a suitably qualified aviation consultant in accordance with item 35 of the Commonwealth Government's National Airports Safeguarding Framework – Guideline D;
	• Reduce tower/mast lights where aligned with State DA requirements for monitoring masts.
	• Switch off unnecessary lights when not needed (e.g., building lights turned off when not in use), where supported by work health and safety requirements.
	• Synchronise any flashing lights.
		• During design and operational phases.	• No notable increase or continuation of bird/bat mortality.	Where mortality of birds and bats due to presence of lighting is determined to be occurring, corrective actions will be undertaken to rectify the issue, including:
				• Review the type and placement of lights at problem WTGs.
				• Reconsider the need for lighting at problem WTGs, remove any lighting deemed unnecessary.
				• Minimise lighting at problem WTGs through additional engineering controls, such as changing lighting colour, adding shrouds, and additional automated switching.

Potential Causes of Impact	Management Activities and Controls	Timing/Phase	Performance Criteria for Measurement of Success	Corrective Action
Proposed Action infrastructure (e.g., cranes, powerlines, poles) provides perching or nesting resources close to WTGs, increasing collision risk.	• WTGs and associated infrastructure will be located away from key bird and bat habitats (such as waterways and drainage lines), where possible. • Powerlines will be located so as to avoid fauna obstruction/entanglement and minimise potential perching resources close to WTG, where possible. • Poles within 200 m of high-risk WTG will be designed so as to discourage use as perching and nesting resources, focusing on modifying the structure to eliminate resting spots, make surfaces uncomfortable, or block access to nesting sites. Effective designs may include: ○ Installing vertical spikes on top of poles; ○ Using smooth, tapered surfaces; and/or ○ Placing specialised nest-diverters on cross arms to prevent sticks from accumulating.	• During design and operational phases.	• No notable increase or continuation of bird/bat mortality.	Where mortality of birds and bats due to presence or proximity of infrastructure is determined to be occurring, corrective actions will be undertaken to rectify the issue, including: • Review the purpose and placement of infrastructure close to problem WTGs. • If the infrastructure is mobile, move away from problem WTGs. • Utilise additional engineering controls to reduce impacts (e.g., attaching bird diverters to additional powerlines). • If the infrastructure is determined to be having a significant impact on listed or at-risk species, consider removal or relocation of infrastructure away from problem WTGs.

5. BIRD AND BAT MONITORING

The BBMP bird and bat monitoring program has been based on information compiled during the desktop and field investigations conducted as part of the referral process for the Proposed Action. To align with the environmental outcomes of this BBMP, this program will aim to:

- Estimate mortality of bird and bat species attributed to the operation of the Proposed Action;
- Improve understanding of the risk of WTG collision, barotrauma impacts and ongoing site utilisation on listed bird and bat species;
- Improve monitoring approaches for the timely identification of WTG collisions and the timely collection and analysis of data; and
- Provide timely and regular validation and updates to the collision risk assessment using monitoring data, to support a robust adaptive management approach.

The BBMP bird and bat monitoring program will achieve these objectives by aligning with the survey data requirements set out in Appendix 2 of the technical report Investigation of existing post-construction mortality monitoring at Victorian wind farms to assess its utility in estimating mortality rates (Moloney, Lumsden & Smales, 2019). This includes:

- WTG details – details of the location, size and proximity to wildlife habitat for each WTG within a wind farm development;
- Searcher efficiency trials – details of each searcher trial undertaken with different carcass types;
- Carcass persistence trials – details of methods used and results of trials;
- Mortality surveys – details of methods used and findings; and
- Incidental finds of carcasses outside of the mortality surveys.

The following Sections detail the timing, methodology, and locations for the bird and bat monitoring program.

5.1 BIRD AND BAT MONITORING AT COMMENCEMENT OF OPERATION

Bird and bat surveys during the commencement of operation will target species listed as known, likely or potential to occur within the Study Area and considered to be above 'negligible' risk of collision in Section 2.3. Two conservation significant species that were considered unlikely to occur, but have distributions that overlap the Study Area and are deemed 'low risk', have also been included.

Bird and bat surveys will occur during the first two years of commencement of operation, with two wet season and two dry season surveys being undertaken in those years. The monitoring methods used in the initial two years of operation of the Proposed Action will be consistent with techniques used during previous field surveys to support BACI monitoring framework. Surveys will be conducted by a suitably qualified expert.

The monitoring during operation will be based on two main approaches:

- Approach 1 – monitor bird and bat activity to detect potential changes to species utilisation of the Study Area and surrounding landscape, and ongoing mortality searches that aim to determine direct impacts (collisions) occurring during the first two years of operation; and

- Approach 2 – inform specific response to impact triggers that may result to bird and bat species, which will trigger increased monitoring surveys and carcass searches, investigation of risk behaviours and subsequent risk mitigation.

The survey methods that will be undertaken for bird and bat species during the first two years of commencement of operation, and the seasonal considerations of such surveys, can be found in Appendix G.

5.2 POST-CONSTRUCTION MORTALITY MONITORING

5.2.1 CARCASS SEARCH METHODOLOGY

As part of the monitoring program, carcass searches will be performed to determine the actual impact of the Proposed Action on birds and bats. The results of the monitoring will be used to review the risk assessment if necessary and to identify and determine if any further monitoring of bird and bat species is required and to update mitigation measures or adaptive management approaches. Carcass search methodology has been developed in line with the *Post-Construction Bird and Bat Fatality Monitoring for Onshore Wind Energy Facilities in Emerging Market Countries* (IFC, 2023), as well as the accompanying *Post-construction Bird and Bat Fatality Monitoring (PCFM) Decision Support Tool* (IFC, 2023). All carcass searches will be undertaken by suitably qualified personnel with appropriate skills in both bird and bat identification, as well as the handling of deceased species.

Survey Type and Area

Based on the *PCFM Decision Support Tool* (IFC, 2023), the recommended first year monitoring program will involve:

- Road and Plot (RAP) searches: searching within access tracks and hard-stand areas only at all WTGs, with road searches ranging up to 270 m from the WTG; and
- Full plot searches: at 50% (approximately 85) selected WTGs, with a search radius of 135 m from the base of the WTG.

Search transect width for both RAP and full plot searches will start at 6 m (Figure 5-1). If visibility is high at the WTG and surrounding area, considering there is existing knowledge of the bat species at risk, transect spacing of 10 m will be considered as an alternative to 6 m. It should be noted that in search areas of WTG that are difficult to access for safety reasons, due to dense vegetation or slope considerations, exceptions may be made as to where transects will be conducted. This will include completing RAP searches only. Such exceptions will be noted for reporting purposes.

Once the first year of surveys is completed, the collected data will be incorporated into the *PCFM Decision Support Tool* (IFC, 2023) to determine an appropriate search radius and search transect width specific to the Proposed Action in subsequent years.

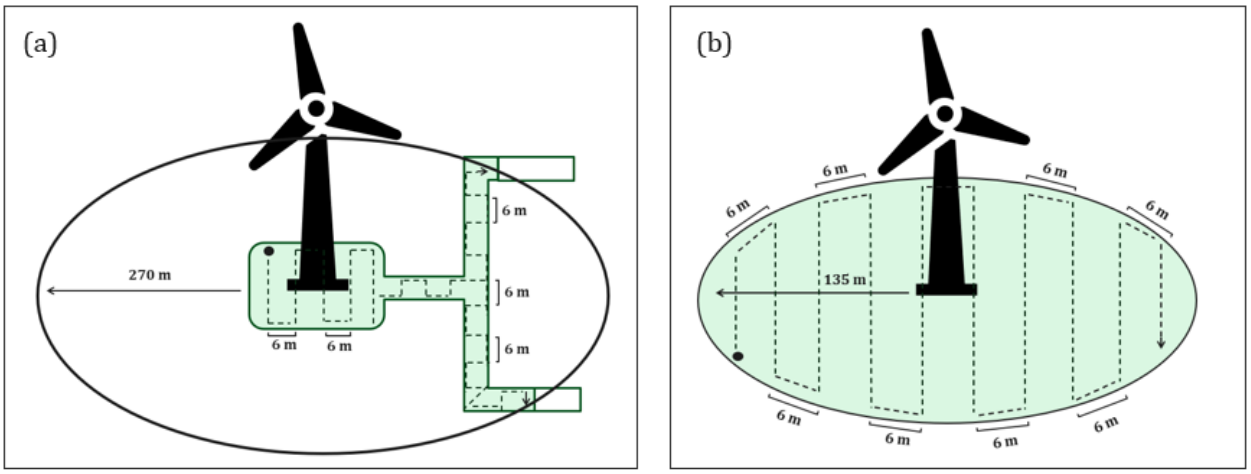


FIGURE 5-1 CARCASS SEARCH AREA (GREEN) FOR (A) RAP SEARCHES (270 M RADIUS AND 6 M TRANSECT WIDTH) AND (B) FULL PLOT SEARCHES (270 M RADIUS AND 6 M TRANSECT WIDTH

WTG selection

Based on the *PCFM Decision Support Tool* (IFC, 2023), 50% (approximately 85) WTGs will be selected as part of the first-year full plot monitoring program. As outlined within Section 3.3, 14 WTG have been identified as high-risk due to their proximity to topographic features that are likely to be associated with increased bird activity. These locations have been recognised as the most likely areas where at-risk species could be impacted. As such, these 14 WTG will be prioritised for carcass search WTG selection. The remaining WTG (approximately 71) will be randomly selected from two strata (forests/woodlands and open areas), so that the selection is representative of the Study Area (i.e. if 70% of WTGs are located within open areas and 30% are located within forest/woodlands, then 70% of monitored WTGs will be within open areas and 30% will be in forest/woodland). It should be noted that some WTG may be excluded from the random selection due to accessibility. The order of selected WTGs searched will be random during each monitoring event.

Duration and Frequency

Mortality monitoring will be conducted at four week intervals between Spring and Autumn (six monitoring events), and two week intervals between Autumn and Spring

Mortality searches will be conducted during the first year of operation at selected WTGs at four weekly intervals from late Autumn to early Spring, and two weekly intervals from early Spring to late Autumn (with increased monitoring in warmer months to align with increased potential for migratory species to occur within the Study Area). Mortality monitoring frequency in subsequent years will then be adjusted to align with recommended intervals provided by the PCFNM Decision Support Tool, and consultation with DCCEEW (accounting for the large scale of the Proposed Action).

5.2.2 SOURCES OF BIAS IN MORTALITY MONITORING

Producing scientifically reliable estimates of fatality rates requires identifying and correcting the sources of bias that naturally occur in carcass counts obtained through carcass search

surveys. In this context, "bias" refers to situations where the number of carcasses detected is lower than the actual number of fatalities, which may arise from:

- **Carcass persistence bias:** some carcasses are removed or decompose before surveys occur. To help ascertain at what rate naturally occurring scavengers remove carcasses from the search area, scavenger trials will be completed (as discussed within Section 5.2.2.1).
- **Detection (searcher) efficiency bias:** not all carcasses are detected by searchers. To account for this bias, detectability trials will be performed (discussed in Section 5.2.2.2).
- **Unsearched/unsearchable area bias:** some carcasses land outside areas that can be effectively searched. This includes 'Crippling bias', where birds and bats are not detected during searches, despite colliding with the WTGs, because they are able to move away from the search plot before dying. This bias is impractical to quantify at the project scale due to requiring real-time monitoring of non-fatal collisions, which are likely to be rare and unpredictable (IFC, 2023). However, the following methodology will be incorporated into the mortality monitoring program to correct for any bias associated with unsearched and unsearchable areas:
    - Once the WTGs have been constructed, ground surveys will be conducted to assess the searchability of WTGs prior to the commencement of the mortality monitoring program;
    - Mapping will be completed to identify the visibility classes across the search area for all WTGs selected as part of the full plot searches;
    - For each WTG with obstacles or unsearchable areas identified during the ground survey, a modified search protocol will be produced to ensure consistency and rigour across regular searches of that WTG; and
    - Unsearchable areas will be accounted for in the overall monitoring regime and mortality estimates by using the *Density Weighted Proportion Tool* provided as part of the *Post-Construction Bird and Bat Fatality Monitoring for Onshore Wind Energy Facilities in Emerging Market Countries* (IFC, 2023). This will require:
        - The proportion of the area searched within each 5 m ring extending to the limit of the searched area; and
        - The carcass count (according to carcass size class) within each 5 m ring.

5.2.2.1 SCAVENGER RATES AND TRIALS

The scavenger trial is adopted to ascertain at what rate naturally occurring scavengers remove carcasses from the Study Area. These trials will be developed such that they are adopted twice within the first year following operation commencement, with each trial undertaken across 30 days. This will ensure that the difference in vegetation conditions is accounted for within the trials; wet season with long grass and dry season with short grass. Such periods are also going to be associated with different stocking levels across seasons.

Two different categories of carcasses will be used for the scavenger trials to help to ascertain the different scavenger rates in the search area. Such carcasses used will be those that are found during mortality trials (if fresh and intact) or suitable surrogates, such as dark-coloured adult mice in place of micro-bats, farm-raised ducks and pigeons as surrogates for non-raptor bird fatalities, or fresh road-killed birds and bats. The two categories that will be used for each trial are:

- Micro-bats and small birds; and
- Medium and large sized birds.

A total of 36 carcasses (12 of each size category) will be randomly placed under the 85 WTGs selected for mortality monitoring (as discussed in Section 5.2.1). Scavenger trials will be undertaken within the full plot search area of the WTG (135 m radius).

Once all carcasses have been placed, all carcasses will be checked in line with the following schedule:

- Each day for the first five days;
- Every two days from day six to day 10;
- Every three days from day 11 to day 19; then
- Every four days from day 20 until they disappear or until the end of the 30-day trial period.

The Proposed Action operation staff will be trained over a five-day period to undertake the scavenger trials following trial establishment by a suitably qualified ecologist.

Additional procedures to follow for scavenger trials is detailed below:

- Timing of searches has been based on the detailed experience and regulatory approval of other wind farms where scavenger trials have been undertaken that show almost all carcasses have been scavenged within a period of 5 – 10 days. Additionally, GPS coordinates will be taken for all carcasses placed during the scavenger trials, so as not to confuse these with any naturally occurring carcasses in the search areas;
- A mix of carcass sizes of bird and bats will be obtained to use in scavenger trials from prior searches of the Study Area. If a carcass of species at risk or of concern cannot be located for the trial, a substitute of the same colour and size will be used in its place;
- Thick latex gloves must be worn at all times when handling the bird and bat carcasses. This will ensure that both the safety of the personnel but also that human scent will not replace the scent of the carcass which will alter scavenger behaviour and find rates;
- A maximum of two carcasses should be placed under any one WTG at any one time to avoid the risk of undue attention from scavengers. This carcass will be thrown in the air in order to recreate the natural landing of a carcass from impact with a WTG, such that feathers, or fur may become dislodged or ruffled from the impact of the simulated fall;
- Detailed observations will be taken at the search areas where carcasses have been scavenged, including the composition of the carcass and weather any types of scavenging behaviour has been present (feathers, bones dispersed, pecking, tearing, partial removal of carcasses, as well as scats and tracks of potential predators). Camera-traps may also be installed to help detect scavenger activity around the placed carcasses; and
- The final state of the carcass will be recorded at the end of the survey period.

An alternative to the method used above is to use motion sensor cameras that could monitor scavenger activity. In this case a star picket (approximately 1 m high) will be placed in the ground approximately 4 m away from the carcass, with a camera attached. This camera will record any scavenging activity over the course of 30 days from placement. This method gathers the exact time and method of scavenging and thus eliminates any uncertainties in the

results analysis. The scavenger trials will be conducted at the same locations as those chosen in Figure 2-1.

5.2.2.2 DETECTABILITY TRIAL

Detectability trials will be conducted at the same time as scavenger trials, conducted during the first day of placing carcasses. These detectability trials will be conducted to test the efficiency of searchers in finding the carcasses for the Study Area. The detectability trials will be conducted twice in the first year of operation, sampling across the wet (September – April) and dry (April – September) seasons. This sampling will represent the greatest change in vegetation cover. Such detectability trials will also be conducted for handlers and dogs, if they are to be used for the Proposed Action. The detectability trials will be conducted by personnel who have been involved in the monthly carcass searches.

The methodology of detectability trials will include a suitably qualified ecologist randomly placing carcasses within the full plot search area (135 m radius) of the 85 WTGs selected for mortality monitoring (as discussed in Section 5.2.1), while recording their location. The efficiency will be recorded as the number of successful finds by a searcher against the actual carcasses placed by the suitably qualified ecologist. The detection efficiency that is determined from the detectability trials will be incorporated into mortality rates and analyses to account for the error associated with human detection of carcasses. This detectability analysis will be documented in the report at the end of the first two-year monitoring period in accordance with this BBMP.

The categories, number of carcasses and replicates to be used in the detectability trials across the wet and dry season is presented in Table 5-1, following the carcass persistence trial design suggested by the *PCFM Decision Support Tool* (IFC, 2023). If there are shortages for bird and bat carcasses for the detectability trials, appropriate substitute species will be used to represent specific target carcass categories (e.g. small birds that are similar in shape and colouring to the white-throated needletail and fork-tailed swift). Suitable substitute species will be in line with the Box 3.5 of the *Post-Construction Bird and Bat Fatality Monitoring for Onshore Wind Energy Facilities in Emerging Market Countries handbook* (IFC, 2023) and may include the same options outlined within the scavenger trails above. Unsuitable surrogates for both scavenger and detectability trails include (IFC, 2023):

- Animals suspected of being poisoned;
- Domestic poultry;
- Game birds as raptor surrogates unless it can be demonstrated that persistence rates can be reliably extrapolated; or
- Any bird or bat acquired by killing individuals from wild populations.

TABLE 5-1 NUMBER OF REPLICATES OF BIRD AND BAT CARCASSES FOR DETECTABILITY

Time	Micro-bat - Small birds	Medium sized birds	Large raptor size birds
Wet season: (long grass)	12	12	12
Dry season: (short grass)	12	12	12

5.2.3 RECORDING INFORMATION AND CARCASS HANDLING PROCEDURES

The following information is to be recorded if a carcass is detected during the carcass searches:

- Position of the carcass in relation to the WTG.
- Comments on the vegetation type and area where the carcass was located, including if the species was found on an access path or on the WTG hard-stand area.
- Details on the individual found such as species, age, sex, number of individuals, the injury description as well as the estimate time of death if found deceased. If the carcass is unable to identified, this will be taken to appropriate facilities for DNA testing to be undertaken.
- Photos must be taken of the area and of the individual found. Such photos will need to be sent to an appropriately qualified ecologist within five business days so they can adequately undertake identification.
- Weather details on the find date, as well as details taken of the weather conditions in the time preceding the find date of the carcass, including wind speeds, temperate and rainfall amounts.

The carcass found will need to be handled in accordance with the following procedure:

1. Carcass is to be safely removed from the site with appropriate personal safety equipment to be worn by personnel. This personal safety equipment includes thick rubber gloves and a long-sleeved shirt, a face mask if possible and appropriate eye wear. The carcass should be placed in a plastic bag, then wrapped in newspaper and placed into a second plastic bag. The removal of the carcass from the area ensures that recounting of the same carcass does not occur at a later date.
2. Labelling of the carcass plastic bag to ensure the species is easily identifiable later and all information is correct. This includes placing a completed datasheet with the above listed information into the outer plastic bag.
3. The carcass bag will then be placed into an appropriate freezer compartment, likely within the Proposed Action's site office. This will keep the carcass for future examination if required by a suitably qualified ecologist if the original retrieval was made by an unqualified operation staff member. Frozen specimens will also be able to be used for detectability trials at a later date.

It is noted that an NC Act authority, a Scientific Purposes Permit must be obtained in order to remove the carcasses from the Study Area. This will need to be obtained for the monitoring program and can be referred to in order to get more detail on the disposal methods of the carcasses. Should any carcasses be found at the Proposed Action during construction, commissioning and maintenance activities, the carcass should be handled as above.

5.2.4 RESULTS ANALYSIS AND PRESENTATION

It is proposed that a 12-month monitoring report, an eight-year monitoring report and a final monitoring report (end of life of the Proposed Action) will be prepared. Data that will be analysed and documented in the reports will align with the survey data requirements set out in Appendix 2 of the technical report Investigation of existing post-construction mortality monitoring at Victorian wind farms to assess its utility in estimating mortality rates (Moloney, Lumsden & Smales, 2019). This includes:

- WTG details – details of the location, size and proximity to wildlife habitat for each WTG within a wind farm development;
- Detectability efficiency trials – details of each detectability trial undertaken with different carcass types;
- Carcass persistence trials – details of methods used and results of trials;
- Mortality surveys – details of methods used and findings; and
- Incidental finds of carcasses outside of the mortality surveys.

Data analysis will estimate mortality rates of birds and bats within the Study Area, considering standard error and variation. Appropriate software packages will be used to inform variables needed to be determined during the carcass detectability and scavenger trials which will subsequently inform the survey design. At this stage, prior to construction and knowledge of precise WTGs to be constructed, the following software packages and statistical principles are proposed for the Proposed Action, with specific variables to be measured and data input requirements (and associated assumptions) considered in the final monitoring design:

- Logistical regression (general liner modelling) to be used to determine detection efficiency. This will account for significance;
- The proportion of the area searched to be estimated using the Monte-Carlo Simulation method as described in Hull and Muir (2010);
- Mortality will be estimated using the Hortvitz-Thompson style estimator from Huso (2011);
- Survival analysis (survival regression to account for interval censoring) to be calculated using Generalised Estimator (GenEst) (or similar). GenEst is used to estimate the total number of individuals that are present within an area in a given time period, when their detection probability may not be known. This program is used as counts of carcasses alone is not an accurate way to measure the true number of fatalities in an area due to those that may be missed in the process. This method also allows for comparisons across locations and years taking into account the rate of detection:
    - GenEst includes tools for estimating searcher efficiency, carcass persistence, and other detection probability parameters from experimental field trials. GenEst is not an evidence of absence-type estimator and is not going to be used in circumstances where few carcasses are found. This is where the Evidence of Absence (EoA) program will be adopted; and
    - EoA – This program can be used in order to help determine potential fatalities which may have occurred, with respect to the survey effort, even in the absence of a carcass being located.

Statistical analyses will assist in determining potential significant differences across size categories of species, vegetation composition or across seasons.

Documented results will inform adaptive management on whether additional mitigation measures are necessary and whether specific WTGs in the Study Area pose higher risks to birds and bats than others. Such adaptive management will occur in consultation with DCCEEW.

5.3 BBMP PERSONNEL AND ASSOCIATED TRAINING REQUIREMENTS

All personnel involved in the implementation of the BBMP will be familiar with this BBMP, as well as with the relevant Proposed Action policies and procedures, and other important administrative matters (e.g., health and safety documents). The Proponent will be responsible for ensuring that suitably qualified and trained people are engaged to supervise and implement the formal monitoring program as defined in this BBMP. Beyond the formal period of monitoring, the Proponent will be additionally responsible for ensuring ongoing reporting of incidental finds and the engagement of relevant specialists triggered by this BBMP.

Training will be provided to all personnel that will be undertaking carcass searches, species identification and handling. Such training will be delivered by suitably qualified ecologists who are specialists in the field of bird and bat carcass retrievals. The training will include trial establishment, transect search techniques, selection of specific WTGs for monitoring, species identification, carcass handling practices and PPE management. The qualified ecologist will be involved in the initial search program of the WTGs to oversee and assist with the carcass search, handling and identification. So that the BBMP is being implemented and monitoring routinely performed to standard, the suitably qualified ecologist will undertake an audit after the first 6 months of the commencement of the implementation of this BBMP.

The suitably qualified ecologist will be available to identify any carcasses that Proposed Action personnel are unable to identify, either from frozen specimens or from photographs taken at the search area.

Training will be provided to assigned operational personnel which on how to properly prepare and handle carcasses and how to randomise the placement of carcasses in trial areas.

Scavenger trials will be developed by the suitably qualified ecologist, who will supervise the searches undertaken by trained operational personnel.

The suitably qualified ecologist will undertake data analysis and prepare the 12 month interim and two year final monitoring reports.

Training will be provided by the suitably qualified ecologist to operational personnel involved in the monitoring program and trials, with refresher training available if requested or deemed necessary during the two-year implementation period of the BBMP.

5.4 HANDLING PROTOCOL AND TRAINING: INJURED AND DECEASED SPECIES

Operational personnel involved in the search for wildlife will be appropriately trained in handling and assisting with injured or deceased wildlife. All injured or deceased wildlife found during the first two years of operation will be reported to the Theodore Wind Farm's Responsible Officer.

Once reported, it will be the responsibility of the Responsible Officer to organise for the retrieval and/or treatment of the individual. Such a protocol will involve defining the correct handling procedures, personal protective equipment, transportation, and wildlife hospital treatment arrangements.

Bats can carry many forms of diseases including Hendra virus and Australian Bat Lyssavirus. Extra precaution and care will need to be taken when handling bat species (Queensland Government, 2020). In this circumstance, professionals should be called to handle injured bat

species. Information sources to contact in case of an injured bat include the RSPCA (1300 264 625) and the Department of Environment, Science and Innovation (1300 130 372). Appropriate and contemporary advice on the best practice for movement of individuals will be provided by these organisations.

6. REPORTING OF BIRD AND BAT DATA

Monitoring reports will be produced annually for the first eight years of operation. Monthly summaries of data from carcass searches and detectability trials will also be provided as attachments to the monitoring reports. Mortality reports for the remainder of the life of the Proposed Action will be reviewed after year eight of operation and adjusted based on the previous bird and bat monitoring results. If impact triggers are met during monitoring and trials, then additional reporting may be proposed by the suitably qualified ecologist.

The data to be analysed and results documented in the monitoring reports include:

- Results of the carcass searches and observations, including the methods adopted during survey searches (dates and times of searches also reported);
- Discussion of the results of the report and how this should impact upon management and mitigation measures, such as high mortality;
- Analysis of bird and bat mortality rates via statistical tests, confirming the number of deaths per annum. This should also consider variability of bird and bat carcasses found during different seasons. Annual WTG strike reports comprising raw strike data and strike notifications, survey methodologies, results of detection/persistence trials, environmental/meteorological conditions and associated statistical analysis;
- Records of any species occurrences, in accordance with the DCCEEW Guidelines for biological survey and mapped data (2018) using the species observation data template on the DCCEEW website;
- Descriptions of the search areas including the presence of any introduced flora and fauna (specifically feral cats and foxes) that may impact the carcasses or species;
- Any construction or operational personnel carcass finds, including the WTG where the carcass was found, date and time; and
- Impact trigger identification, or identification of any species or risk levels that may need to be adaptively adjusted within the bird and bat risk assessment (Section 3.2).

Analysis of the effectiveness of the mitigation measures in place and whether changes or adjustments need to be made. This will include an analysis of the effectiveness of the impact trigger framework also to ensure that all impacts are being appropriately considered and accounted for in a reasonable manner.

7. ADAPTIVE MANAGEMENT AND SPECIES IMPACT TRIGGERS

This section outlines the adaptive management decision making framework with respect to species-specific impact triggers associated with interactions with WTGs.

Impact triggers and response requirements will be different for both listed (Section 7.1) and non-listed species (Section 7.2).

The Proponent will be responsible for ensuring implementation of this BBMP and the adaptive management approach. A suitably qualified ecologist will support decision-making elements and provide advice where Regulator consultation (State and Commonwealth) is required.

7.1 LISTED THREATENED AND MIGRATORY SPECIES

7.1.1 IMPACT TRIGGER REQUIREMENTS

Where a listed threatened and/or migratory bird or bat species carcass is found within the search area of a WTG (proximity that can be attributed to WTG collision) during implementation of this BBMP, or via an incidental find, then the impact trigger methodology as described below applies. Additionally, if a breeding area for these species is located within 200 m of a WTG, then an impact trigger will occur. No breeding resources for species likely or known to occur within the Study Area or locality are expected to be impacted by the Proposed Action. Listed threatened and/or migratory species are those that are listed under the EPBC Act and NC Act.

Where a single carcass of a listed threatened and/or migratory species is detected within the Study Area, a decision-making framework will be implemented (Section 7.1.2), to implement corrective actions to circumvent a significant impact. Documents that have been assessed to determine impact triggers include (noting that impact triggers may be revised with updated information through the adaptive management process):

- *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance per the EPBC Act* (DEWHA, 2013);
- *Draft referral guideline for 14 birds listed as migratory species under the EPBC Act* (DoE, 2015);
- *Impacts on birds and bats from onshore wind farms in Australia* (Reid & Baker, 2025); and
- Species-specific management plans and Conservation Advice from SPRAT profiles.

It is proposed that the method of assessment to identify a significant impact is to quantify the number of mortalities of each species based on the carcass search results (refer to Section 5.3). In the event that the number of mortalities exceeds an ecologically significant proportion of a population over a defined time period it is regarded as a significant impact.

A review of species population ecology has been used to establish species specific significant impact thresholds based on estimates of ecologically significant proportions of populations. This has been applied to all listed threatened and migratory species identified as possessing 'low' or 'moderate' risk of collision in this BBMP (at-risk species). For migratory species, a significant impact threshold equates to 0.1% of the estimated Australian population (DoE, 2015). For listed threatened species, an ecologically significant proportion of a population, and therefore significant impact threshold has been defined based on the species EPBC Act listing and population estimate. For the red goshawk, large eared pied bat and Australian painted

snipe (listed as endangered), thresholds have considered the rarity of the species, the estimated population size and the potential effect that mortality will have on the local/regional population. For example, the red goshawk has the lowest threshold given the smallest estimated population size. The grey falcon also is rare in the landscape and has a low population estimate, but with its listing of vulnerable has a higher threshold in comparison.

To prevent a significant impact occurring as a result of WTG collision, mortality monitoring will be assessed against the following thresholds:

- **Annual Threshold:** indicates whether mortality rates are progressing towards Cumulative Impact Threshold Trigger 1. The Approval Holder will undertake a review to determine why the threshold was reached and implement corrective actions as outlined within Section 7.1.2.
- **Cumulative Impact Thresholds (cumulative over the defined generational timeframes):**
    - Trigger 1: indicates that the Proposed Action is progressing towards a significant impact (Trigger 2). The Approval Holder must commence the adaptive management measures, corrective actions and additional monitoring as outlined within Section 7.1.2.
    - Trigger 2: indicates that a significant impact threshold has been reached. The Approval Holder must immediately (within 24 hours) cease operation of WTGs contributing to the death of the MNES, during the ecologically relevant periods (accounting for migratory timeframes and flight activity patterns) as outlined within Section 7.1.2. The Approval Holder must not recommence operation during the ecologically relevant period of those WTGs unless approval is provided by DCCEEW.

Generation time can be used as an indication of the time required for a population to replace individuals lost to WTG collisions and has therefore been used to identify the time frames in which to monitor significant impacts from cumulative collision mortality. Generation times for bird species are based on age of first reproduction, maximum longevity and annual adult survival. For bat species, a family level generation time is applied due to paucity of information on individual species (Reid and Baker 2025). An estimate of generational time for the at-risk species has been sourced from *Impacts on Birds and Bats from Onshore Wind Farms in Australia* (Reid & Baker, 2025), where a generation time range is provided for Australian bird and bat species.

- Table 7- presents the estimated generational time range (Reid & Baker, 2025), and the associated cumulative impact assessment timeframe trigger resets for each at-risk listed species.

Table 7-2 provides the numerical impact threshold relative to each at-risk listed species. Cumulative impact assessment time frame trigger resets have been determined based on the nearest whole year within the generational time range. This has been done to enable a more pragmatic operational application. Cumulative impact assessment time frames are triggered at first mortality event relative to each at-risk species and is successive for each mortality event for the cumulative impact assessment trigger timeframe on a sliding scale.

It is important to note that the trigger resets provided may exhibit fluctuations through time as updated species population estimates become available. It is expected that contemporary information be used during an investigation, as required throughout the life of this BBMP.

TABLE 7-1 GENERATIONAL TIME OF AT-RISK LISTED SPECIES

At-risk Species	Estimated Generation Time Range	Cumulative Impact Assessment Timeframe Trigger Resets
Red goshawk	4.7 – 8.5 years	8 years
Grey falcon	2.6 – 4.7 years	4 years
White-throated needletail	2.6 – 4.7 years	4 years
Australian painted snipe	2.6 – 4.7 years	4 years
Fork-tailed swift	2.6 – 4.7 years	4 years
Large-eared pied bat	4.9 – 6.4 years	6 years

TABLE 7-2 SIGNIFICANT IMPACT COLLISION THRESHOLD OF AT-RISK LISTED SPECIES

At-risk Species	EPBC Act Listing	Australian Population Estimate	Annual Threshold	Cumulative Impact Threshold	
			Evidence of Progression towards Trigger 1	Trigger 1	Trigger 2
Cumulative Assessment over 4 years					
Fork-tailed swift	Mi	100,000[1]	13 individuals	50 individuals	100 individuals
Grey falcon	V	<1,000[3]	1 individual	2 individuals	4 individuals
White-throated needletail	V, Mi	40,000[4]	5 individuals	20 individuals	40 individuals
Australian painted snipe	E	2,500[6]	1 individual	2 individuals	4 individuals
Cumulative Assessment over 6 years					
Large-eared pied bat	E	20,000[5]	2 individuals	10 individuals	20 individuals
Cumulative Assessment over 8 years					
Red goshawk	E	<1,000[2]	Detected within the Locality*	1 individuals	2 individuals

**Records detected within the Locality will be monitored following the methodology provided within Appendix G (Bird and Bat Monitoring for the Life of the Proposed Action).*
[1] (DoE, 2015)
2 (DCCEEW, 2023c)
3 (TSSC, 2020
4 (Garnett & Crowley, 2000)
5 (DCCEEW, 2023a)
6 (DSEWPC, 2013)

7.1.2 DECISION-MAKING FRAMEWORK

A decision-making framework has been developed to have a systematic workflow when implementing management measures and corrective actions. This decision-making framework aims to help achieve the environmental outcomes of the BBMP (outlined in Section 1.3), to promote a long-term reduction in the risk of WTG collision and barotrauma impacts on listed bird and bat species. This decision-making framework has been developed with consideration for *Impacts on birds and bats from onshore wind farms in Australia* (Reid & Baker, 2025).

If a carcass of a listed bird or bat species is detected, the following decision making framework will be followed:

1. The bird or bat carcass must be immediately (within 24 hours) reported to the Proposed Action's Responsible Officer, the area where the species was found and any other contributing factors that appear appropriate. Photos must be taken of the carcass or injured species so that correct identification can be carried out. All deceased listed threatened and migratory birds and bats found in the Project Area will be reported to DCCEEW (regardless of cause of death).
2. The following assessments will be completed after the carcass is detected:
    f. A suitably qualified ecologist will undertake an analysis either in person or through analysis of the carcass and/or photographic evidence (to be completed within five business days of detecting the carcass). The ecologist will assess whether the death/injury can be directly attributed to a WTG strike. Where there is conclusive evidence the death/injury is not related to WTG strike, no further action is required.
    g. Simultaneously to this, an immediate assessment will be completed against the annual and significant impact thresholds identified within

h. Table 7-2. If a threshold has been met, the Proposed Action's Responsible Officer will report the trigger to DESI and/or DCCEEW within five business days and the following steps of the decision-making framework will be implemented. If a threshold has not been met, no further action is required

3. If an A**nnual Threshold** is met, a suitably qualified ecologist will:
   a. Undertake a detailed investigation in order to determine the event and the location of the WTGs that caused the death or injury of the listed species. Further monitoring (fortnightly for six-weeks) will be completed to determine re-occurrences/extent of the impact.
   b. Re-assess the species site utilisation using data collected from pre and post-construction bird and bat utilisation surveys and undertake a population viability analysis (PVA) where data is available.
   c. Identify species-specific corrective actions that are likely to prevent or reduce deaths of the species to avoid meeting a significant impact. As part of the adaptive management strategy, a number of corrective actions will be considered, these include:
      i. Acoustics to discourage foraging birds at particular locations;
      ii. Encourage species into alternative low-risk areas using social attraction techniques (decoys and audio playback systems);
      iii. Investigation of alternative stocking arrangements;
      iv. Installation of ultrasound acoustic devices;
      v. Installation of detection systems;
      vi. Increased mortality monitoring frequency;
      vii. Moving grain and water sources away from identified WTGs (subject to agreement with landholder) (detailed within Table 4-1);
      viii. Reduce/alter lighting around WTGs (detailed within Table 4-1);
      ix. Relocating/altering infrastructure providing roosting/nesting resources (detailed within Table 4-1); and
      x. Low wind speed curtailment (cut-in speeds).
   d. Update the BBMP to incorporate the information obtained from the above assessments and present to DCCEEW for approval.
   e. If the investigation above identifies a direct link between the species mortality events and a risk-factor which can be immediately rectified through corrective actions (e.g. moving grain and water sources away from identified WTGs, alternative stocking arrangements and adding deterrents to infostructure providing roosting/nesting resources), this will be completed within five business days. Note, where the Annual Threshold is met in two consecutive years, the management response for the Cumulative Impact Trigger 1 will apply.
4. If the **Cumulative Impact Trigger 1** is met:
   a. Corrective actions identified within the BBMP updated as a result of meeting the annual threshold (described above) will be implemented within 72 hours of meeting Trigger 1 so that timely mitigation of the impact to the species occurs (see Table 7-3 for examples of relevant corrective actions for each at-risk species).

b. Further monitoring of these additional corrective actions will be undertaken by a suitably qualified ecologist to determine and report on their effectiveness. Outcomes of this monitoring will be reported in the monitoring reports that are prepared by the ecologist to the Proponent.

c. As part of the adaptive management strategy, the BBMP will be updated to include any additional or adjusted corrective actions where required.

5. If the **Cumulative Impact Trigger 2** is met:

a. A significant impact to the species has occurred. The Proponent must cease operation of WTGs identified as contributing to the death of the MNES (all WTGs with identified carcasses of the species and the five closest neighbours of these WTGs), during the ecologically relevant period for the species (e.g. diurnal shutdown during migratory period) (see Table 7-3).

b. Offsets may be required where the significant impact to the species cannot be effectively mitigated by other measures. Offsets may be in the form of financial offsets or research-based offsets where an appropriate institution can undertake species specific research. Offsets will need to be considered and developed in accordance with EPBC Act Environmental Offsets Policy (DSEWPC, 2012). Any offset consultations will need to be undertaken with the relevant authority.

TABLE 7-3 ECOLOGICALLY RELEVANT PERIOD AND CORRECTIVE ACTIONS FOR AT-RISK SPECIES.

At-risk Species	Ecologically Relevant Period	Examples of relevant Corrective Actions
Fork-tailed swift	Migratory period specific to the area (species migrates through Australia between October and April).	• Installation of detection systems (early warning for migratory passage); • Low wind speed curtailment during peak passage windows; • Reduce/alter lighting around WTGs (to minimise attraction during migration); and • Increased mortality monitoring frequency.
Grey falcon	Diurnal flight activity	• Relocating/altering infrastructure providing roosting/nesting resources near WTGs; • Moving grain and water sources away from WTGs to reduce prey attraction; and • Increased mortality monitoring frequency.
White-throated needletail	Migratory period specific to the area (species migrates through Australia between September and April).	• Installation of detection systems (to detect large migratory flocks); • Low wind speed curtailment during high risk weather conditions (wind fronts/updraft days); • Reduce/alter lighting around WTGs; and • Increased mortality monitoring frequency.
Australian painted snipe	Nocturnal flight activity	• Reduce/alter lighting around WTGs (to minimise night-time attraction); • Installation of detection systems (thermal/IR for nocturnal birds); • Relocating/altering infrastructure or wet areas that may attract foraging individuals; and • Increased mortality monitoring frequency.

At-risk Species	Ecologically Relevant Period	Examples of relevant Corrective Actions
Large-eared pied bat	Nocturnal flight activity	• Installation of ultrasound acoustic devices (to deter bats); • Reduce/alter lighting around WTGs (to minimise attraction of prey species); • Low wind speed curtailment (cut-in speeds); and • Increased mortality monitoring frequency.
Red goshawk	Diurnal flight activity	• Relocating/altering infrastructure providing roosting/nesting resources; • Moving grain/water sources away from WTGs to reduce prey attraction; • Installation of detection systems and increased mortality monitoring; and • Increased mortality monitoring frequency.

7.2 NON-THREATENED (PROTECTED AND LOCALLY ABUNDANT) SPECIES

7.2.1 IMPACT TRIGGER REQUIREMENTS

The cumulative impact trigger for non-listed bird and bat species, identified in this BBM, is the observation of five or more carcasses of the same species recorded at the same WTG for two or more consecutive searches.

The definition of a significant impact to a non-listed species is an impact that is likely to reduce the viability of the population of the species within that bioregion. Sometimes the population numbers for a species are not known or reported. In the case where such information is not publicly available, a suitably qualified ecologist will undertake an assessment of the potential impact to a species in the bioregion to determine whether the impact will reduce population viability.

7.2.2 DECISION-MAKING FRAMEWORK

A decision-making framework has been developed to have a systematic workflow when implementing management measures and corrective actions. This decision-making framework aims to help achieve the environmental outcomes of the BBMP (outlined in Section 1.3), to promote a long-term reduction in the risk of WTG collision and barotrauma impacts on local bird and bat species.

If the impact trigger requirements (outlined in Section 7.2.1) are met for the Proposed Action, the following decision-making framework will be followed:

1. DCCEEW will be notified of the trigger (including species, time and area) within ten business days of the trigger event.
2. A suitably qualified ecologist will undertake an analysis to determine if the impact trigger will cause a significant impact on the viability of the population of a species within the bioregion. This assessment will consider factors including the distribution of the species, known population size and habitat requirements, as well as any literature on specific threats to the species within the bioregion.

3. A report on the findings of the analysis will be prepared by the suitably qualified ecologist and presented to the Proposed Action's Responsible Officer and subsequently then presented to DCCEEW within three weeks of the impact triggering event (this date may be subject to change upon consultation with DCCEEW).
    a. If the evaluation undertaken by the suitably qualified ecologist reveals the impact trigger to be a one-off event and unlikely to occur again, no further action will be required.
    b. If the evaluation undertaken by the suitably qualified ecologist reveals the impact trigger may lead to a significant impact to the population viability of a species in the bioregion, species-specific monitoring will likely be recommended and implemented. These monitoring exercises (fortnightly for six-weeks) will need to be observed and reported on by the suitably qualified ecologist, who will then determine if any additional mitigation measures are necessary to manage or reduce the significant impact upon the species. Such measures will be decided upon through adaptive management approach.
4. The investigations and mitigation measures recommended in the case of a significant impact will need to be included in the monitoring reports, in accordance with this BBMP.

8. SUMMARY OF SPECIFIC MANAGEMENT OBJECTIVES, ACTIVITIES, TIMING AND PERFORMANCE CRITERIA

Table 8-1 summarises management objectives, activities, timing and responsible parties for the implementation of this BBMP. This table should be referred to for reporting and monitoring purposes throughout the monitoring period. It is noted that adaptive management may require an adjustment to the requirements in under the direction of a suitably qualified ecologist.

TABLE 8-1 SUMMARY OF MANAGEMENT OBJECTIVES, ACTIVITIES, RESPONSIBLE PARTIES AND TIMING

Stage	Management Actions	Responsibility	Timing
Pre-Development	The two-stage impact and disturbance mitigation process will be implemented. Areas of remnant and regrowth vegetation will be avoided at the design and micro-siting phases.	Proponent	Design
	Design of a WTG with a blade sweep area to provide a collision-free foraging zone within the canopy and within a reasonable zone above the canopy.	Proponent	Design
	Locating WTGs away from key bird and bat habitats (waterways and drainage lines).	Proponent	Design
	Initial field surveys for bird and bats will be undertaken. Impacts areas to be selected as part of the BACI designed bird surveys. CRM to be undertaken.	Proponent	Design
Pre-Construction	Pre-clearing surveys shall be undertaken prior to clearing efforts within the marked boundaries. These pre-clearance surveys will form part of the micro-siting process, which will closely analyse potential infrastructure locations. If potential habitat for bats, such as riparian areas and dense woodlands, occur in such locations, development layout will be adjusted. Control areas to be selected as part of BACI designed bird surveys. Surveys will then be undertaken in the control and impact areas prior to construction beginning. These surveys will include BUS such as point, waterbody and bird of prey surveys, in order to determine species presence in the RSA and bat surveys will be conducted via the use of echolocation call detectors and harp trapping.	Principal Contractor	Prior to Construction
	Targeted surveys to identify important habitat features of value to birds and bats in the Study Area, in particular, identify raptor nesting sites so that WTG location can be adjusted as part of micro-siting requirements to minimise collision risk.	Principal Contractor	Prior to Construction
Construction	All clearing shall be within clearly marked boundaries and in accordance with the Development Permit.	Principal Contractor	At all times
	Where trenching and excavations are created which may entrap fauna, suitable escape measures are put in place, and excavation are checked for fauna before backfilling.	Principal Contractor	At all times
	Include toolbox talks for site specific bird and bat information during the Proposed Action.	Principal Contractor	Monthly
	Ensure appropriate waste management (lidded bins), including food scraps, to reduce potential for feral species to become established on-site.	Principal Contractor	At all times

Stage	Management Actions	Responsibility	Timing
	BACI surveys conducted at impact and control areas during construction to determine bird and bat composition, abundance and density at control and development areas. This includes BUS and use of bat survey techniques.	Principal Contractor	Bi-annually to Quarterly
Monitoring	Mitigation measures will be reviewed throughout the monitoring program, and at the end of every two-year monitoring period to determine whether any adjustments should be made	Ecologist	Bi-annually
	Daily inspections by spotter-catcher during clearing, specifically hollow trees, roosting sites, and rocky outcrops and caves for birds and bats	Principal Contractor	Daily
	Weekly site inspections to review flora and fauna control measures during clearing and construction	Principal Contractor	Weekly
	BACI surveys to be conducted in the operation phase at control and impacts areas, to determine the 'after' development effect on bird and bat composition, abundance and density.	Principal Contractor	Bi-annually to Quarterly
	Mortality monitoring completed monthly for eight years. Mortality monitoring requirements will be re-assessed and implemented accordingly for the life of the Proposed Action.	Ecologist or trained personnel	Monthly
	Scavenger and detectability trials: two of each, undertaken within the first year of monitoring, approximately 6 months apart.	Ecologist or trained personnel	Detectability = biannually Scavenger = biannually
	Adaptive management and inclusion of additional mitigation measures recommended by a suitably qualified ecologist, as a result of meeting impact triggers.	Proponent	As required
Reporting	Sightings and incidents reported in daily Pre-starts	Principal Contractor	Daily
	Fauna spotter-catcher will keep an inventory of any bird and bat species encountered with details of species, capture and release condition and capture and release GPS co-ordinates during construction. This also includes carcass reporting and notification.	Spotter Catcher	Daily
	Injured native fauna to be reported to Health, Safety, Environment Quality (HSEQ) Manager.	Site Manager	Within 24 hours

Stage	Management Actions	Responsibility	Timing
	Preparation of monitoring BBMP reports: one within three months of the first year of monitoring, and then annually until year eight of operation. Mortality reporting requirements will be re-assessed and implemented accordingly for the life of the Proposed Action. Monitoring report to include estimates of mortality for bird and bat species across the monitoring period, considering detectability and scavenger trial results.	Ecologist	Annually
Corrective Action	All near misses and incidents will be investigated to establish root cause. Where necessary corrective actions will be developed to improve existing processes.	All Personnel	As required

8.1 BBMP MONITORING AND IMPLEMENTATION RISKS

There are certain factors that may impact the carcass searches and monitoring for the BBMP. Such factors include weather events that restrict access to search areas, including significant flooding and storms (electrical activity) as well as heatwaves and bushfires. Other incidents include risks to health and safety like the unlikely event of a WTG suffering a malfunction in weather events or due to mechanical failures. Access issues may also play a contributing factor to the hindering of search efforts, especially if vegetation becomes unmanageable to traverse.

There will also be stop work cues in which operational and construction personnel may cease their operations due to safety concerns. In this unlikely event, all BBMP monitoring will also cease.

If these factors arise and monitoring per the usual BBMP cannot proceed, limitations or changes to the original BBMP will be recorded during reporting periods.

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APPENDIX A PMST AND WILDNET 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: 26-Aug-2024

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:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	38
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:	18
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:	1
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	6
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

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	Buffer Status
Brigalow (Acacia harpophylla dominant and co-dominant)	Endangered	Community known to occur within area	In feature area
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Endangered	Community may occur within area	In feature area
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	Community likely to occur within area	In feature area
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	Community likely to occur within area	In buffer area only
Weeping Myall Woodlands	Endangered	Community likely to occur within area	In feature 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	Buffer Status
BIRD			
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Falco hypoleucos](#) Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area	In feature area
[Gallinago hardwickii](#) Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat may occur within area	In feature area
[Geophaps scripta scripta](#) Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Grantiella picta](#) Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area	In feature area
[Hirundapus caudacutus](#) White-throated Needletail [682]	Vulnerable	Species or species habitat may occur within area	In feature area
[Neochmia ruficauda ruficauda](#) Star Finch (eastern), Star Finch (southern) [26027]	Endangered	Species or species habitat likely to occur within area	In feature area
[Rostratula australis](#) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area	In feature area
[Stagonopleura guttata](#) Diamond Firetail [59398]	Vulnerable	Species or species habitat may occur within area	In feature area
[Turnix melanogaster](#) Black-breasted Button-quail [923]	Vulnerable	Species or species habitat may occur within area	In feature area
MAMMAL			
[Chalinolobus dwyeri](#) Large-eared Pied Bat, Large Pied Bat [183]	Endangered	Species or species habitat may occur within area	In feature area
[Dasyurus hallucatus](#) Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Macroderma gigas](#)			
Ghost Bat [174]	Vulnerable	Species or species habitat may occur within area	In feature area
[Nyctophilus corbeni](#)			
Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area	In feature area
[Petauroides volans](#)			
Greater Glider (southern and central) [254]	Endangered	Species or species habitat known to occur within area	In feature area
[Petaurus australis australis](#)			
Yellow-bellied Glider (south-eastern) [87600]	Vulnerable	Species or species habitat may occur within area	In feature 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 likely to occur within area	In feature area
[Pteropus poliocephalus](#)			
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour may occur within area	In feature area
PLANT			
[Arthraxon hispidus](#)			
Hairy-joint Grass [9338]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Cadellia pentastylis](#)			
Ooline [9828]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Cossinia australiana](#)			
Cossinia [3066]	Endangered	Species or species habitat known to occur within area	In feature area
[Dichanthium queenslandicum](#)			
King Blue-grass [5481]	Endangered	Species or species habitat known to occur within area	In feature area
[Dichanthium setosum](#)			
bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Leuzea australis listed as Rhaponticum australe			
Austral Cornflower, Native Thistle [9363]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Polianthion minutiflorum			
[82772]	Vulnerable	Species or species habitat may occur within area	In feature area
Solanum dissectum			
[75720]	Endangered	Species or species habitat may occur within area	In buffer area only
Solanum johnsonianum			
[84820]	Endangered	Species or species habitat may occur within area	In buffer area only
Xerothamnella herbacea			
[4146]	Endangered	Species or species habitat may occur within area	In feature area
REPTILE			
Delma torquata			
Adorned Delma, Collared Delma [1656]	Vulnerable	Species or species habitat may occur within area	In feature area
Denisonia maculata			
Ornamental Snake [1193]	Vulnerable	Species or species habitat known to occur within area	In feature area
Egernia rugosa			
Yakka Skink [1420]	Vulnerable	Species or species habitat may occur within area	In feature area
Elseya albagula			
Southern Snapping Turtle, White-throated Snapping Turtle [81648]	Critically Endangered	Species or species habitat may occur within area	In feature area
Furina dunmalli			
Dunmall's Snake [59254]	Vulnerable	Species or species habitat may occur within area	In feature area
Hemiaspis damelii			
Grey Snake [1179]	Endangered	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Rheodytes leukops](#)			
Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver [1761]	Vulnerable	Species or species habitat likely to occur within area	In feature area
SNAIL			
[Adclarkia dawsonensis](#)			
Boggomoss Snail, Dawson River Snail, Dawson Valley Snail [67458]	Critically Endangered	Species or species habitat may occur within area	In buffer area only

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
[Apus pacificus](#)			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
[Cuculus optatus](#)			
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area	In feature area
[Hirundapus caudacutus](#)			
White-throated Needletail [682]	Vulnerable	Species or species habitat may occur within area	In feature area
[Monarcha melanopsis](#)			
Black-faced Monarch [609]		Species or species habitat may occur within area	In feature area
[Motacilla flava](#)			
Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area
[Myiagra cyanoleuca](#)			
Satin Flycatcher [612]		Species or species habitat likely to occur within area	In feature area
[Rhipidura rufifrons](#)			
Rufous Fantail [592]		Species or species habitat known to occur within area	In feature area
Migratory Wetlands Species			
[Actitis hypoleucos](#)			
Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris acuminata			
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris ferruginea			
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calidris melanotos			
Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Gallinago hardwickii			
Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat may occur within area	In feature area

Other Matters Protected by the EPBC Act

Listed Marine Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Anseranas semipalmata			
Magpie Goose [978]		Species or species habitat may occur within area overfly marine area	In feature area
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis			
Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata			
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
[Chalcites osculans as Chrysococcyx osculans](#) Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area	In feature area
[Gallinago hardwickii](#) Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat may occur within area overfly marine area	In feature area
[Haliaeetus leucogaster](#) White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area	In feature area
[Hirundapus caudacutus](#) White-throated Needletail [682]	Vulnerable	Species or species habitat may occur within area overfly marine area	In feature area
[Merops ornatus](#) Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
[Monarcha melanopsis](#) Black-faced Monarch [609]		Species or species habitat may occur within area overfly marine area	In feature area
[Motacilla flava](#) Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area overfly marine area	In feature area
Pterodroma cervicalis White-necked Petrel [59642]		Species or species habitat may occur within area	In feature area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area overfly marine area	In feature 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	In feature area

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Oxtrack	Nature Refuge	QLD	In buffer area only

EPBC Act Referrals				[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Theodore Wind Farm	2024/09842		Assessment	In feature area
Controlled action				
Construct and operate 447km high pressure gas transmission pipeline	2009/4976	Controlled Action	Post-Approval	In feature area
Construction of a high pressure buried gas pipeline, Kogan to Gladstone, QLD	2009/5029	Controlled Action	Post-Approval	In feature area
Queensland Curtis LNG Project - Pipeline Network	2008/4399	Controlled Action	Post-Approval	In feature area
Not controlled action				
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
Surat Basin Railway	2008/3944	Not Controlled Action	Completed	In buffer area only

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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Queensland Government

WildNet species list

Search Criteria: Species List for a Specified Point
Species: All
Type: Native
Queensland status: Rare and threatened species
Records: All
Date: Since 1980
Latitude: -24.9007
Longitude: 150.4475
Distance: 25.5
Email: jethro.ottley@erm.com
Date submitted: Friday 23 Aug 2024 16:58:50
Date extracted: Friday 23 Aug 2024 17:00:05

The number of records retrieved = 8

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Apodidae	*Hirundapus caudacutus*	white-throated needletail		V	V	1
animals	mammals	Petauridae	*Petaurus australis australis*	yellow-bellied glider (southern subspecies)		V	V	3
animals	mammals	Phascolarctidae	*Phascolarctos cinereus*	koala		E	E	1
animals	mammals	Pseudocheiridae	*Petauroides volans volans*	southern greater glider		E	E	3
animals	reptiles	Diplodactylidae	*Strophurus taenicauda*	golden-tailed gecko		NT		5
plants	land plants	Asteraceae	*Leuzea australis*			V	V	1/1
plants	land plants	Euphorbiaceae	*Bertya pedicellata*			NT		2/2
plants	land plants	Sapindaceae	*Cossinia australiana*			E	E	1/1

CODES

I - Y indicates that the taxon is introduced to Queensland and has naturalised.

Q - Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992.*
The codes are Extinct (EX), Extinct in the Wild (PE), Critically Endangered (CR), Endangered (E), Vulnerable (V), Near Threatened (NT), Special Least Concern (SL) and Least Concern (C).

A - Indicates the Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999.*
The values of EPBC are Extinct (EX), Extinct in the Wild (XW), Critically Endangered (CE), Endangered (E), Vulnerable (V) and Conservation Dependent (CD).

Records - The first number indicates the total number of records of the taxon (wildlife records and species listings for selected areas).
This number is output as 99999 if it equals or exceeds this value. A second number located after a / indicates the number of specimen records for the taxon.
This number is output as 999 if it equals or exceeds this value.

APPENDIX B LIKELIHOOD OF OCCURENCE

TABLE 1 THREATENED OR MIGRATORY SPECIES AND TECS THAT ARE KNOWN, LIKELY OR HAVE POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Scientific Name	Common Name	EPBC Act Listing
Known		
Poplar Box Grassy Woodlands on Alluvial Plains TEC		E
Brigalow (Acacia harpophylla dominant and co-dominant) TEC		E
Geophaps scripta scripta	Squatter pigeon (southern)	V
Petauroides volans	Greater glider (southern and central)	E
Phascolarctos cinereus	Koala	E
Myiagra cyanoleuca	Satin flycatcher	Mi
Likely		
Chalinolobus dwyeri	Large-eared pied-bat	E
Potential		
Hirundapus caudacutus	White-throated needletail	V and Mi
Rostratula australis	Australian painted snipe	E
Stagonopleura guttata	Diamond firetail	V
Turnix melanogaster	Black-breasted button-quail	V
Apus pacificus	Fork-tailed swift	Mi
Rhipidura rufifrons	Rufous fantail	Mi
Petaurus australis australis	Yellow-bellied glider (south-eastern)	V
Xerothamnella herbacea		E
Solanum johnsonianum		E
Solanum dissectum		E
Rhaponticum australe	Austral cornflower	V
Cadellia pentastylis	Ooline	V
Cossinia australiana	Cossinia	E

Status listing per EPBC Act: CE = Critically Endangered; E = Endangered; V = Vulnerable; Mi = Migratory

Species Name	EPBC Act Status	Habitat Requirements	Study Area within Species Distribution	Records in the Study Area/ Locality	Comment on Likelihood of Occurrence in Study Area
Birds (including listed and migratory species)					
Sharp-tailed sandpiper (*Calidris acuminata*)	V and Mi	Prefers habitat on muddy edges of freshwater wetlands or brackish wetlands. Can be found at dams inland. Will often occupy coastal mudflats when ephemeral terrestrial wetlands have dried out. **Breeding habitat**: Does not breed in Australia. **Foraging habitat**: Foraging habitat is at the edge of the water of wetlands or intertidal mudflats, either on bare wet mud or sand, or in shallow water. Also among inundated vegetation of saltmarsh, grass or sedges. They forage in sewage ponds, and often in hypersaline environments. After rain, they may forage in paddocks of short grass, well away from water. They may forage on coastal mudflats at low tide, and move to freshwater wetlands near the coast to feed at high tide. **Roosting habitat:** Roosting occurs at the edges of wetlands, on wet open mud or sand, in shallow water, or in short sparse vegetation, such as grass or saltmarsh. Occasionally, they roost on sandy beaches, stony shores or on rocks in water. Potential foraging and roosting habitat is present within the Study Area associated with farm dams.	Yes	No	**Unlikely** to occur • Study Area is within the distribution for this species. PMST states species or species habitat may occur. • Marginal foraging and roosting habitat present within the Study Area associated with farm dams. Study Area is non-coastal, species prefers coastal environments. • No records for the species exist within the Study Area/Locality. The closest historic record (2000) is approx. 30km south-west (ALA, 2024). • No important habitat for this migratory species was detected in the Study Area during field surveys.
Curlew sandpiper (*Calidris ferruginea*)	CE and Mi	This species is recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Occasionally they are recorded around floodwaters. **Breeding habitat:** This species does not breed in Australia.	Yes	No	**Unlikely** to occur • Study Area is within the distribution for this species. PMST states species or species habitat may occur. • Marginal foraging habitat in the form of farm dams present. • Study Area is non-coastal.

Species Name	EPBC Act Status	Habitat Requirements	Study Area within Species Distribution	Records in the Study Area/ Locality	Comment on Likelihood of Occurrence in Study Area
		Foraging habitat: potential marginal foraging habitat exists in the Study Area in the form of dams. **Roosting habitat:** this species roost in open situations with damp substrate, especially on bare shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands, occasionally roosting in dunes during very high tides and sometimes in saltmarsh. Low quality foraging and roosting habitat associated with farm dams. Non-coastal environment.			• No records within the Study Area/Locality, closest record is approximately 30 km to the west of the Study Area (ALA, 2024). • No habitat critical to the survival of the species was identified from field surveys within the Study Area.
Red goshawk (*Erythrotriorchis radiatus*)	V	This species prefers wooded and forested lands of tropical and warm-temperate Australia. Forests of intermediate density, with tall stands or individual trees so that nests are supported, are favoured, or ecotones between habitats of differing densities, e.g. between rainforest and eucalypt forest, between gallery forest and woodland, or on edges of woodland and forest where they meet grassland, cleared land, roads or watercourses. This species avoids very dense and very open habitats. This species has a large home range. **Breeding and roosting habitat:** This species rarely breeds in areas with fragmented vegetation. Breeding habitat is restricted to trees that are taller than 20m and within 1km of a watercourse or wetland. **Foraging habitat**: Habitat must be open enough for fast hunting and maneuvering in flight, but with enough cover for ambushing of prey. No preferred ecotones are present within the Study Area as the plateaus and plains are dominated by stunted ironbark.	Yes	No	**Unlikely** to occur • Study Area is within the distribution for this species. PMST states species or species habitat may occur. • No preferred ecotones are present within the Study Area as the plateaus and plains are dominated by stunted ironbark. • No records within the Study Area/Locality. • No habitat critical to the survival of the species identified from field surveys within the Study Area.

Species Name	EPBC Act Status	Habitat Requirements	Study Area within Species Distribution	Records in the Study Area/ Locality	Comment on Likelihood of Occurrence in Study Area
Grey falcon (*Falco hypoleucos*)	V	This species prefers arid and semi-arid Australia and frequents timbered lowland plains, particularly acacia shrublands that are crossed by tree-lined watercourses. This species has also been observed in treeless areas, frequenting tussock grassland and open woodland for foraging. **Breeding habitat**: Nests chosen are usually in the tallest trees along watercourses, particularly River Red Gum (*Eucalyptus camaldulensis*) and Coolibah (*E. coolabah*) **Foraging habitat:** timbered lowland plains, acacia shrubland crossed by tree-line watercourses, as well as treeless areas, tussock grasslands and open woodlands. **Roosting habitat**: this species is likely to roost in both its breeding and foraging habitat. This species has also been observed roosting on the ground. Study Area lacks preferred breeding, roosting and foraging habitat in the form of riverine Eucalypt communities, open woodlands, grasslands, and acacia shrublands near tree-lined watercourses.	Yes	No	**Unlikely** to occur • Study Area is within the distribution for this species. PMST states species or species habitat may occur. • Study Area lacks preferred breeding, roosting and foraging habitat in the form of riverine Eucalypt communities, open woodlands, grasslands, and acacia shrublands near tree-lined watercourses. • No records within the Study Area/Locality.
Latham's snipe (*Gallinago hardwickii*)	V and Mi	They usually occur in open, freshwater wetlands that have some form of shelter (usually low and dense vegetation) nearby. They generally occupy flooded meadows, seasonal or semi-permanent swamps, or open waters, but various other freshwater habitats can be used including bogs, waterholes, billabongs, lagoons, lakes, creek or river margins, river pools and floodplains. This species has been said to occur very rarely in small patches of habitat such as roadside ditches and alpine bogs (Higgins & Davies, 1996). **Breeding habitat**: Does not breed in Australia.	Yes	No	**Unlikely** to occur • Study Area is within the distribution for this species. PMST states species or species habitat may occur. • Marginal foraging and roosting habitat present within the Study Area associated with farm dams. • No records for the species exist within the Study Area/Locality, closest record

Species Name	EPBC Act Status	Habitat Requirements	Study Area within Species Distribution	Records in the Study Area/ Locality	Comment on Likelihood of Occurrence in Study Area
		Foraging habitat: characterized by areas of mud (either exposed or beneath a very shallow covering of water) and some form of cover (e.g. low, dense vegetation). **Roosting habitat:** on the ground near (or sometimes in) their foraging areas, usually in sites that provide some degree of shelter, e.g. beside or under clumps of vegetation, among dense tea-tree, in forests, in drainage ditches or plough marks, among boulders, or in shallow water if cover is unavailable. Potential foraging and roosting habitat present within the Study Area associated with farm dams.			(2000) is approximately 20km to the south-west of the Study Area (ALA, 2024). • No important habitat for this migratory species was detected in the Study Area during field surveys.
Southern squatter pigeon (*Geophaps scripta scripta*)	V	Squatter pigeon (southern) habitat is generally defined as open-forests to sparse, open-woodlands and scrub that are mostly dominated by *Eucalyptus, Corymbia* or *Callitris* species. Additionally, they also favour remnant regrowth or partly modified vegetation communities that are within 3 km of water bodies. **Breeding habitat**: Breeding habitat occurs on stony rises on sandy, gravelly soils, within 1 km of a suitable, permanent waterbody (including farm dams and watercourses). **Foraging habitat**: Natural foraging habitat for the species is any remnant or regrowth open-forest to sparse, open-woodland or scrub dominated by *Eucalyptus, Corymbia, Acacia* or *Callitris* species, on sandy or gravelly soils, within 3 km of a suitable, permanent or seasonal waterbody	Yes	Yes	**Known** to occur • Study Area is within the distribution for this species. PMST states species or species habitat is likely to occur. • General habitat exists as areas close to bodies of water, remnant grasslands and remnant Eucalypt vegetation within the Study Area. • Three observations of the species were made during field surveys in October 2022, September/October 2023 and December 2023. The species was observed in the northern section of the Study Area

Species Name	EPBC Act Status	Habitat Requirements	Study Area within Species Distribution	Records in the Study Area/ Locality	Comment on Likelihood of Occurrence in Study Area
		Dispersal habitat: Dispersal habitat is any forest or woodland occurring between patches of foraging or breeding habitat, and suitable waterbodies. Habitat within the Study Area exists as areas close to bodies of water, remnant grasslands and remnant *Eucalypt* vegetation.			outside the Development Footprint.
Painted honeyeater (*Grantiella picta*)	V	The painted honeyeater is a specialized mistletoe honeyeater. This species inhabits dry, open forests and woodlands with a preference of high numbers of mature trees, as these host larger quantities of mistletoe. The species usually occurs in areas with flowering and fruiting mistletoe and flowering Eucalypts. **Breeding habitat**: breeding habitat is typically mature trees in remnant vegetation with high quantities of mistletoe. **Foraging and roosting habitat:** Associated with woodlands and forests with mistletoe. There is a lack of preferred mistletoe present throughout the riverine eucalypt communities, however potential breeding and foraging habitat does exist in these communities.	Yes	No	**Unlikely** to occur • Study Area is within the distribution for this species. PMST states species or species habitat may occur. • A distinct lack of mistletoe in woodlands, or associated with tall eucalypts in riverine communities, and so the habitat is generally unsuitable for the species. • No records of the species exist within the Study Area/Locality, closest record (2017) is approximately 25 km to the south-west of the Study Area (ALA, 2024). • No habitat critical to the survival of the species identified from field surveys within the Study Area.

Species Name	EPBC Act Status	Habitat Requirements	Study Area within Species Distribution	Records in the Study Area/ Locality	Comment on Likelihood of Occurrence in Study Area
White-throated needletail (*Hirundapus caudacutus*)	V and Mi	According to Higgins (1999), this species occurs over most types of habitat, but are recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland (as cited in DSEWPC, 2019b). Whilst rare, they have been recorded on wooded ends of ridges, roosting after dark high in the eucalypt tree canopies (Tarburton, 1993). **Breeding habitat:** this species does not breed in Australia. **Roosting habitat**: the species is noted to roost in tall mature forests and woodlands amongst dense foliage and in hollows often associated with ridgelines. **Foraging habitat**: the species almost always will fly aerially at 'cloud level' and forage over farmland, heathland and mudflats. Species likely to fly aerially over the Study Area. The Study Area does contain potential roosting and foraging habitat in the form of eucalypt forests, specifically on elevated areas with ridges.	Yes	Yes (Locality, 2002)	**Potential** to occur • Study Area is within the distribution for this species. PMST states species or species habitat may occur. • Species likely to disperse aerially over the Study Area, which also contains potential foraging and roosting habitat in the form of tall eucalypt forests, likely in elevated areas. • There is one record within the Locality from 2002 (ALA, 2024).

Species Name	EPBC Act Status	Habitat Requirements	Study Area within Species Distribution	Records in the Study Area/ Locality	Comment on Likelihood of Occurrence in Study Area
Star finch (eastern) (*Neochmia ruficauda ruficauda*)	E	This species occurs mainly in grasslands and grassy woodlands that are located close to bodies of freshwater. Habitats can be habitats dominated by trees typically associated with permeant water or areas regularly inundated; with the most common species being *Eucalyptus Coolabah, E. tereticornis, E. tessellaris, Melaleuca leucadendra, E. camaldulensis and Casuarina cunninghamii.* Records that are more recent indicate that preferred habitat is areas dominated by grasses or have been in areas where the native vegetation has been partially cleared. Breeding, foraging and roosting habitat is not clearly delineated for this species, however, all preferred habitat types are expected to be close to water and comprising of grasslands and grassy woodlands. Potential foraging and breeding habitat occurs in the Study Area present as Eucalypt dominated habitat associated with riparian areas.	Yes	No	**Unlikely** to occur • Study Area is within the distribution for this species. PMST states species or species habitat is likely to occur. • Potential foraging and breeding habitat of Eucalypt dominated habitat adjacent to the riparian areas (*E crebra and E. melanophloia*), and partially cleared grasslands/grassy woodlands are located throughout the Study Area. • No records of the species exist within the Study Area/Locality, one undated record approximately 80km to the south-west of the Study Area (ALA, 2024). • No habitat critical to the survival of the species identified from field surveys within the Study Area.

Species Name	EPBC Act Status	Habitat Requirements	Study Area within Species Distribution	Records in the Study Area/ Locality	Comment on Likelihood of Occurrence in Study Area
Australian painted snipe (*Rostratula australis*)	E	This species prefers shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. That also utilise inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum *Muehlenbeckia* or canegrass or sometimes tea-tree (*Melaleuca*). **Breeding habitat:** may be specific for this species, shallow wetlands with bare mud and both upper and canopy cover nearby. Nest records are all, or nearly all, from or near small islands in freshwater wetlands. **Foraging habitat**: Terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. Farm dams in the Study Area are regarded as potential foraging habitat for the species.	Yes	No	**Potential** to occur • Study Area is within the distribution for this species. PMST states species or species habitat is likely to occur. • Potential foraging and roosting habitat in the form of farm dams present. • No records of the species exist within the Study Area/Locality, closest record (2000) approximately 17km to the south-west of the Study Area (ALA, 2024. • No habitat critical to the survival of the species identified from field surveys within the Study Area.

Species Name	EPBC Act Status	Habitat Requirements	Study Area within Species Distribution	Records in the Study Area/ Locality	Comment on Likelihood of Occurrence in Study Area
Diamond firetail (*Stagonopleura guttata*)	V	Found in grassy eucalypt, acacia or casuarina woodlands, including Box-Gum Woodlands and Snow Gum *Eucalyptus pauciflora* Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. **Breeding habitat**: Nests are globular structures built either in the shrubby understorey, or higher up associated in woodland areas, especially under hawk's or raven's nests. **Roosting habitat**: Birds roost in dense shrubs of woodlands or in smaller nests built especially for roosting. **Foraging habitat**: Feeds exclusively on the ground, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects (especially in the breeding season). Suitable habitat includes any Eucalyptus or Acacia woodlands/forests throughout the Study Area, particularly riparian areas.	Yes	No	**Potential** to occur • Study Area is within the distribution for this species. PMST states species or species habitat may occur. • Potential foraging and breeding habitat of Eucalypt woodland and open forest dominated by *E. crebra* with a grassy understory is present throughout the Study Area. • No records of the species exist within the Study Area/Locality, closest (undated) record approximately 30km to the west of the Study Area (ALA, 2024).

Species Name	EPBC Act Status	Habitat Requirements	Study Area within Species Distribution	Records in the Study Area/ Locality	Comment on Likelihood of Occurrence in Study Area
Black-breasted button-quail (*Turnix melanogaster*)	V	The black-breasted button-quail is restricted to rainforests and forests, mostly in areas with 770-1200 mm rainfall per annum. In south-eastern Queensland, they are recorded on rare occasions in open eucalypt forest. It also occurs within semi-evergreen vine thicket habitats. Habitat considered critical to the survival of the black-breasted button-quail includes: • Vine thickets and rainforest vegetation types that are periodically water-stressed. These include: semi-evergreen vine thicket, low microphyll vine forest, Araucarian microphyll vine forest, Araucarian notophyll vine forest and *Brachychiton* scrubs that may incorporate bottle trees (*Brachychiton sp.*), brigalow (*Acacia harpophylla*) and belah (*Casuarina cristata*); • Low thickets or woodlands with a dense understorey but little ground cover, typically dominated by *Acacia* spp.; and • In littoral situations, dry vine scrubs, acacia thickets and areas densely covered in shrubs, particularly midgen berry *Austromyrtus dulcis*. Small areas of potential foraging and roosting habitat with rainforest vegetation types do occur within the Study Area. There is a lack of good quality habitat and connectivity in the Study Area.	Yes	No	**Potential** to occur • Study Area is within the distribution for this species. PMST states species or species habitat may occur. • Low density of suitable quality habitat in the Study Area. • No records within the Study Area/Locality. Closest dated record from Coominglah State Forest 20km to the east in 2021 (ALA, 2024). • No habitat critical to the survival of the species identified from field surveys within the Study Area.
Birds (Migratory)					
Oriental cuckoo (*Cuculus optatus*)	Mi	The species is found in forest canopy, open wooded areas and orchards, often in hill country, also in coniferous forest and in birch (*Betula*) above the treeline. The species may occur in association with remnant and regrowth RE types 11.3.2, 11.3.25, 11.9.4, 11.9.5, 11.9.10, 11.3.19, 11.5.1. The species winters in many different countries,	Yes	No	**Unlikely** to occur • Study Area is within the distribution for this species. PMST states species or species habitat may occur. • There is limited potential roosting and foraging habitat

Species Name	EPBC Act Status	Habitat Requirements	Study Area within Species Distribution	Records in the Study Area/ Locality	Comment on Likelihood of Occurrence in Study Area
		including the coastal parts of northern and eastern Australia (BirdLife International, 2015). **Breeding habitat**: Does not breed in Australia. **Foraging and roosting habitat**: Monsoonal rainforest, vine thickets, wet sclerophyll forest or open *Casuarina, Acacia,* or *Eucalyptus* woodlands. Frequently at the edges or ecotones between habitat types. There is limited potential roosting and foraging habitat of monsoonal rainforest or vine thickets present within the Study Area.			of monsoonal rainforest or vine thickets present within the Study Area. • No records for the species exist within the Study Area/Locality, closest dated record (2019) approximately 48 km to the east of the Study Area (ALA, 2024). • No important habitat for this migratory species was detected in the Study Area during field surveys.
Fork-tailed swift (*Apus pacificus*)	Mi	In Australia, they occur over cliffs and beaches and also over islands and sometimes well out to sea. They also occur over settled areas, including towns, urban areas and cities. They mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. **Breeding habitat**: Does not breed in Australia. **Foraging and roosting habitat**: exclusively aerial and found across a range of habitats. Potential aerial foraging habitat over dry open habitats present. There is a lack of preferred coastal and riparian heathland or swamp habitat.	Yes	Yes (Locality, 2002)	**Potential** to occur • Study Area is within the distribution for this species. PMST states species or species habitat is likely to occur. • Potential aerial foraging habitat over dry open habitats present. There is a lack of preferred coastal and riparian heathland or swamp habitat. • One record of the species exists within the Locality from 2002 (ALA, 2024). • No important habitat for this migratory species was detected in the Study Area during field surveys.
Common sandpiper (*Actitis hypoleucos*)	Mi	The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins	Yes	No	**Unlikely** to occur

Species Name	EPBC Act Status	Habitat Requirements	Study Area within Species Distribution	Records in the Study Area/ Locality	Comment on Likelihood of Occurrence in Study Area
		or rocky shores and rarely on mudflats. The common sandpiper has been recorded in estuaries and deltas of streams, as well as on banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. **Breeding habitat**: Does not breed in Australia. **Foraging habitat**: This species forages in shallow water and on bare soft mud at the edges of wetlands; often where obstacles project from substrate, e.g. rocks or mangrove roots. Birds sometimes venture into grassy areas adjoining wetlands. **Roosting habitat:** Roost sites are typically on rocks or in roots or branches of vegetation, especially mangroves. The species is known to perch on posts, jetties, moored boats and other artificial structures, and to sometimes rest on mud or 'loaf' on rocks. Potential foraging and roosting habitat present within the Study Area associated with farm dams.			• Study Area is within the distribution for this species. PMST states species or species habitat may occur. • Potential marginal to low quality foraging and roosting habitat present within the Study Area associated with farm dams non-coastal area. Coastal environments preferred. • No records of the species within the Study Area/Locality. The closest record from 2007 is approx. 42km north-west of the Study Area (ALA, 2024). • No important habitat for this migratory species was detected in the Study Area during field surveys.
Pectoral sandpiper (*Calidris melanotos*)	Mi	In Australasia, the pectoral sandpiper prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. **Breeding habitat**: Does not breed in Australia. **Foraging habitat**: Forages in shallow water or soft mud at the edge of wetlands. **Roosting habitat:** Prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated	Yes	No	**Unlikely** to occur • Study Area is within the distribution for this species. PMST states species or species habitat may occur. • No wetland habitats, however, potential marginal foraging and roosting habitat present within the Study Area associated with farm dams. • No records for the species exist within the Study Area/Locality. The closest

Species Name	EPBC Act Status	Habitat Requirements	Study Area within Species Distribution	Records in the Study Area/ Locality	Comment on Likelihood of Occurrence in Study Area
		grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. No wetland habitats, however, potential marginal foraging and roosting habitat present within the Study Area associated with farm dams.			records are over 180km east (ALA, 2024). • No important habitat for this migratory species was detected in the Study Area during field surveys.
Satin flycatcher (*Myiagra cyanoleuca*)	Mi	Satin flycatchers inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in drier woodlands and open forests. **Roosting habitat:** There is no information on the roosting behaviour for the species. **Foraging habitat:** Species is known to forage in the canopy and subcanopy of trees **Breeding habitat:** Breeding occurs in south-east Australia, but no other information is provided on the specifics of such locations. Suitable foraging habitat of densely vegetated wet eucalypt gullies occur within the Study Area.	Yes	Yes	**Known** to occur • Study Area is within the distribution for this species. PMST states species or species habitat is likely to occur. • There is suitable foraging habitat of densely vegetated wet eucalypt gullies within the Study Area. • Species was detected during the October 2022 and September/October 2023 field surveys through both sight and call.
Rufous fantail (*Rhipidura rufifrons)*	Mi	In east and south-east Australia, the rufous fantail mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts such as tallow-wood (*Eucalyptus microcorys*) and mountain grey gum (*E. cypellocarpa*). When on passage, they are sometimes recorded in drier sclerophyll forests and woodlands, including spotted gum (*E. maculata*), yellow box (*E. melliodora*), ironbarks or stringybarks, often with a shrubby or heath understorey.	Yes	Yes (Locality, 2002)	**Potential** to occur • Study Area is within the distribution for this species. PMST states species or species habitat is likely to occur. • There is a lack of preferred species in the tree canopy of eucalypt forests present, and an absence of wet sclerophyll forests for roosting and foraging habitat. General

Species Name	EPBC Act Status	Habitat Requirements	Study Area within Species Distribution	Records in the Study Area/ Locality	Comment on Likelihood of Occurrence in Study Area
		Breeding habitat: Breeding occurs in south-east Australia, but no other information is provided on the specifics of such locations. **Foraging and roosting habitat:** There is no information concerning feeding or roosting sites during species migration. There is a lack of preferred species in the tree canopy of eucalypt forests present, and an absence of wet sclerophyll forests for roosting and foraging habitat. General movement habitat exists along densely vegetated gully lines within the Study Area.			movement habitat exists along densely vegetated gully lines within the Study Area. • One record (2002) for the species occurs within the Locality. No observations were made during field surveys.
Black-faced monarch (*Monarcha melanopsis*)	Mi	The black-faced monarch mainly occurs in rainforest ecosystems, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll (broadleaf) thicket/shrubland, warm temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest. It is also sometimes found in nearby open eucalypt forests (mainly wet sclerophyll forests), especially in gullies with a dense, shrubby understorey as well as in dry sclerophyll forests and woodlands, often with a patchy understorey. The species especially occurs in 'marginal' habitats during winter or during passage (migration). **Breeding habitat:** Species breeds in specific locations including the Atherton Region in Queensland, Julatten south to the Paluma Range and inland to the Atherton Tableland. **Roosting and foraging habitat:** Species feeds in mostly rainforest ecosystems, at all vertical levels of the forest.	Yes	No	**Unlikely** to occur • Study Area is within the distribution for this species. PMST states species or species habitat may occur. • There is a lack of suitable rainforest foraging and roosting habitat in the Study Area. • No records for the species within the Study Area/Locality and no observations were made during field surveys. The closest record (2000) is approximately 18km south-west of the Study Area (ALA, 2024). • Habitat present is marginal with limited patches of vine thickets. The fragmentation and small size of these habitat patches in the landscape mean they are

Species Name	EPBC Act Status	Habitat Requirements	Study Area within Species Distribution	Records in the Study Area/ Locality	Comment on Likelihood of Occurrence in Study Area
		There is limited suitable foraging and roosting habitat in the Study Area.			unlikely to be utilised by black-faced monarch.
Yellow wagtail (*Motacilla flava*)	Mi	Habitat requirements for the yellow wagtail are highly variable, but typically include open grassy flats near water. Habitats include open areas with low vegetation such as grasslands, airstrips, pastures, sports fields; damp open areas such as muddy or grassy edges of wetlands, rivers, irrigated farmland, dams, waterholes; sewage farms, sometimes utilise tidal mudflats and edges of mangroves (Garnett et al., 2010). This species may occur in association with non-remnant vegetation. **Breeding habitat**: Does not breed in Australia. **Foraging and roosting habitat**: Not clearly defined however will be in line with habitat requirements stated above. Potential breeding and foraging habitat of open grasslands associated with farm dams present within the Study Area.	Yes	No	**Unlikely** to occur • Study Area is within the distribution for this species. PMST states species or species habitat may occur. • No records for the species exist within the Study Area/Locality. Closest record over 130km away in Gladstone from 2016. • Open grasslands associated with farm dams are present within the Study Area however these dams are small in size and lack dense vegetation for roosting. • No important habitat for this migratory species was detected in the Study Area during field surveys.
Mammals					
Large-eared pied-bat (*Chalinolobus dwyeri*)	E	This microbat species is found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland, down south to Bungonia in the NSW Southern Highlands. The species has close association with the presence of sandstone escarpment (for roosts) and fertile valleys (for foraging).	Yes	No	**Likely** to occur • Study Area is within the distribution for this species. PMST states species or species habitat may occur. • The species may forage in the Study Area in ironbark woodlands however, there is a

Species Name	EPBC Act Status	Habitat Requirements	Study Area within Species Distribution	Records in the Study Area/ Locality	Comment on Likelihood of Occurrence in Study Area
		Foraging habitat: Foraging tends to occur in riverine and riparian corridors however eucalypt dominated patches of vegetation are also suitable. **Roosting and breeding habitat:** The large-eared pied bat requires the presence of diurnal roosts in order to shelter. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. Foraging habitat for the species is likely to occur within the Study Area in eucalypt open and riparian woodland however there is a lack of suitable roosting habitat.			lack of suitable roosting habitat. • 'Probable' recordings of the species via Anabat detection equipment were recorded at five locations within the Study Area.
Ghost bat (*Macroderma gigas*)	V	This species occupies habitats ranging from the arid Pilbara to tropical savannah woodlands and rainforests. Ghost bats roost in caves or crevices that are generally deep with relatively stable temperatures and moderate to high relative humidity roosting cave dependency. **Breeding habitat**: Breeding habitat is within their roosting sites and is confined to caves with multiple entrances. **Foraging habitat**: Foraging habitat is comprised of tropical savanna woodlands and rainforests approximately 2km away from roosting sites. **Roosting habitat:** Roost sites used permanently are generally deep natural caves or disused mines with a relatively stable temperature of 23-28 degrees C and a moderate to high relative humidity of 50-100 percent.	Yes	No	**Unlikely** to occur • Study Area is within the distribution for this species. PMST states species or species habitat may occur. • Suitable breeding, roosting and foraging habitat of deep crevices with stable temperatures and relatively high humidity were not observed within the Study Area. • No records for the species exist within the Study Area/Locality. Closest record (1985) approx. 65km north of the Study Area. • No habitat critical to the survival of the species was observed during fieldwork within the Study Area.

Species Name	EPBC Act Status	Habitat Requirements	Study Area within Species Distribution	Records in the Study Area/ Locality	Comment on Likelihood of Occurrence in Study Area
		Suitable breeding, roosting and foraging habitat of deep crevices with stable temperatures and relatively high humidity were not observed within the Study Area.			
Corben's long-eared bat (*Nyctophilus corbeni*)	V	This microbat species has a scattered distribution mostly within the Murray-Darling Basin, but with some records outside of this area. It is more common in box, ironbark and cypress pine woodland on the western slopes and plains. Its stronghold seems to be the Pilliga scrub. It roosts in tree hollows, crevices and under loose bark. **Foraging habitat:** Foraging tends to be located around patches of trees in the landscape. **Breeding habitat:** Little information is available on the breeding behaviour for the species. **Roosting habitat:** Roosting behaviour is located within dead trees including ironbark's, cypress and bulloak. Marginal habitat of ironbark woodland is present in areas within the Study Area.	Marginally	No	**Unlikely** to occur • Study Area is within the distribution for this species, though close to the north-eastern extent. PMST states species or species habitat may occur. • Marginal habitat of ironbark woodland is present, though suitable roosting habitat is generally absent from the Study Area. • No records for the species exist within the Study Area/Locality. The closest record is approx. 40km south-west of the Study Area from 2000 (ALA, 2024). • Desktop review and bat call analysis indicate that the Study Area location is more consistent with the distribution of two unlisted species of *Nyctophilus*.
Greater glider (*Petauroides volans*)	V	The greater glider is an arboreal, nocturnal marsupial, largely restricted to eucalypt forests and woodlands. It is primarily folivorous, with a diet mostly comprising eucalypt leaves, and occasionally flowers. It is more common in taller, montane older forests which have an abundance of hollows.	Yes	Yes	**Known** to occur • Study Area is within the distribution for this species. PMST states species or

Species Name	EPBC Act Status	Habitat Requirements	Study Area within Species Distribution	Records in the Study Area/ Locality	Comment on Likelihood of Occurrence in Study Area
		There is no information available that differentiates foraging, breeding and roosting habitat for the species however, for roosting it prefers tall mature forests with hollow bearing trees. Potential foraging and roosting habitat of tall, mature eucalypt forests present within the Study Area, although large trees with large hollows are present at low densities.			species habitat is known to occur. • Potential foraging and roosting habitat of tall, mature eucalypt forests present within sections of the Study Area, with large hollow bearing trees present at low densities. • There is one ALA record (2020) within the Locality (ALA, 2024), and three records listed in the WildNet search results (n.d.). • This species was observed on 14 occasions during June 2023 surveys, and on 12 occasions during the September 2024 surveys.
Grey-headed flying fox (*Pteropus poliocephalus*)	V	Grey-headed flying fox is a canopy-feeding frugivore and nectarivore, which utilises vegetation communities including rainforests, open forests, closed and open woodlands, *Melaleuca* swamps and *Banksia* woodlands. It also feeds on commercial fruit crops and on introduced tree species in urban areas. Ebv (1998) explained that the primary food source is blossom from *Eucalyptus* and related genera but in some areas it also utilises a wide range of rainforest fruits (as cited in, DoE, 2019i). **Breeding habitat:** No specific information is available for breeding habitat requirements however it is understood that roosting camps constitute breeding habitat. **Foraging and roosting habitat**: The listing advice for this species says that individuals can travel up to	Yes	No	**Unlikely** to occur • Study Area is within the distribution for this species. PMST states species or species habitat is likely to occur. • The Study Area is approximately 190 km north-west from the closest active colony with recent grey-headed flying fox activity (per the interactive flying-fox viewer of the Department of Environment). This colony is located near Woocoo National Park.

Species Name	EPBC Act Status	Habitat Requirements	Study Area within Species Distribution	Records in the Study Area/ Locality	Comment on Likelihood of Occurrence in Study Area
		50 km from their known roosting camps, in order to forage. They generally roost within 20 km of food sources which include the nectar and pollen of *Eucalyptus*, *Melaleuca* and *Banksia* native trees.			• No records for the species exist within the Study Area/Locality. The closest record (1980) is approx. 22km west of the Study Area (ALA, 2024).
Yellow-bellied glider (south-eastern) (*Petaurus australis australis*)	V	This species is found in eucalypt-dominated woodlands and forests, including both wet and dry sclerophyll forests (Kavanagh et al. 1995; Rees et al. 2007). **Breeding habitat:** No specific information is available on breeding habitat for the species. **Foraging and roosting habitat:** Species shows a preference for larger patches of mature growth forests that contain suitable trees that they require for foraging and roosting. The Study Area does contain some old growth eucalypt forests that could be used as suitable habitat for the species. Larger remnant forests, which have records for the species, occur in the Locality and are likely more favourable for the species in terms of foraging and denning. It is noted that smooth-barked Eucalypts are important due to the range of foraging substrates (and therefore food resources) they provide, as loose bark hanging in strips from these trees provides shelter for insect prey (DCCEEW 2022). Study Area may be a corridor for movement.	Yes	Yes (Locality, 1998)	**Potential** to occur • Study Area is within the distribution for this species. PMST states species or species habitat may occur. • There is potential foraging habitat for the species in the form of old growth eucalypt forests present within the Study Area. The Locality contains remnant vegetation such as state forests that would make the Study Area a movement corridor, should suitable foraging resources be present. • There are three records listed in the WildNet search results (n.d.) and several in the Locality from 1998 (ALA, 2024), though these do not meet recency criteria (within 20 years).

APPENDIX C SURVEY ADEQUACY ASSESSMENT

SURVEY ADEQUACY OF LISTED THREATENED BIRDS AND BATS KNOWN OR LIKELY TO OCCUR

Target Species	Listing Status		Survey Guidelines and Requirements	Sampling Technique / Effort	Comment on Survey Adequacy
	NC Act	EPBC Act			
Birds					
Squatter pigeon (southern) (*Geophaps scripta scripta*)	VU	V	As per the *Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the EPBC Act* (DEWHA, 2017): Area searches or transect surveys in suitable habitat. Flushing surveys also likely to be useful. Area searches or transect surveys for 15 hours over 3 days. Flushing surveys for 10 hours over 3 days.	171 dawn and dusk timed surveys (20 minutes), BUS across 35 locations in the Study Area. 3 area/transect searches were also conducted during BUS in appropriate habitat. These area/transect searches were completed by 2 ecologists for 1.5 hours each (9 total hours)	*Survey effort considered adequate due to positive identification of squatter pigeon (southern).* • The southern squatter has been observed on one occasion during the October 2022 survey at a farm dam located in the northern section of the Study Area, on one occasion during the September/October 2023 survey in the north-western section of the Study Area, and on one occasion during December 2023 survey. • 171 surveys across 35 locations. Surveys were conducted throughout the Study Area, in suitable patches of open eucalypt woodlands and areas close to permanent bodies like farm dams and waterways.
Listed Threatened Mammals					
Large-eared pied bat (*Chalinolobus dwyeri*)	VU	V	As per the *Survey guidelines for Australia's threatened bats* (DEWHA, 2010):	Anabats have been deployed across 10 locations within the Study Area (for up to four nights per survey event), for a	*Survey effort considered adequate to detect large-eared pied bat.*

Target Species	Listing Status		Survey Guidelines and Requirements	Sampling Technique / Effort	Comment on Survey Adequacy
	NC Act	EPBC Act			
			A combination of survey efforts is recommended for this species. This includes unattended bat detectors for 16 detector nights for a minimum of four nights and attended bat detectors for six detector hours for a minimum of three nights. It is also including harp traps and/or mist nets for 16 trap or net nights for a minimum of four nights. Surveys are best undertaken from October through to March.	total of 40 Anabat trapping nights across the October 2022, February and March 2023 survey periods (across two seasons in wormer months). 245 vegetation and habitat assessments were completed determining the presence of any suitable habitat features for the species, including any camps or roosting sites. Assessment of potential roosting sites was extended to areas adjacent the Study Area. Assessments undertaken across 6 surveys events in both the wet and dry seasons (October 2022, March, June and September/October 2023, June and September 2024).	• Diurnal habitat assessments were conducted, which identified potentially suitable large-eared pied bat foraging habitat within the Study Area. • Anabats were deployed in suitable habitat of well-vegetated areas such as eucalypt forest and in the appropriate seasons from October to March across two years. • This species' call was recorded as 'probable' on Anabat devices deployed in the October 2022, February and March 2023 surveys.

APPENDIX D BIRD SPECIES RECORDED DURING FIELD SURVEYS

Birds recorded foraging and roosting predominately within the canopy (<20 m high):

- Apostlebird (*Struthidea cinerea*);
- Australasian darter (*Anhinga novaehollandiae*);
- Australasian grebe (*Tachybaptus novaehollandiae*);
- Australasian pipit (*Anthus novaeseelandiae*);
- Australian bustard (*Ardeotis australis*);
- Australian king parrot (*Alisterus scapularis*);
- Australian magpie (*Cracticus tibicen*);
- Australian pied cormorant (*Phalacrocorax varius*);
- Australian wood duck (*Chenonetta jubata*);
- Australian zebra finch (*Taeniopygia guttata castanotis*);
- Black-fronted dotterel (*Elseyornis melanops*);
- Black-faced cuckoo-shrike (*Coracina novaehollandiae*);
- Black-winged stilt (*Himantopus himantopus*);
- Blue-faced honeyeater (*Entomyzon cyanotis*);
- Brush cuckoo (*Cacomantis variolosus*);
- Brown honeyeater (*Entomyzon cyanotis*);
- Brown treecreeper (*Climacteris picumnus*);
- Brown quail (*Coturnix ypsilophora*);
- Cockatiel (*Nymphicus hollandicus*);
- Common bronzewing (*Phaps chalcoptera*);
- Common myna (*Acridotheres tristis*);
- Crested pigeon (*Ocyphaps lophotes*);
- Dollarbird (*Eurystomus orientalis*);
- Double-barred finch (*Taeniopygia bichenovii*);
- Dusky moorhen (*Gallinula tenebrosa*):
- Eastern barn owl (*Tyto javanica*);
- Eastern koel (*Eudynamys orientalis*);
- Emu (*Dromaius novaehollandiae*);
- Fairy martin (*Petrochelidon ariel*);
- Fan-tailed cuckoo (*Cacomantis flabelliformis*);
- Forest kingfisher (*Todiramphus macleayii*);
- Galah (*Eolophus roseicapilla*);
- Golden-headed cisticola (*Cisticola exilis*);
- Grey butcherbird (*Cracticus torquatus*);
- Grey-crowned babbler (*Pomatostomus superciliosus*);
- Grey fantail (*Rhipidura albiscapa*);
- Grey shrikethrush
- Grey teal (*Anas gracilis*);
- Hoary-headed grebe (*Poliocephalus poliocephalus*);

- Horsfield bronze cuckoo (*Chrysococcyx basalis*);
- Horsfield's bushlark (*Mirafra javanica*);
- Large-billed scrubwren (*Sericornis magnirostra*);
- Laughing kookaburra (*Dacelo novaeguineae*);
- Leaden flycatcher (*Myiagra rubecula*);
- Lewin's honeyeater (*Meliphaga lewinii*);
- Little black cormorant (*Phalacrocorax sulcirostris*);
- Little friarbird (*Philemon citreogularis*);
- Magpie-lark (*Grallina cyanoleuca*);
- Masked lapwing (*Vanellus miles*);
- Mistletoebird (*Dicaeum hirundinaceum*);
- Noisy friarbird (*Philemon corniculatus*);
- Noisy miner (*Manorina melanocephala*);
- Olive-backed Oriole (*Oriolus sagittatus*);
- Painted buttonquail (*Turnix varius*);
- Pacific black duck (*Anas superciliosa*);
- Pacific koel (*Eudynamys orientalis*);
- Pale-headed rosella (*Platycercus adscitus*);
- Peaceful dove (*Geopelia placida*);
- Pheasant coucal (*Centropus phasianinus*);
- Pied butcherbird (*Cracticus nigrogularis*);
- Pied currawong (*Strepera graculina*);
- Pink-eared duck (*Malacorhynchus membranaceus*);
- Rainbow bee-eater (*Merops ornatus*);
- Rainbow lorikeet (*Trichoglossus moluccanus*);
- Red-backed fairywren (*Malurus melanocephalus*);
- Restless flycatcher (*Myiagra inquieta*);
- Red-winged parrot (*Aprosmictus erythropterus*);
- Rufous whistler (*Pachycephala rufiventris*);
- Sacred kingfisher (*Todiramphus sanctus*);
- Satin flycatcher (*Myiagra cyanoleuca*);
- Scaly-breasted lorikeet (*Trichoglossus chlorolepidotus*);
- Singing honeyeater (*Lichenostomus virescens*);
- Shining bronze cuckoo (*Chrysococcyx lucidus*);
- Spangled drongo (*Dicrurus bracteatus*);
- Spotted bowerbird (*Chlamydera maculata*);
- Sulphur-crested cockatoo (*Cacatua galerita*);
- Superb fairywren (*Malurus cyaneus*);
- Squatter pigeon (*Geophaps scripta scripta*);
- Straw-necked ibis (*Threskiornis spinicollis*);

- Striated pardalote (*Pardalotus striatus*);
- Tree martin (*Petrochelidon nigricans*);
- Weebill (*Smicrornis brevirostris*);
- White-bellied cuckoo-shrike (*Coracina papuensis*);
- White-browed babbler (*Pomatostomus superciliosus*);
- White-faced heron (*Egretta novaehollandiae*);
- White-naped honeyeater (*Melithreptus lunatus*);
- White-throated gerygone (*Gerygone olivacea*);
- White-throated honeyeater (*Melithreptus albogularis*);
- White-throated treecreeper (*Cormobates leucophaea*);
- White-winged chough (*Corcorax melanorhamphos*); and
- Willie wagtail (*Rhipidura leucophrys*).

Species recorded either above the canopy or with known tendencies or potential to fly >50 m high:

- Black kite (*Milvus migrans*);
- Black-shouldered kite (*Elanus axillaris*);
- Brown falcon (*Falco berigora*);
- Nankeen kestrel (*Falco cenchroides*);
- Peregrine falcon (*Falco peregrinus*);
- Torresian crow (*Corvus orru);* and
- Wedge-tailed eagle (*Aquila audax*).

APPENDIX E ECHOLOCATION ANALYSIS FOR BAT SURVEYS

Bat Call Analysis Report

Theodore Project

Prepared for ERM

Prepared by:

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Document Records - Quality

TITLE	Bat Analysis for the site at Theodore
FILED AS	ME23006_Theodore Wind Farm

Revision	Date	Prepared by (name/title)	Reviewed by (name/ title)	Approved by (name/title)
Version A	15/12/2022	Kelly Matthews, Principal Ecologist	ERM	Client
Version B	28/04/2022	Kelly Matthews, Principal Ecologist	ERM	Client

Table of Content

TABLES

FIGURES

1.0 Introduction

1.1 Background

Green Tape Solutions were commissioned to undertake bat call analysis for a Project Area in Theodore, Queensland.

1.2 Scope of Work

The specific scope of works for this report includes the following:

- Outline the methodology used to analyse the microbat call within the subject site; and,
- Present the findings of all of the bat call surveys conducted at the project site.

2.0 Methodology

2.1 Capture Technique

Microbat calls were sampled using Anabat Swift devices and Anabat Chorus devices (Titley Electronics). Passive monitoring was undertaken from several periods within the last 12 months totalling 77 trap nights (One trap night being one detector recording for one night) including 17-22 October 2022, 13-17 February 2023 and 27-31 March 2023. The original call files display Australian Eastern Standard Time. The data was analysed using Anabat Insight.

Monitoring commenced at dusk (approximately 1800 hours) and continued until dawn (approximately 0530 hours). Ultrasonic call monitoring surveys on anabat detectors were conducted using full-spectrum fitted with omnidirectional ultrasonic microphone.

2.2 Call Identification

Anabat recordings were analysed using Anabat software (Anabat Insight). Identifications were made by categorising call shape and frequency, with a species match given in consideration to region, known bat distributions, and habitats present. The focus of the bat surveys was to assess the presence of bat species found within the Project Area, and to assess the potential for rare and threatened species to occur.

Call identification for this dataset was based on call keys and descriptions published for Queensland (Reinhold *et al.*, 2001) and New South Wales (Pennay *et al.*, 2004).

Species' identification was further refined using the probability of occurrence of each species based on their geographic distribution (Churchill, 2008, Van Dyck and Strahan, 2008). Species nomenclature used in this report follows Churchill (2008).

The reliability of identification is as follows:

- **Definite** - one or more calls where there is no doubt about the identification of the species;
- **Probable** - most likely to be the species named, low probability of confusion with species that use similar calls; and,
- **Possible -** call is comparable with the named species, with a moderate to high probability of confusion with species of similar calls.

2.3 National Standard

The format and content of this report complies with the nationally accepted standards for the interpretation and reporting of Anabat and Songmeter data (Reardon, 2003), which is currently available from the Australasian Bat Society at www.ausbats.org.au.

3.0 Results

3.1 Total Species Recorded

The majority of calls were considered to be of medium to good quality calls.

A total of 8,840 sequence files were analysed. Two devices did not have any identifiable calls. A small proportion of the files in this dataset contained background noise or resulted in poor quality calls that did not provide bat calls for analysis. While some call sequences were recognised as bat calls, the quality was not sufficient to assign species identification.

A summary of the species identified through bat call analysis is provided in **Table 1**.

Table 1: Summary of bat call analysis (QLD)

Species	NC Act	EPBC Act	October 2022		February 2023			March 2023		
			A9	A12	A14	A19	A26	C2	C11	C15
Austronomus australis	LC	NOC	Definite	Definite		Definite			Definite	Definite
Chaerephon jobensis	LC	NOC		Probable	Probable	Probable			Definite	Probable
Chalinolobus dwyeri	V	V		Probable	Probable	Probable	Probable			Probable
Chalinolobus gouldii	LC	NOC	Definite	Definite	Definite	Definite	Probable	Definite	Definite	Definite
Chalinolobus morio	LC	NOC			Probable			Definite	Probable	Probable
Chalinolobus nigrogriseus	LC	NOC		Definite	Definite	Definite	Definite		Definite	Definite
Chalinolobus picatus	LC	NOC			Probable	Probable	Probable		Probable	Probable
Miniopterus australis	LC	NOC								Probable
Miniopterus orianae oceanensis	LC	NOC		Probable	Probable	Probable	Probable		Probable	Probable
Myotis macropus	LC	NOC	Possible		Possible	Possible	Possible	Possible	Possible	Possible
Nyctophilus sp	LC	NOC	Possible		Possible	Possible	Possible	Possible	Possible	Possible
Ozimops lumsdenae	LC	NOC	Possible		Possible	Possible	Possible	Possible	Possible	Possible
Ozimops ridei	LC	NOC	Definite	Definite	Definite	Definite	Probable			Probable
Rhinolophus megaphyllus	LC	NOC	Definite	Definite	Definite	Definite			Definite	Definite
Saccolaimus flaviventris	LC	NOC								Definite
Scotorepens balstoni	LC	NOC	Definite	Definite	Definite	Definite			Definite	Definite
Scotorepens greyii	LC	NOC	Probable	Probable	Probable	Probable	Probable		Probable	Probable
Scotorepens sp.	LC	NOC		Probable	Probable	Probable	Probable		Probable	Probable
Setirostris eleryi	LC	NOC		Possible	Possible	Possible	Possible		Possible	Possible

Taphozous troughton	LC	NOC	Definite	Definite	Definite	Definite		Definite	Definite
Vespadelus troughtoni	LC	NOC		Probable					Probable
Vespadelus vulturnus	LC	NOC		Probable			Probable		Probable

LC: Least Concern, NOC: Not of Concern, V: Vulnerable

3.2 Samples of Calls / Sequences Files

Samples of call extracted from the dataset for each species identified is provided in the following figures

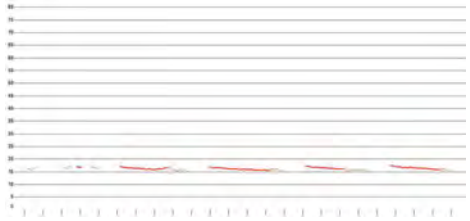
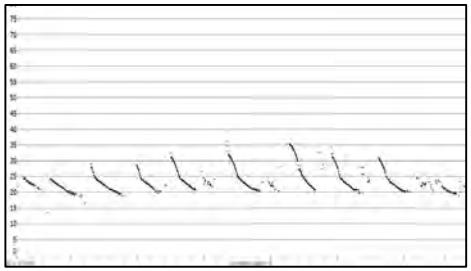
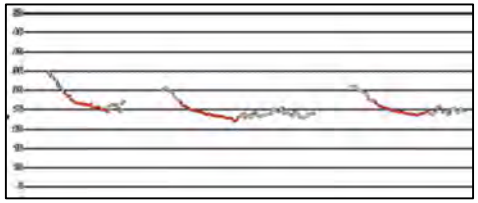
Species	Calls	Known distribution (Extract from Ausbats maps from Australian Bat Society)
Figure 1: *Austronomus australis*		
Definite call. This bat is easily recognised by its constant frequency calls range in bandwidth from 10.5 to 15 kHz (Pennay *et al.*, 2004).		
Figure 2: *Chaerephon jobensis*		
Definite call. Their characteristic frequency average 19.8 kHz (range 16.12-23.6kHz). Pulse shape variable and inconsistent with abrupt changes in frequency. *C. jobensis* often flies in pairs and therefore produce paired call pulses at alternating frequencies with intermittent, “excited”, linear pulses.		

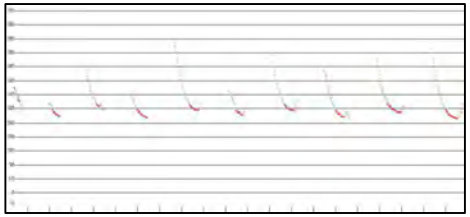
Figure 3: *Chalinolobus dwyeri*



Probable call.

The call is composed of alternate curved pulses, which have up-sweeping, down-sweeping or no tail. The average call characteristic frequency varies between 23 to 24 kHz. Every second pulse stepped-up by about 2 kHz, so that the lower pulses are about 22.5 kHz and the higher pulses are about 25 kHz.

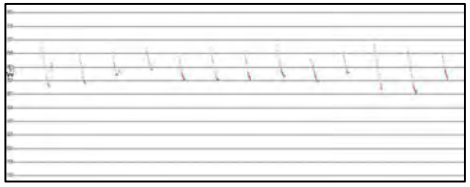
Figure 4: *Chalinolobus gouldii*



Definite call.

This species has a curved shape call with characteristic frequency 28 to 34kHz. Pulse alternates in frequency and mostly down-sweeping tail or no tail.

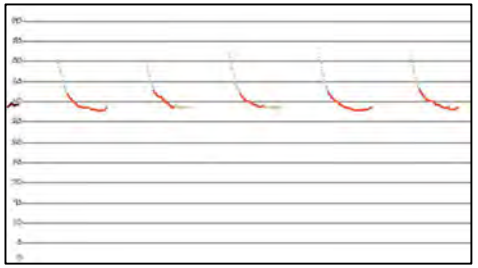
Figure 5: *Chalinolobus morio*



Definite call.

C. morio has a down-sweeping tail curved pulse with characteristic frequency 47.5 to 53 kHz. It often has a very brief characteristic section. Species that overlap in frequency (*Vespadelus troughtoni, V. pumilus* and *V. vulturnus*) but all have up-sweeping tails.

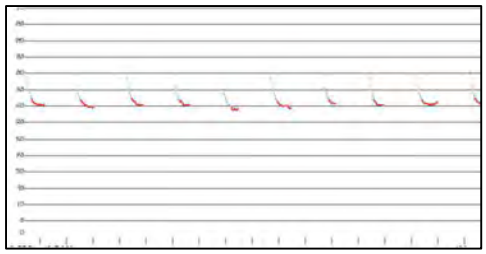
Figure 6: ***Chalinolobus nigrogriseus***



Definite call.

This species has a curved shape pulse with characteristic frequency between 37 to 40 kHz. Usually with no tail or occasionally up sweeping tail. *C. nigrogriseus* have relatively longer characteristic and tail sections, usually 2/3 or more of the total pulse (Pennay *et al* 2004).

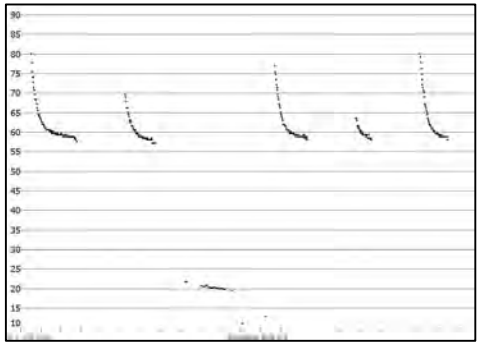
Figure 7: ***Chalinolobus picatus***



Probable call.

The call is composed of alternate curved pulses without a tail or short up-sweeping tail when in search phase. Average characteristic frequency 38 to 42 kHz. Every second pulse is stepped-up by about 2 kHz.

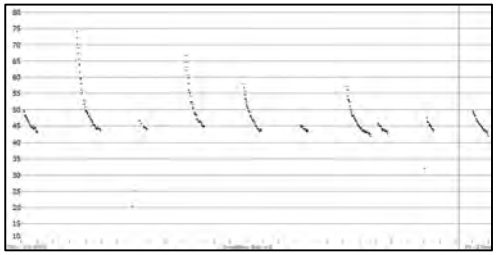
Figure 8: ***Miniopterus australis***



Definite call.

This species displays a characteristic frequency between 54.5 – 64.5 kHz with a curved, usually down-sweeping tail (Pennay *et al* 2004). It overlaps in frequency with *Vespadelus pumilus* between 57 – 58 kHz but the latter exhibits curved up-sweeping tail.

Figure 9: ***Miniopterus orianae oceanensis***



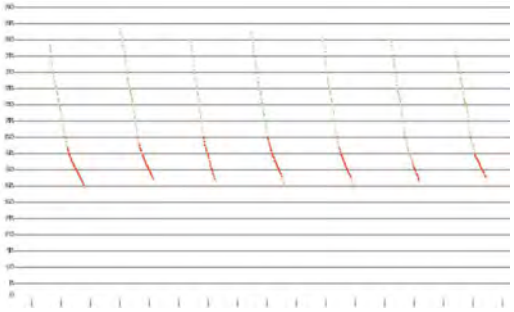
Probable call.

The species call is characterised by its long curved pulse with a small down-sweeping tail and its frequency between 43-47kHz (Reinhold, 2001).

Pulse shape and time between calls usually variable within a sequence.

Shorter duration, can be distinguished from *V. vulturnus* by having a longer pre-characteristic section (drop in frequency usually greater than 2 kHz) and most pulses do not have an up-sweeping tail (Reinhold, 2001). Pulse shape and time between calls can be quite variable within a sequence (Reinhold, 2001).

Figure 10: ***Myotis macropus***



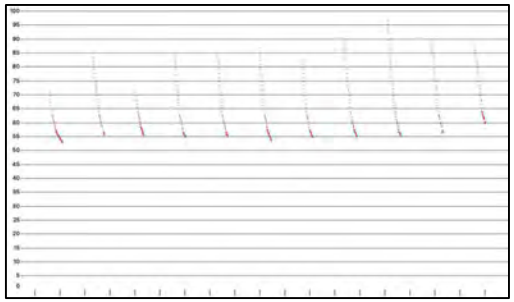
Possible call.

Near-vertical pulse dropping to about 30 to 35-50kHz. *M. macropus* mostly have a pulse interval of less than 75ms and usually have one kink close to the middle so that the second part has a lesser slope than the first (Reinhold, 2001).

This call can be confused with *Nyctophilus spp* calls. The latest have usually a pulse interval greater than 95ms and are slightly more complicated structure

with two kinks instead of one.

Figure 11: Nyctophilus spp



Possible call.

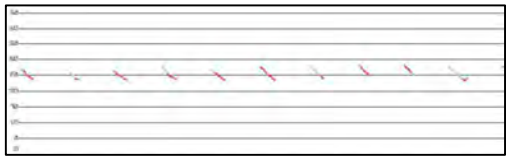
This species displays a near-vertical pulse, characteristic frequency between 80 and 35KHz (Pennay *et al*, 2004).

The species from this genus cannot be distinguished from each other.

N. geoffroyi

N. gouldi

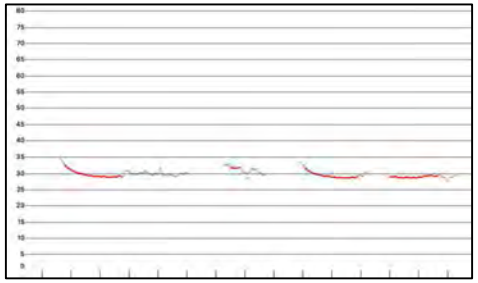
Figure 12: *Ozimops lumsdenae*



Definite call.

Characteristic frequency higher than 22 and lower than 24kHz. *O. lumsdenae* pulse can be confused with *S. flaviventris* However, the latter rarely has calls above 22kHz. *O. lumsdenae* reference calls have pulses] rising in frequency and can get up to 27kHz.

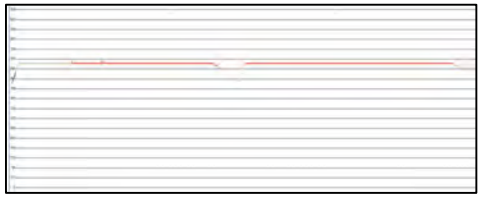
Figure 13: *Ozimops ridei*



Definite call.

O. ridei calls are flat and sometimes a bit curved with frequency a bit lower than 30kHz. Characteristic frequency of this species is between 28 to 36 kHz. Calls in the same frequency range as *Micronomus norfolkensis*, but *O. ridei* calls may jump up to a higher frequency than the surrounding pulses, this does not occur in a regular pattern like in *M. norfolkensis*.

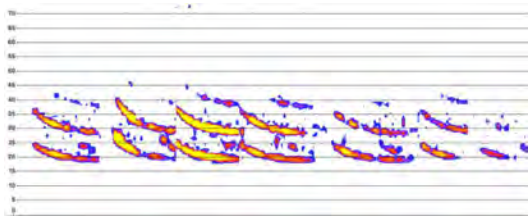
Figure 14: *Rhinolophus megaphyllus*



Definite call.

The species call cannot be misidentified with any other species. Pulses have an up-sweeping initial section a perfectly flat, relatively long characteristic section and a down sweeping tail (Reinhold, 2001). Characteristic frequency ranges from 66 to 72 kHz.

Figure 15: *Saccolaimus flaviventris*

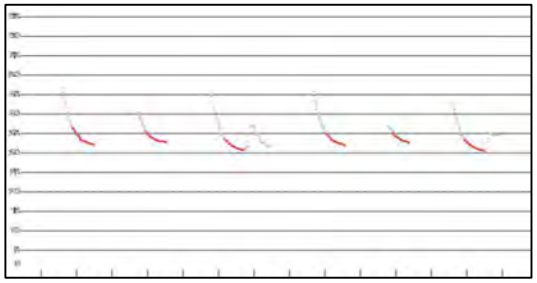


Definite call.

Curved, characteristic frequency 18 to 21.5 kHz. The characteristic frequency does not go above 22 kHz. Other species that could overlap do not occur in this area.

T. troughtoni also produces a flat type call pulse at the same frequency as *S. saccolaimus*. It is typically long and straight or slightly curved and almost horizontal, similar to *S. saccolaimus*.

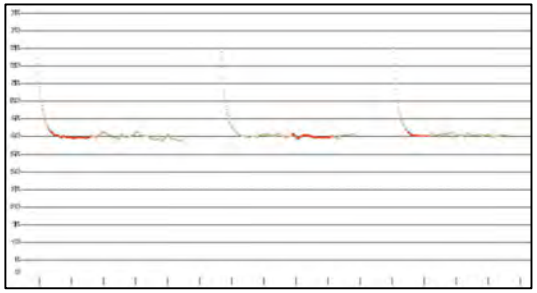
Figure 16: *Scotorepens balstoni*



Probable call.

Pulse of this species is curved with tail variable, but an up-sweeping tail is often more prominent with greater duration. Characteristic frequency 31 to 35 kHz (n = 28) and the frequency of the knee 33 to 37 kHz.

Figure 17: *Scotorepens greyii*



Probable call.

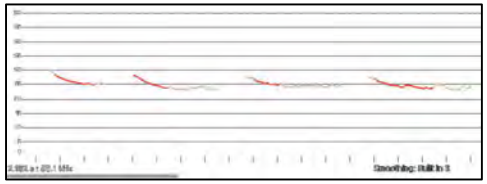
S. greyii has a curved and up-sweeping tail pulse. Its characteristic frequency is between 36 to 41.5 kHz. *S. eleryi* and S. sp (Parnaby) cannot be distinguished from S. greyii.

S. eleryi

S. sp. (Parnaby

S. greyii

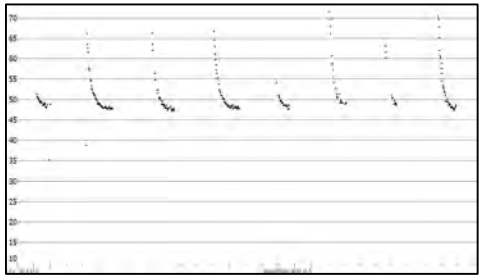
Figure 18: *Taphozous troughtoni*



Definite call.

T. troughtoni produces a flat type call pulse at the same frequency as *S. saccolaimus*. It is typically long and straight or slightly curved and almost horizontal, similar to *S. saccolaimus*.

Figure 19: *Vespadelus troughtoni*



Possible call.

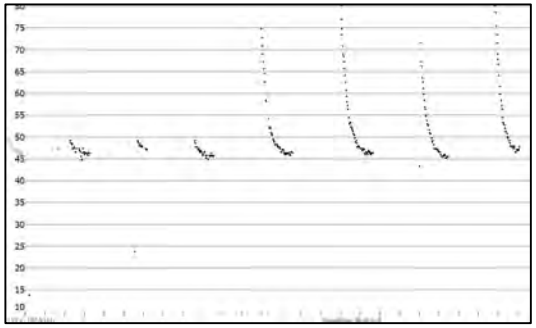
This species displays a curved pulse with not prominent up-sweeping tail. Its characteristic frequency is between 48.5 to 55 kHz (Pennay *et al*, 2004). If the end frequency is lower than 51 kHz, then the call can be identified to *V. Troughtoni* and be differentiated from *V. pumilus*.

Figure 20: Vespadelus vulturnus

Curved and up-sweeping tail calls with characteristic frequency between 45 to 53 kHz.

It cannot be distinguished from *V. regulus*, or some *V. darlingtoni* when up-sweeping tail.

It is distinguished from *Miniopterus schreibersii oceanensis* by having consecutive pulses even, with mostly up-sweeping tails and drop in frequency of pre-characteristic section mostly less than 2 kHz.



4.0 Conclusion

A total of 23 microbat species were either confirmed ‘definite’, ‘probable’ or ‘possible’ within the Project area. All bats identified on the site were expected to be present within the region.

Calls from *Nyctophilus sp* have been identified as possible in the project areas, as they are very similar to *Myotis macropus*. Two species of *Nyctophilus* possibly occur within the Project Area.

Chalinolobus dwyeri calls have been detected as probable at several sites. This species is listed as vulnerable under state and federal legislation.

Two of the reliably identified call types were only attributable to genus level due to similarities in call characteristics of the following groups:

- Nyctophilus/Myotis species
    - ✓ Steep, almost-linear linear (FM) call pulses are distinctive from those of other bat calls but cannot be reliably identified to species
    - ✓ Three species of Nyctophilus potentially occur in the project area (*N. geoffroyi* or *N. gouldii*)
    - ✓ These calls are also often confused with *Myotis Macropus* therefore all four species are listed as possible
- *Scotorepens greyii, Scotorepens sp. (Parnaby) and Setirostris eleryi*
    - Steep, curvilinear (FM-qCF) pulses with Fc of 37-41 kHz and a long tail
    - This species can be distinguished from *Chalinolobus nigrogriseus* in same Fc range by shorter pulse duration and hooked pulse body (cf. longer and flatter body in C. nigrogriseus)
    - Both Scotorepens spp. and *S. eleryi* are likely to occur in the project area, *S. eleryi* and *S. sp. (Parnaby)* calls are indistinguishable from *S. greyii* therefore both these species have been marked as ‘possible’ alongside *S. greyii identified* calls.

5.0 References

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APPENDIX F BIRD AND BAT RISK ASSESSMENT

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
Listed Migratory and Threatened Birds					
Grey falcon (*Falco hypoleucos*)	V, VU	Less likely	Major	Low	This species has been concluded as unlikely to occur within the Study Area. The following information was also considered for the risk rating: • Species listed as vulnerable for both EPBC Act and NC Act; • Study Area lacks preferred breeding, roosting and foraging habitat in the form of riverine Eucalypt communities, open woodlands, grasslands, and acacia shrublands near tree-lined watercourses; • No records exist for the species within the Study Area or locality; • Little to low number of records in the broader locality in the last 20 years (100 km radius of Study Area). Nearest records are west of the Study Area within 30 km of the Study Area however the records are undated and have a spatial uncertainty of 2,000 m; • Small and low-density population (<1,000 individuals (TSSC, 2020); • Generation time of 2.6 – 4.7 years (Reid & Baker, 2025); • Flight height does not occur within the RSA with the species documented flying at heights of around 25 m (TSSC, 2020). Therefore, it is considered less likely that the Proposed Action will have an impact upon this species through collision with the WTGs, and it is considered that this impact would be major if it were to occur due to the estimated population

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
					and species listing. Thus, the risk rating for this species is low.
Red goshawk (*Erythrotriorchis radiatus*)	E, EN	Less likely	Major	Low	This species has been concluded as being unlikely to occur within the Study Area. The following information was also considered for the risk rating: • Species listed as endangered for both EPBC Act and NC Act; • No records exist for the species within the Study Area or locality; • Little to low number of records in the broader locality in the last 20 years (100 km radius of Study Area). Nearest records are west of the Study Area within 30 km of the Study Area however the records are undated and have a spatial uncertainty of 2,000 m; • The red goshawk is often foraging throughout the tree-canopy level but has been recorded soaring at heights of up to 150 m above the ground (Debus & Czechura, 1988); • Small and low-density population (DCCEEW, 2023c); • Generation time of 2.6 – 4.7 years (Reid & Baker, 2025); and • Study Area lacks preferred breeding, roosting and foraging habitat in the form of riverine Eucalypt communities, open woodlands, grasslands, and acacia shrublands near tree-lined watercourses. Therefore, it is considered less likely that the Proposed Action will have an impact upon this species through collision with the WTGs, and it is considered that this impact would be major if it were to occur due to the estimated population and species listing. Thus, the risk rating for this species is low.

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
Black-breasted buttonquail (*Turnix melanogaster*)	V, VU	Less likely	Moderate	Negligible	This species has been concluded as having the potential to occur within the Study Area. This is because the Study Area is within the distribution for the species and suitable habitat is present. The following information was considered for the risk rating: • Species listed as vulnerable for both EPBC Act and NC Act; • No records exist for the species within the Study Area or locality; • Low number of records exist within the broader locality in the last 20 years (100 km radius of the Study Area), closest occurring 50 km east of the Study Area within Coominglah State Forest; • Generation time of 2.6 – 4.7 years (Reid & Baker, 2025); • Moderate population size (DCCEEW, 2022); • Species specific flight heights unknown, quail genera do not fly within RSA heights- the species is ground-dwelling, has short wings and has limited flight; and • Low density of suitable quality habitat in the Study Area. Therefore, it is considered less likely that the Proposed Action will have an impact upon this species through collision with the WTGs. It is considered that this impact would be moderate if it were to occur due to the listing of the species. Thus, the risk rating for this species is negligible.
Squatter pigeon (southern) (*Geophaps scripta scripta*)	V, VU	Less likely	Minor	Negligible	This species has been confirmed to occur within the Study Area. The following information was also considered for the risk rating: • Species listed as vulnerable for both EPBC Act and NC Act; • Records exist for the species within the Study Area; • Species was observed within the Study Area with no observations occurring within the RSA;

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
					• Moderate amounts of records exist within the broader locality in the last 20 years (100 km radius of the Study Area); • Flight height generally does not occur within RSA - the species is ground-dwelling and has limited flight (Reid & Baker, 2025); • High estimated population size (TSSC, 2015); • Generation time of 5 years (TSSC, 2015); and • Breeding, foraging and dispersal habitat occurs within the Study Area, particularly in association with permanent water bodies. The squatter pigeon is less likely to be at risk of collision with the WTG as the species is not known to fly within the RSA and the consequence of this collision is minor due to the species status and population size. Thus, the risk rating for this species is negligible.
White-throated needletail (*Hirundapus caudacutus*)	V and Mi, VU	Moderately likely	Moderate	Low	This species is considered potential to occur within the Study Area with no observation of the species during field surveys. The following information was also considered for the risk rating: • Species as vulnerable for both EPBC Act and NC Act and Migratory for the EPBC Act; • No records exist for the species within the Study Area and locality; • Low-moderate amounts of records exist within the broader locality in the last 20 years (100 km radius of the Study Area); • Species population data is unavailable with population believed to be above 10,000 (TSSC, 2019). Therefore, the population for this species is large; • Flight height generally occur within the RSA (known to fly 1-300m above ground); • The species is known to form large flocks of up to 1000s of individuals; and

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
					• The species is considered to be exclusively aerial, with no roosting habitat mapped within the Study Area. It is assumed that the species could utilise the entire Study Area aerially. Therefore, it is considered moderately likely for the species to be impacted through collision with the WTG. This can be attributed to potential to enter RSA and presence of foraging habitat. It is considered that this impact would be moderate if it were to occur due to the vulnerable and migratory listing of the species. Thus, the risk rating for this species is low.
Australian painted snipe (*Rostratula australis*)	E, EN	Moderately likely	Moderate	Low	This species has been concluded as having the potential to occur within the Study Area. This is because the Study Area is within the distribution for the species and suitable habitat is present. The following information was considered for the risk rating: • Species listed as endangered for both EPBC Act and NC Act; • No records exist for the species within the Study Area or locality; • No records exist within the broader locality in the last 20 years (100 km radius of the Study Area) (several either undated or outdated records exist within 100 km of the Study Area); • Moderate population estimated population size 2,500 (DSEWPC, 2013); • Flight height is usually below RSA (low level flight in wetlands) or greater than the RSA (migrating); and • Potential foraging and roosting habitat in the form of farm dams present. Therefore, it is considered moderately likely for the species to be impacted through collision with the WTG. This can be attributed to potential to enter RSA and presence of foraging habitat. It is considered that this impact would be moderate

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
					if it were to occur due to the endangered listing of the species. Thus, the risk rating for this species is low.
Diamond firetail (*Stagonopleura guttata*)	V, VU	Less likely	Minor	Negligible	This species has been concluded as having the potential to occur within the Study Area. This is because the Study Area is within the distribution for the species and suitable habitat is present. The following information was considered for the risk rating: • Species listed as vulnerable for both EPBC Act and NC Act; • No records exist for the species within the Study Area or locality; • Low number of records exist within the broader locality in the last 20 years (100 km radius of the Study Area), closest (undated) record approximately 30 km to the west of the Study Area; • High population estimated population size 136,000 (DCCEEW, 2023b); • Does not fly within RSA heights, typically flying within woodland height; and • Potential foraging and breeding habitat of Eucalypt woodland and open forest dominated by *E. crebra* with a grassy understory is present throughout the Study Area. Therefore, it is considered less likely that the Proposed Action will have an impact upon this species through collision with the WTGs, and it is considered that this impact would be minor if it were to occur due to the estimated population and species listing. Thus, the risk rating for this species is negligible.
Fork-tailed swift (*Apus pacificus*)	Mi, -	Moderately likely	Moderate	Low	This species is considered to have the potential to occur within the Study Area. The following information was considered for the risk rating: • Species is listed as migratory under the EPBC Act; • No records exist for the species within the Study Area or locality;

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
					• Low amounts of records exist within the broader locality in the last 20 years; • Large global population estimate of 100,000 (DoE, Draft referral guidelines for 14 birds listed as migratory species under the EPBC Act, 2015); • The species is known to form large flocks of 1,000s of individuals; • The species is known to fly within the RSA; and • Potential aerial foraging habitat over dry open habitats present. There is a lack of preferred coastal and riparian heathland or swamp habitat. Therefore, it is considered moderately likely that the Proposed Action will have an impact upon this species through collision with the WTGs, and it is considered that this impact would be moderate if it were to occur due to the estimated population and species listing. Thus, the risk rating for this species is low.
Non-listed Bird Species					
Australasian darter (*Anhinga novaehollandiae*)	-	Moderately likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area; • Low number of records exist within the locality (20 km buffer) and moderate records exist within the broader locality in the last 20 years (100 km buffer); and • The species was not recorded flying above 50m during surveys but is known to flyer at higher heights. Therefore, there is a moderately likely likelihood of collision due to the species behaviour and a minor consequence of such an event due to the species non-threatened listing and

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
					population size in the locality. Thus, the risk rating for this species is negligible.
Australasian little pied cormorant (*Microcarbo melanoleucos melanoleucos*)	-	Moderately likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area; • Low number of records exist within the locality (20 km buffer) and moderate records exist within the broader locality in the last 20 years (100 km buffer); and • The species was recorded flying within the RSA but only on one occasion. Therefore, there it is a moderately likely likelihood of collision due to the species behaviour and a minor consequence of such an event due to the species non-threatened listing and population size in the locality. Thus, the risk rating for this species is negligible.
Australian bustard (*Ardeotis australis*)		Less likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed;

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
					• Species was directly observed during field survey efforts within the Study Area; • Moderate number of records exist within the locality (20 km buffer) and high records exist within the broader locality in the last 20 years (100 km buffer); and • The species was not recorded flying within the RSA during field surveys. Therefore, there is a less likely likelihood of collision due to the species behaviour and a minor consequence of such an event due to the species non-threatened listing and population size in the locality. Thus, the risk rating for this species is negligible.
Australian great pied cormorant (*Phalacrocorax varius hypoleucos*)	-	Less likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area; • Low number of records exist within the locality (20 km buffer) and moderate records exist within the broader locality in the last 20 years (100 km buffer); and • The species was not recorded flying within the RSA during field surveys, with the highest record observed at 50m. Therefore, there is a less likely likelihood of collision due to the species behaviour and a minor consequence of such an event due to the species non-threatened listing and population size in the locality. Thus, the risk rating for this species is negligible.

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
Australian magpie (*Gymnorhina tibicen*)	-	Moderately likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area; • High number of records exist within the locality (20 km buffer) and broader locality in the last 20 years (100 km buffer); and • The species was not recorded flying above 50m during surveys but is known to fly at higher heights. Therefore, there is a moderately likely likelihood of collision due to the species behaviour and a minor consequence of such an event due to the species non-threatened listing and population size in the locality. Thus, the risk rating for this species is negligible.
Australian wood duck (*Chenonetta jubata*)	-	Moderately likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area; • Moderate number of records exist within the locality (20 km buffer) and high records exist within the broader locality in the last 20 years (100 km buffer); and • The species was not recorded flying within the RSA during field surveys, with the highest record observed at 50m. Therefore, there is a moderately likely likelihood of collision due to the species behaviour and a minor consequence of such an event due to the species non-threatened listing and

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
					population size in the locality. Thus, the risk rating for this species is negligible.
Black kite (*Milvus migrans*)	-	Likely	Minor	Low	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area; • High number of records exist within the locality (20 km buffer) and broader locality in the last 20 years (100 km buffer); and • The species was not recorded flying above 50m during surveys but is known to fly at higher heights. Therefore, there is a likely likelihood of collision due to the species behaviour and a minor consequence of such an event due to the species non-threatened listing and population size in the locality. Thus, the risk rating for this species is low.
Black-faced cuckoo-shrike (*Coracina novaehollandiae*)	-	Less likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area; • High number of records exist within the locality (20 km buffer) and broader locality in the last 20 years (100 km buffer); and • The species was not recorded flying above 50m during field surveys, with the species staying close to canopy height. Therefore, there is a less likely likelihood of collision due to the species behaviour and a negligible consequence of such

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
					an event due to the high number of historically relevant records within the broader locality. Thus, the risk rating for this species is negligible.
Black-faced woodswallow (*Artamus cinereus*)	-	Likely	Minor	Low	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area; • High number of records exist within the locality (20 km buffer) and broader locality in the last 20 years (100 km buffer); and • Although this species was not recorded flying within the RSA during field surveys, the species is known to fly at these heights with soaring behaviours common. Therefore, there is a likely likelihood of collision due to the species behaviour and a minor consequence of such an event. Thus, the risk rating for this species is low.

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
Black-shouldered kite (*Elanus axillaris*)	-	Moderately likely	Minor	Negligible	This species is known to occur within the Study Area. The following information was considered for the risk rating: • Species is not state or federally listed; • Multiple records of the species exist within the Study Area and locality (1 individuals were sighted during bird surveys); • Moderate number of records exist within the broader locality in the last 20 years (100 km radius of the Study Area); • The species was not recorded flying through the RSA within the Study Area during field surveys, however the species is known to fly at these heights; and • This species is known to occur within and flying over wooded, forests and open land occasionally known to enter RSA. Therefore, there is a moderately likely likelihood of collision due to the species behaviour and a minor consequence of such an event. Thus, the risk rating for this species is negligible.
Brown falcon (*Falco berigora*)	-	Likely	Minor	Low	This species is known to occur within the Study Area. The following information was considered for the risk rating: • Species is not state or federally listed; • Multiple records of the species exist within the Study Area and locality (10 individuals were sighted during bird surveys, 6 of which were within the RSA); • High number of records exist within the broader locality in the last 20 years (100 km radius of the Study Area); and • This species is known to occur within and flying over wooded, forests and open land. Therefore, there is a likely likelihood of collision due to the species behaviour and a minor consequence of such an event. Thus, the risk rating for this species is low.

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
Brown goshawk (*Accipiter fasciatus*)	-	Moderately Likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts not within RSA; • Moderate-high number of records exist within the broader locality (100 km); and • The species is known to occur within and flying over wooded, forests and open land, as its hunting tactic aligns with wait and pounce methods. However, the species has been observed reaching heights of over 100m during prospecting runs. Therefore, there is a moderately likely likelihood of collision due to species behaviour. Due to moderate-high historically relevant records within the broader locality the consequence of such an event is minor. Thus, the risk rating for this species is negligible.
Fairy martin (*Petrochelidon ariel*)	-	Moderately likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area; • Low number of records exist within the locality (20 km buffer) and moderate records exist within the broader locality in the last 20 years (100 km buffer); and • The species was not recorded flying within the RSA during field surveys, with the highest record observed at 50m. Species can enter RSA heights when foraging over waterbodies.

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
					Therefore, there is a moderately likely likelihood of collision due to the species behaviour and a minor consequence of such an event due to the species non-threatened listing and population size in the locality. Thus, the risk rating for this species is negligible.
Galah (*Eolophus roseicapilla*)	-	Likely	Minor	Low	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area; • High number of records exist within the locality (20 km buffer) and broader locality in the last 20 years (100 km buffer); and • The species was recorded flying within the RSA during field surveys on 6 occasions out of 235 observations. Therefore, there is a very likely certain likelihood of collision due to the species records within the RSA and a minor consequence of such an event. Thus, the risk rating for this species is moderate.
Grey teal (*Anas gracilis*)	-	Moderately likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area; • High number of records exist within the locality (20 km buffer) and broader locality in the last 20 years (100 km buffer); and • The species was not recorded within the RSA during field surveys, however the species is known to fly at these heights.

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
					Therefore, there is a moderately likely likelihood of collision due to the species behaviour and a minor consequence of such an event due to the high number of historically relevant records within the broader locality. Thus, the risk rating for this species is negligible.
Hardhead (*Aythya australis*)	-	Moderately likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area; • High number of records exist within the locality (20 km buffer) and broader locality in the last 20 years (100 km buffer); and • The species was not recorded within the RSA during field surveys, however the species is known to fly at these heights. Therefore, there is a moderately likely likelihood of collision due to the species behaviour and a minor consequence of such an event due to the high number of historically relevant records within the broader locality. Thus, the risk rating for this species is negligible.
Intermediate egret (*Ardea intermedia*)	-	Moderately likely	Minor	Negligible	This species is known to occur within the Study Area. The following information was considered for the risk rating: • Species is not state or federally listed; • The presence of this species was confirmed during field surveys. • There are moderate-high records within the broader locality. • The species was not recorded at heights above 30m during field surveys. • Suitable habitat has been identified within the Study Area.

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
					Therefore, it is considered moderately likely that the species will collide with the WTGs due to the species behaviour, distribution and records, and there is a minor consequence of this happening due to the species threatened listing and population size. Thus, the risk rating for this species is negligible.
Little black cormorant (*Phalacrocorax sulcirostris*)	-	Moderately likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area; • Low number of records exist within the locality (20 km buffer) and moderate records exist within the broader locality in the last 20 years (100 km buffer); and • The species was not recorded within the RSA. Therefore, there is a moderately likely likelihood of collision due to the species behaviour and a minor consequence of such an event due to the species non-threatened listing and population size in the locality. Thus, the risk rating for this species is negligible.
Nankeen kestrel (*Falco cenchroides*)	-	Moderately likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area; • High number of records exist within the locality (20 km buffer) and broader locality in the last 20 years (100 km buffer); and

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
					• Out of the 33 records of the species within the Study Area, the species was recorded flying within the RSA on one occasion. Therefore, there is a moderately likely likelihood of collision due to the species behaviour and a minor consequence of such an event due to the species non-threatened listing and population size in the locality. Thus, the risk rating for this species is negligible.
Noisy miner (*Manorina melanocephala*)	-	Less likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area; • High number of records exist within the locality (20 km buffer) and broader locality in the last 20 years (100 km buffer); and • The species was not recorded flying within the RSA, with the max height of the species recorded at 50 m. Therefore, there is an unlikely likelihood of collision due to the species behaviour and a negligible consequence of such an event due to the high number of historically relevant records within the broader locality. Thus, the risk rating for this species is negligible.
Pacific baza (*Aviceda subcristata*)	-	Moderately likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts not the RSA;

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
					• High amounts of records exist within the broader locality in the last 20 years (100 km radius of the Study Area) and few records within the Locality (20 km from the Study Area); and • This species often moves in family groups concealed within the canopy and hunts within the canopy layer. Although the species was not observed within the RSA during field surveys, during breeding season, males are known to do aerial displays where they fly up high and do aerial manoeuvres and dives. Therefore, there is a moderately likely likelihood of collision due to the species behaviour and a minor consequence of such an event due to the species listing. Thus, the risk rating for this species is negligible.
Pacific black duck (*Anas superciliosa*)	-	Moderately likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area; • High number of records exist within the locality (20 km buffer) and broader locality in the last 20 years (100 km buffer); and • The species was not recorded within the RSA during field surveys, however the species is known to fly at these heights. Therefore, there is a moderately likely likelihood of collision due to the species behaviour and a minor consequence of such an event due to the high number of historically relevant records within the broader locality. Thus, the risk rating for this species is negligible.

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
Peregrine falcon (*Falco peregrinus*)	-	Moderately Likely	Minor	Negligible	This species is known to occur within the Study Area. The following information was considered for the risk rating: • Species is not state or federally listed; • Multiple records of the species exist within the Study Area and locality (1 individuals were sighted during bird surveys); • Low- moderate number of records exist within the broader locality in the last 20 years (100 km radius of the Study Area); • The species was not recorded within the RSA; and • This species is known to occur within and flying over wooded, forests and open land The species can gain great heights for diving hunting manoeuvres. Therefore, there is a moderately likely likelihood of collision due to the species behaviour and a minor consequence of such an event due to the species not being listed. Thus, the risk rating for this species is negligible.
Pied currawong (*Strepera graculina*)	-	Moderately likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area; • High number of records exist within the locality (20 km buffer) and broader locality in the last 20 years (100 km buffer); and • The species was not recorded within the RSA during field surveys, however the species is known to fly at these heights. Therefore, there is a moderately likely likelihood of collision due to the species behaviour and a minor consequence of such an event due to the high number of historically relevant

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
					records within the broader locality. Thus, the risk rating for this species is negligible.
Pink-eared duck (*Malacorhynchus membranaceus*)	-	Moderately likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area; • Low number of records exist within the locality (20 km buffer) and low-moderate records exist within the broader locality in the last 20 years (10 km buffer); and • The species was not recorded flying within the RSA during field surveys, with the highest record observed at 50 m. Therefore, there is a moderately likely likelihood of collision due to the species behaviour and a moderate consequence of such an event due to the species non-threatened listing and population size in the locality. Thus, the risk rating for this species is negligible.
Plumed whistling-duck (*Dendrocygna eytoni*)	-	Moderately likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area; • Low number of records exist within the locality (20 km buffer) and moderate-high records exist within the broader locality in the last 20 years (100 km buffer); and • The species was not recorded flying within the RSA during field surveys, however the species is known to reach these heights

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
					Therefore, there is a moderately likely likelihood of collision due to the species behaviour and a minor consequence of such an event due to the species non-threatened listing and population size in the locality. Thus, the risk rating for this species is negligible.
Rainbow bee-eater (*Merops ornatus*)	-	Moderately likely	Minor	Negligible	This species is known to occur within the Study Area. The following information was considered for the risk rating: • Species is not state or federally listed; • The presence of this species was confirmed during field surveys. • High number of records exist within the locality (20km buffer) and broader locality in the last 20 years (100km buffer); and • The species was not recorded within the RSA during field surveys, however the species is known to fly at these heights. • Suitable habitat has been identified within the Study Area Therefore, there is a moderately likely likelihood of collision due to the species behaviour and a minor consequence of such an event. Thus, the risk rating for this species is negligible.
Rainbow lorikeet (*Trichoglossus moluccanus*)	-	Moderately likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area; • High number of records exist within the locality (20 km buffer) and broader locality in the last 20 years (100 km buffer); and • The species was not recorded within the RSA.

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
					Therefore, there is a moderately likely likelihood of collision due to the species behaviour and a minor consequence of such an event due to the high value of observations within the RSA during surveys. Thus, the risk rating for this species is negligible.
Red-winged parrot (*Aprosmictus erythropterus*)		Moderately likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area; • High number of records exist within the locality (20 km buffer) and broader locality in the last 20 years (100 km buffer); and • The species was recorded flying within the RSA, however this was only observed on one occasion (60m). Therefore, there is a moderately likely likelihood of collision due to the species behaviour and a minor consequence of such an event due to the high number of historically relevant records within the broader locality. Thus, the risk rating for this species is negligible.
Spotted harrier (*Circus assimilis*)	-	Moderately likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area; • Low number of records exist within the locality (20 km buffer) and low-moderate records exist within the broader locality in the last 20 years (100 km buffer); and • The species was recorded flying within the RSA during field surveys, however only on two occasions.

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
					Therefore, there is a moderately likely likelihood of collision due to the species behaviour and a minor consequence of such an event due to the species non-threatened listing and population size in the locality. Thus, the risk rating for this species is negligible.
Straw-necked ibis (*Threskiornis spinicollis*)	-	Moderately likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area; • Low number of records exist within the locality (20 km buffer) and moderate-high records exist within the broader locality in the last 20 years (100 km buffer); and • The species was not recorded flying within the RSA during field surveys (max 18 m). • The species has the capacity to reach great heights within large flocks when moving between foraging areas. Therefore, there is a moderately likely likelihood of collision due to the species behaviour and a minor consequence of such an event due to the species non-threatened listing and population size in the locality. Thus, the risk rating for this species is negligible.
Sulphur-crested cockatoo (*Cacatua galerita*)	-	Moderately likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area;

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
					• Moderate-high number of records exist within the locality (20 km buffer) and broader locality in the last 20 years (100 km buffer); and • The species was not recorded within the RSA. Therefore, there is a moderately likely likelihood of collision due to the species behaviour and a minor consequence of such an event. Thus, the risk rating for this species is negligible.
Torresian crow (*Corvus orru*)	-	Likely	Minor	Low	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area; • High number of records exist within the locality (20 km buffer) and broader locality in the last 20 years (100 km buffer); and • The species was recorded flying within the RSA on 4 occasions out of 338 during BUS. Therefore, there is a likely likelihood of collision due to the species behaviour and a minor consequence of such an event. Thus, the risk rating for this species is low.
Tree martin (*Petrochelidon nigricans*)	-	Moderately likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area; • Low-moderate number of records exist within the locality (10 records) (20 km buffer) and broader locality (70 records) (100 km buffer); and

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
					• The species was not recorded within the RSA during field surveys, however the species is known to fly at these heights. Therefore, there is a likely likelihood of collision due to the species behaviour and a low consequence of such an event due to the number of observations within the RSA during field surveys. Thus, the risk rating for this species is negligible.
Wedge-tailed eagle (*Aquila audax*)	-	Very likely	Minor	Moderate	This species is known to occur within the Study Area. The following information was considered for the risk rating: • Species is not state or federally listed; • Multiple records of the species exist within the Study Area and locality (99 individuals were sighted in the Study Area during bird surveys, 70 of which were within the RSA); • High number of records exist within the broader locality in the last 20 years (100 km radius of the Study Area); • The species was recorded flying in the RSA 65 times of 99 times; and • This species is known to occur within and flying over wooded, forests and open land. Therefore, there is a very likely likelihood of collision due to the species behaviour and a minor consequence of such an event due to high number or records within locality. Thus, the risk rating for this species is moderate.
Welcome swallow (*Hirundo neoxena*)	-	Moderately likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area;

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
					• High number of records exist within the locality (20 km buffer) and broader locality in the last 20 years (100 km buffer); and • The species was not recorded flying within the RSA (max 5 m). However the species is known to fly at these heights. Therefore, there is a moderately likely likelihood of collision due to the species behaviour and a minor consequence of such an event. Thus, the risk rating for this species is negligible.
Whistling kite (*Haliastur sphenurus*)	-	Very likely	Minor	Moderate	This species is known to occur within the Study Area. The following information was considered for the risk rating: • Species is not state or federally listed; • Multiple records of the species exist within the Study Area and locality (4 individuals were sighted during bird surveys, 3 of which were observed within the RSA); • High number of records exist within the broader locality in the last 20 years (100 km radius of the Study Area); • The species was recorded on multiple occasions flying throughout the RSA within the Study Area; and • This species is known to occur within and flying over wooded, forests and open land. Therefore, there is a very likely likelihood of collision due to the species behaviour and a minor consequence of such an event. Thus, the risk rating for this species is moderate.
White-breasted woodswallow (*Artamus leucorynchus*)	-	Moderately likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area;

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
					• High number of records exist within the locality (20 km buffer) and broader locality in the last 20 years (100 km buffer); and • The species was not recorded flying within the RSA (max 50m), however the species is known to fly at these heights. Therefore, there is a moderately likely likelihood of collision due to the species behaviour and a minor consequence of such an event. Thus, the risk rating for this species is negligible.
White-faced heron (*Egretta novaehollandiae*)	-	Moderately likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed; • Species was directly observed during field survey efforts within the Study Area; • Moderate number of records exist within the locality (20 km buffer) and high records exist within the broader locality in the last 20 years (100 km buffer); and • The species was recorded flying within the RSA during field surveys, however only on one occasion. Therefore, there is a moderately likely likelihood of collision due to the species behaviour and a minor consequence of such an event due to the species non-threatened listing and population size in the locality. Thus, the risk rating for this species is negligible.
White-necked heron (*Ardea pacifica*)	-	Moderately likely	Minor	Negligible	This species has been concluded as known to occur within the Study Area as observations occurred during field surveys. The following information was considered for the risk rating: • Species is not state or federally listed;

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
					• Species was directly observed during field survey efforts within the Study Area; • Moderate number of records exist within the locality (20 km buffer) and high records exist within the broader locality in the last 20 years (100 km buffer); and • The species was not recorded flying within the RSA during field surveys. Therefore, there is a moderately likely likelihood of collision due to the species behaviour and a minor consequence of such an event due to the species non-threatened listing and population size in the locality. Thus, the risk rating for this species is negligible.
Listed Threated Bats					
South-eastern long-eared bat (*Nyctophilus corbeni*)	V, VU	Less likely	Minor	Negligible	This species has been concluded as unlikely to occur within the Study Area. The following information was considered for the risk rating: • Species listed as vulnerable for both EPBC Act and NC Act; • No records exist for the species within the Study Area or locality; • No records exist within the broader locality in the last 20 years (100 km radius of the Study Area); • Suitable habitat is generally absent from the Study Area; • Desktop review and bat call analysis indicate that the Study Area location is more consistent with the distribution of two unlisted species of *Nyctophilus*; and • Flight height unlikely to reach the RSA. This species has a less likely likelihood WTG collision due to flight behaviour. The consequence would be minor due to lack of species and habitat. Therefore, the species has been considered to be at a negligible risk of being impacted by the Proposed Action.

Species	Threatened Species Status EPBC Act, NC Act	Likelihood of Event	Consequence of Event	Risk Rating	Comments
Large-eared pied bat (*Chalinolobus dwyeri*)	E, EN	Moderately likely	Major	Moderate	This species has been concluded as likely to occur within the Study Area. The following information was considered for the risk rating: • Species listed as endangered for both EPBC Act and NC Act; • Several 'probable' recordings of the species were detected within the Study Area through Anabat recordings; • No records exist within the broader locality in the last 20 years (100 km radius of the Study Area); • Canopy and above canopy forager; and • Potential foraging habitat is present in areas within the Study Area. This species has a moderately likely likelihood WTG collision, and as an endangered EPBC Act listed species, the consequence risk is concluded to be major. Therefore, the species has been considered to be at a moderate risk of being impacted by the Proposed Action.

APPENDIX G BIRD AND BAT SURVEY METHODOLOGY

The below methodology is suitable for detection of a wide range of bird species including those identified as target species that could be potentially impacted by WTG strike. The survey program has taken into consideration the seasonal variation of migratory and threatened species and is structured to ensure two visits occur each year within the suitable season and habitat of each targeted species. The bird and bat seasonal consideration table below details the seasonal considerations for each targeted species.

Appendix C details the full list of EPBC Act and NC Act listed bird and bat species confirmed as being present within the Study Area during the baseline surveys, their survey guideline requirements and survey adequacy.

The survey guidelines for diurnal bird surveys and their requirements are as follows:

- *Terrestrial Vertebrate Fauna Survey Guidelines for Queensland:*
    - Diurnal bird surveys involve six 5-10 min area searches within 100 x 100 m survey site; and
    - Two surveys conducted in the morning (<two hours after sunrise), two in mid-morning (two to four hours after sunrise) and two in less optimal times (four hours after sunrise and two hours before sunset).

Bird and Bat Surveys during Construction

During the construction phase, two wet season and two dry season surveys will be undertaken (in addition to the baseline surveys that have already been undertaken and informed the development of this BBMP). Bird and bat survey techniques undertaken during the construction phase of the Proposed Action will be consistent with the techniques and locations already undertaken in baseline surveys detailed in Section 2.2, and in accordance with the two phase and design avoidance process, will target known, likely and potentially occurring listed threatened and/or migratory species or micro-habitat features at proposed infrastructure locations in the Study Area.

Bird and Bat Monitoring at Commencement of Operation

Bird and bat surveys during the commencement of operation will target the species listed as known or likely to occur within the Study Area in Section 3, as well as those listed species with potential to occur in the Study Area. Bird surveys will occur during the first two years of commencement of operation with two wet season and two dry season surveys being undertaken in those years. Monitoring during the commencement of operation of the Proposed Action will be consistent with techniques used during previous field surveys.

The location of the operational phase bird and bat surveys has been informed by the habitat mapping prepared for the species determined as known, likely or having the potential to occur within the Study Area.

The monitoring during operation will be based on two main approaches. The first is to monitor bird and bat activity and ongoing mortality searches that aim to determine impacts (collisions) occurring during the first two years of operation. The second is to inform specific response to impact triggers that may result to bird and bat species, which will include increase monitoring surveys and carcass searches, investigation of risk behaviours and subsequent risk mitigation.

Bird Utilisation Surveys (BUS)

BUS involve 20-minute fixed point surveys to provide data based on the species present, height, speed and direction of flight as stipulated by the Band Model (SNH, 2012; Band, 2000).

Each fixed-point survey site was located to provide a search radius of at least 100 m for small birds and up to 800 m for large birds with range finders used to determine distances. Searches primarily focused on birds most likely to be affected by the Proposed Action, such as raptors (birds of prey) and large flocks of birds.

The draft *Onshore Wind Farm Guidance* (DCCEEW, 2024) details the need to undertake a risk assessment for birds and bats following BUS for the Study Area. This risk assessment has taken into account the likelihood and consequences of events including collision with WTGs and the impact of construction and operation on the Proposed Action causing changes in site utilisation by bird and bat species.

The State Code 23 details the requirement for BUS for proposed wind farm developments. Such surveys identify avian species, numbers present, height flown and site utilisation. The 2022-2023 field surveys undertook BUS in accordance with the Band Model, at waterbodies and in open areas for birds of prey (Band, 2000).

The State Code also recommends a Before-After-Control-Impact (BACI) design principle for surveys where the Study Area is determined to support significant bird species. The aim of the BACI design is to compare environmental variables before and after a human activity and between the area affected by the development footprint (impact) and an unaffected area (control) (Stewart-Oaten, 1986). Areas visited during the 2022-2024 field surveys, prior to construction/operation, were identified as impact areas. These areas will be revisited and resurveyed during the second design phase (pre-construction), during construction and after construction (operation phase) of the Proposed Action. Additional neighbouring control sites will be selected and surveyed as part of the second design phase (within 1 km of the Proposed Action).

The BACI designed bird surveys include BUS such as point, waterbody and birds of prey surveys, as was conducted during the phase one design field investigations. It is noted that the second design phase will include ongoing surveys at impact sites (at the sites already surveyed) as well as control sites that are yet to be determined. The final location of BACI survey sites will be dependent on changes in proposed infrastructure placement that may result from findings of the second phase design field program.

Point Surveys

Point surveys are conducted to target diurnal woodland and riparian bird species. Suitable woodland and riparian habitats will be traversed by suitably trained ecologists, with 20-minute timed surveys to be conducted for all birds in the Study Area.

Waterbody Surveys

Waterbody surveys are conducted in order to target waterbirds (particularly some migratory species), and woodland species utilising the waterbodies. Observations are made from a stationery position, and birds identified by call detection and visual observations. The Study Area contains approximately 17 artificial waterbodies (farm dams), with potential to act as important water sources in the landscape, particularly during dry conditions.

Birds of Prey Surveys

Birds of prey surveys will be undertaken to target listed threatened species, such as the red goshawk (*Erythrotriorchis radiatus*), and other birds of prey that may be at risk of collision with WTGs during operation, such as raptors. Surveys are undertaken at vantage points (e.g.

large hills and extensively cleared areas) at mid-morning when birds of prey become increasingly active.

Call Playback

Call playback surveys are conducted to target cryptic, nocturnal bird species. Within suitable habitat 2-minute calls are broadcast interspersed with 2 minutes of silence to listen for response calls. Suitable habitat includes vegetated gully lines and areas with suitably sized tree hollows. A handheld Bluetooth speaker is used to broadcast calls. Following two rounds of call broadcasts, a spotlighting search is performed to search for owls that had responded by flying quietly to the broadcast area.

Bats

The BACI design has also been implemented for bat surveys in order to identify any impacts on bats as a result of the Proposed Action, with future control sites also to be determined at the conclusion of the design process.

The survey requirements and recommended survey effort and methods for bats are as follows:

- *Survey guidelines for Australia's threatened bats:*
    - Trapping methods such as harp traps are recommended. Such effort is not precisely stated, but studies have found that the use of 20 or more traps a night a good for detection (Schulz, 1999);
    - Echolocation call detection to be carried out for a recommended 30-60 minutes per night for four to five survey nights; and
    - Recommended that a variety of trapping and call detection methods are used together, where possible and if required to detect target species.

The 2022 and 2023 surveys were carried out in accordance with echolocation call detection requirements. Trapping methods such as harp traps are recommended in certain situations to target those bats that are difficult to identify to species level by echolocation surveys alone. Harp trapping was not used based on the lack of potential for listed threatened species detected by the deployed Anabats.

State Code 23 identifies methods must be carried out to determine which bat species occur on the Study Area. It recommends the use of survey techniques including mist nets and/or bat detection systems that record and analyse echolocation calls of bats. The 2022 and 2023 survey efforts involved the use of Anabats, thus meeting the State Code 23 requirement.

Bird and Bat Monitoring for the Life of the Proposed Action

To identify if an annual trigger for red goshawk or grey falcon has been met (see Section 7.1.1 of the Theodore Wind Farm PER), desktop searches will be completed to identify any publicly reported records of target species identified within the Locality of the Study Area (10 km buffer). These desktop searches will be completed at the same time as each mortality monitoring survey (see Section 5.2 of the BBMP) and will include review of records within publicly available datasets such as Atlas of Living Australia or WildNet. Any sightings of the species identified during the BUSs completed within the first two years of operation (described above) will also contribute to the annual trigger.

Bird and Bat Seasonal Consideration

Species Name	Threatened Species Status		Likelihood of Occurrence	Seasonal Consideration
	EPBC Act	NC Act		
Listed Threatened and Migratory Bird Species				
Grey falcon (*Falco hypoleucos*)	VU	V	Unlikely	Wet and Dry season
Red goshawk (*Erythrotriorchis radiatus*)	E	EN	Unlikely	May to December (breeding)
White-throated needletail (*Hirundapus caudacutus*)	V, Mi	VU	Potential	Wet and Dry season
Fork-tailed swift (*Apus pacificus*)	Mi	SLC	Potential	Wet and Dry season
Squatter pigeon (southern) (*Geophaps scripta scripta*)	VU	VU	Known	Wet and Dry season
Black-breasted buttonquail (*Turnix melanogaster*)	V	VU	Potential	September to March (breeding)
Australian painted snipe (*Rostratula australis*)	EN	E	Potential	August to February (breeding)
Diamond firetail (*Stagonopleura guttata*)	V	VU	Potential	August to January (breeding)
Non-listed Bird Species (Raptors within the RSA)				
Wedge-tailed eagle (*Aquila audax*)	-	LC	Known	Wet and Dry season
Nankeen kestrel (*Falco cenchroides*)	-	LC	Known	Wet and Dry season
Brown falcon (*Falco berigora*)	-	LC	Known	Wet and Dry season
Whistling kite (*Haliastur sphenurus*)	-	LC	Known	Wet and Dry season
Listed Threatened Bat Species				
Ghost bat (*Macroderma gigas*)	V	EN	Unlikely	September to April
Grey-headed flying fox (*Pteropus poliocephalus*)	V	LC	Unlikely	Wet and Dry season
Corben's long-eared bat (*Nyctophilus corbeni*)	V	VU	Unlikely	October to March
Large-eared pied bat (*Chalinolobus dwyeri*)	V	VU	Likely	October to March

APPENDIX H POTENTIAL SPECIES SIGNIFICANT IMPACT ASSESSMENT

White-throated needletail

A significant impact assessment based on the guidance provided in the SIG 1.1 is presented in in Table H.1. It has been concluded that the Proposed Action is **unlikely** to have a significant impact on the white-throated needletail.

Considering the species nature as an aerial species in Australia, and proclivity to fly at RSA heights and above, there is a risk of WTG collision as a result of the Proposed Action. Therefore, should the species be observed in the Study Area, adaptive management measures will be undertaken to further prevent any impact to this species.

TABLE H.1 SIGNIFICANT IMPACT ASSESSMENT FOR THE WHITE-THROATED NEEDLETAIL

Criteria	Description	Criteria Triggered?
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;	White-throated needletail is almost exclusively aerial in nature while in Australia, with the entire Study Area (46,830 ha) considered aerial foraging habitat for the species. It is unlikely that development for the Proposed Action will interfere with this species ability to forage and disperse. The white-throated needletail is considered potential to occur within the Study Area, with no individuals recorded during field surveys. The minimum threshold for an ecologically significant impact to a population for white-throated needletail is 40 individuals (Garnett & Crowley, 2000). As the species was not identified within the Study Area and no impacts to this species ability to forage aerially overhead will occur, it is considered unlikely that the Proposed Action will lead to a long-term decrease in the size of an important population of the species.	Unlikely
Reduce the area of occupancy of an important population;	White-throated needletail's area of occupancy while migrating through coastal Eastern Australia is estimated at approximately 126,000 km^2 (TSSC, 2019). As discussed, white-throated needletail, is almost exclusively aerial whilst migrating across Australia. Therefore, disturbance of vegetation associated with the Proposed Action is unlikely to reduce this area of occupancy. Additionally, no important population has been identified utilising the Study Area.	Unlikely
Fragment an existing important population into two or more populations;	White-throated needletail is a highly mobile species that migrates southwards over large areas of coastal Eastern Australia in the spring, summer, and autumn seasons (TSSC, 2019). It is not expected that the Proposed Action will fragment a population of this species given its dispersive and aerial nature.	Unlikely
Adversely affect habitat critical to the survival of a species;	The Study Area has been considered as habitat critical to the survival of the species conservatively, based on its potential utility for foraging behaviour. However, the Proposed Actions potential impacts will not adversely affect this habitat for white-throated needletail, as its foraging value is highly unlikely to be altered. Therefore, it is unlikely that the Proposed Action will adversely affect habitat critical to the survival of this species.	Unlikely

Criteria	Description	Criteria Triggered?
Disrupt the breeding cycle of an important population;	White-throated needletail does not breed during its migration to Australia. While a loss of old growth forest and mature hollow bearing trees in the northern hemisphere is suspected to be impacting the species' breeding success, it is not projected the Proposed Action will disrupt or have any impact on white-throated needletail's ability to breed.	Unlikely
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;	A loss of potential roosting sites in Australia is potentially contributing to the decline of the species, as well as the loss of suitably wooded habitat that invertebrate prey species require (TSSC, 2019). However, since no roosting habitat has been identified and all foraging habitat is aerial in nature, it is unlikely that the Proposed Action will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Unlikely
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;	No invasive species have been identified as a threat to the white-throated needletail. The Proposed Action will adopt and follow a Biosecurity Plan, as outline in Section 7. The activities related to the Proposed Action, both during construction and operation, will implement and follow biosecurity measures to reduce the risk of introducing new invasive species and to prevent the further spread of existing invasive species.	Unlikely
Introduce disease that may cause the species to decline; or	While not necessarily a disease, the use of insecticides, particularly organochlorines, has been linked with the decline of white-throated needletail through indirect impacts. These indirect impacts include secondary poisoning through bioaccumulation of insecticides in prey species, and the decrease in the availability of preferred invertebrate prey species (Tarburton, 2014). There is no evidence to suggest that the Proposed Action will increase the risk of these impacts. However, precautions will be taken as detailed in a Biosecurity Plan, to ensure that insecticides are not improperly applicated within the Study Area (see Section 7).	Unlikely
Interfere substantially with the recovery of the species.	There are no threat abatement or recovery actions proposed or underway for this species. Due to no individuals being observe during field surveys, and the habitat within the Study Area being exclusively aerial foraging habitat, it is considered unlikely that the Proposed Action will interfere with the recovery of the species.	Unlikely
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 loss of potential roosting sites as well as wooded habitat suitable for prey species in Australia, may potentially be contributing to the decline of the species (TSSC, 2019). However, since no roosting habitat has been identified and all foraging habitat is aerial in nature it is unlikely that the Proposed Action will substantially modify, destroy or isolate an area of important habitat for the migratory species.	Unlikely

Criteria	Description	Criteria Triggered?
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	No invasive species have been identified as a threat to the white-throated needletail. Additionally, biosecurity risks associated with the Proposed Action will be managed with a Biosecurity Management Plan, as outlined in Section 7. Ensuring that this plan is adequately followed, it is considered unlikely that the Proposed Action will result in invasive species that are potentially harmful to the white-throated needletail becoming established in the Study Area.	Unlikely
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	The minimum threshold for an ecologically significant impact to a population for white-throated needletail is 40 individuals (Garnett & Crowley, 2000). The white-throated needletail is considered only potential to occur within the Study Area, with no individuals recorded during field surveys. As the white-throated needletail does not breed during its migration to Australia, it is not projected the Proposed Action will disrupt or have any impact on white-throated needletail's ability to breed. White-throated needletail is almost exclusively aerial in nature while in Australia, with the entire Study Area considered aerial foraging habitat for the species. No roosting habitat has been identified within the Study Area. It is therefore unlikely that development for the Proposed Action will interfere with this species ability to roost, forage and migrate.	Unlikely
Significant Impact: Unlikely		

Black-breasted buttonquail

A significant impact assessment based on the guidance provided in the SIG 1.1 is presented in Table H.2. It has been concluded that the Proposed Action is **unlikely** to have a significant impact on the black-breasted buttonquail.

TABLE H.2 SIGNIFICANT IMPACT ASSESSMENT FOR THE BLACK-BREASTED BUTTONQUAIL

Criteria	Description	Criteria Triggered?
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;	Black-breasted buttonquail is considered potential to occur within the Study Area. A total of 277.4 ha of Potential Foraging and Roosting Habitat for this species has been identified within the Study Area, however no individuals have been recorded within the Study Area or Locality within the last 20 years. As there is no known population of black-breasted buttonquail within the Study Area, it is unlikely that any potential population would be an 'important population'. It is therefore unlikely that the Proposed Action will lead to a long-term decrease in the size of an important population of the species.	Unlikely
Reduce the area of occupancy of an important population;	The species is estimated to have an area of occupancy of 75,000 ha (Garnett & Crowley, 2000) and given the broad-scale loss of vine thicket vegetation and other black-breasted button-quail habitat (up to 90%, as suggested in Hamley et al., 1997), it is highly likely that the remaining distribution is severely fragmented (DoE, 2015a). Black-breasted buttonquail is considered potential to occur within the Study Area. A total of 277.4 ha of Potential Foraging and Roosting Habitat for this species has been identified within the Study Area, however no individuals have been recorded within the Study Area or Locality within the last 20 years. As there is no known population of black-breasted buttonquail within the Study Area, it is unlikely that any potential population would be an 'important population'. It is therefore unlikely that the Proposed Action will reduce the area of occupancy of an important population.	Unlikely
Fragment an existing important population into two or more populations;	Black-breasted buttonquail is considered potential to occur within the Study Area. A total of 277.4 ha of Potential Foraging and Roosting Habitat for this species has been identified within the Study Area, however no individuals have been recorded within the Study Area or Locality within the last 20 years. As there is no known population of black-breasted buttonquail within the Study Area, it is unlikely that any potential population would be an 'important population'. It is therefore unlikely that the Proposed Action will fragment an existing important population into two or more populations.	Unlikely
Adversely affect habitat critical to	Black-breasted buttonquail is considered as having the potential to occur within the Study Area. A total 277.4 ha of	Unlikely

Criteria	Description	Criteria Triggered?
the survival of a species;	Potential Foraging and Roosting Habitat for this species has been identified within the Study Area. Habitat critical to the survival of the black-breasted buttonquail has been defined within the National Recovery Plan for Black-breasted Button-quail (*Turnix melanogaster*) (Mathieson & Smith, 2009): • Foraging and breeding habitat; • Habitat for the long-term maintenance of the species; • Areas with potential habitat; and • Areas supporting recovery. Based on this definition, the potential habitat within the Study Area constitutes habitat critical to the survival of the species. A total of 5.0 ha of Potential Foraging and Roosting Habitat will be subject to disturbance by the Proposed Action. Impact to this 5.0 ha of habitat critical to the survival of the species is not considered to be 'adverse' given the very limited area impacted (1.8% of available habitat in the Study Area). Therefore, the Proposed Action is unlikely to adversely affect habitat critical to the survival of the species.	
Disrupt the breeding cycle of an important population;	Black-breasted buttonquail is considered potential to occur within the Study Area. A total of 277.4 ha of Potential Foraging and Roosting Habitat for this species has been identified within the Study Area, however no individuals have been recorded within the Study Area or Locality within the last 20 years. There is not expected to be any important population of the black-breasted buttonquail in the Study Area, due to the lack of records of the species in the Locality, and the fragmented existence of potential habitat. Therefore, impact to 5.0 ha of Potential Foraging and Roosting Habitat (1.8% of available habitat in the Study Area) is unlikely to disrupt the breeding cycle of an important population.	Unlikely
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;	Black-breasted buttonquail is considered potential to occur within the Study Area. A total of 277.4 ha of Potential Foraging and Roosting Habitat for this species has been identified within the Study Area, however no individuals have been recorded within the Study Area or Locality within the last 20 years. Due to the absence of any records of the species, and the fragmented existence of potential habitat, it is unlikely that impact to 5.0 ha of Potential Foraging and Roosting Habitat (1.8% of available habitat in the Study Area) would modify this species habitat to the extent that the species would decline.	Unlikely
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;	Based on the species conservation advice (DoE, 2015a), both invasive flora and fauna species have been identified as a threat to the black-breasted buttonquail. These include: • Habitat degradation as a result of domestic livestock and feral pigs (*Sus scrofa*); and • Predation by feral animals such as feral cats (*Felis catus*) and foxes (*Vulpes vulpes*). Biosecurity risks associated with the Proposed Action will be managed with a Biosecurity Plan, as outlined in Section 7. By	Unlikely

Criteria	Description	Criteria Triggered?
	ensuring that this plan is adequately followed, it is considered unlikely that the Proposed Action will result in increasing the risk of any of the above invasive species becoming established in this species habitat.	
Introduce disease that may cause the species to decline; and	No specific disease has been identified within the approved conservation advice as a threat to this species (DoE, 2015a). Biosecurity risks associated with the Proposed Action will be managed with a Biosecurity Management Plan, as outlined in Section 7. By ensuring that this plan is adequately followed, it is considered unlikely that the Proposed Action will introduce a disease that may cause the species to decline.	Unlikely
Interfere substantially with the recovery of the species.	The main recovery plan objectives for this species, outlined in National Recovery Plan for Black-breasted Button-quail (*Turnix melanogaster*) (Mathieson & Smith, 2009), include: • By 2032, maintain and improve the extent, condition and connectivity of habitat of the Black-breasted Button-quail; • By 2032, demonstrably reduce the severity of identified anthropogenic threats across the extent of the species' range; • By 2032, achieve, measure and sustain a stable or positive trend in area of occupancy and population size (assessed by new baseline counts) in the number of mature individuals of the Black-breasted Button-quail; and • This will be achieved by implementing the actions set out in this recovery plan that minimise threats while protecting and enhancing the species' habitat throughout its range, adequately monitoring the species, generating new knowledge to guide recovery actions and increasing public awareness. Although the Proposed Action will result in the disturbance of 5.0 ha of Potential Foraging and Roosting Habitat, as this habitat is only potential (no population has been identified within the Study Area) it is considered unlikely that this impact will interfere with the recovery of the species.	Unlikely
Significant Impact: Unlikely		

Australian painted snipe

A significant impact assessment based on the guidance provided in the SIG 1.1 is presented in Table H.3. It has been concluded that the Proposed Action is **unlikely** to have a significant impact on the Australian painted snipe.

TABLE H.3 SIGNIFICANT IMPACT ASSESSMENT FOR THE AUSTRALIAN PAINTED SNIPE

Criteria	Description	Criteria Triggered?
An action is likely to have a significant impact on an 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 Australian painted snipe is considered potential to occur within the Study Area with no known population observed during field surveys. It is expected that 1.3 ha (or 2.4%) of Australian painted snipe Potential Foraging Habitat will be impacted as a result of the Proposed Action. The Proposed Action's activities are unlikely to cause a local population to experience decline as there is no current evidence to suggest a local population utilises this habitat. Additionally, the impacts that will occur are small in size (2.4% of total habitat available), are mostly linear in nature, and are unlikely to impact any potentially occurring populations.	Unlikely
Reduce the area of occupancy of the species,	The current extent of occurrence for the species is extensive, at 4,500,000 km² ha, though the area of occupancy is estimated (with low reliability) to be 1,000 km² (Garnett & Crowley, 2000). Impact to 1.3 ha of potential habitat is considered unlikely to reduce this area of occupancy.	Unlikely
Fragment an existing population into two or more populations,	The Australian painted snipe is considered potential to occur within the Study Area with no known population observed during field surveys. It is expected that 1.3 ha (or 2.4%) of Australian painted snipe Potential Foraging Habitat will be impacted as a result of the Proposed Action. However, due to the high mobility of the species, the small area of impact to habitat, and the lack of evidence of a population utilising habitat within the Study Area, it is considered unlikely that an impact to 1.3 ha of Potential Foraging Habitat will fragment an existing population into two or more populations.	Unlikely
Adversely affect habitat critical to the survival of a species,	While Potential Foraging Habitat for this species has been mapped, this habitat is not considered to constitute habitat critical to the survival of the species due to its degraded nature. Habitat is in poor condition due to the historical cattle grazing within the Study Area. Therefore, the Proposed Action's impact to 1.3 ha of Potential Foraging Habitat is unlikely to adversely affect habitat critical to the survival of this species.	Unlikely
Disrupt the breeding cycle of a population,	No breeding habitat was identified within the Study Area, as the species requires shallow freshwater wetlands with interspersed small islands and nearby	Unlikely

Criteria	Description	Criteria Triggered?
	canopy cover. As there is no such habitat in the Study Area, it is unlikely that breeding cycles will be directly impacted. A species breeding cycle can be disrupted due to substantial changes in foraging behaviour, however the limited impact to 1.3 ha of Potential Foraging Habitat is unlikely to lead to a substantial impact. Ultimately, considering the lack of breeding habitat within the Study Area, and the limited value of foraging habitat, it is unlikely that the Proposed Action's impacts would disrupt the species breeding cycle.	
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline,	The Proposed Action will result in the disturbance of 1.3 ha (or 2.4%) of Australian painted snipe Potential Foraging Habitat. This accounts for only a small area of habitat to be removed in relation to the larger context of the Study Area, which supports 56.0 ha of Potential Foraging Habitat for Australian painted snipe in total. It is expected that the limited amount of disturbance in the larger context of the landscape will not remove, isolate or decrease the quality of habitat such that it would result in species to decline.	Unlikely
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 following invasive species are expected to be detrimental to the Australian painted snipe (DSEWPC, 2013): • Livestock via grazing and trampling of wetland vegetation and nests; • Feral foxes and cats via predation; and • Weeds that replace native wetland vegetation. The Proposed Action activities during construction and operation will adopt and follow biosecurity measures to prevent introduction of new invasive species or the spread of those known to the Study Area (see Section 7). The Study Area has been historically used for cattle grazing, and therefore no new impacts will arise as a result of the Proposed Action with regards to livestock.	Unlikely
Introduce disease that may cause the species to decline, or	The conservation advice for Australian painted snipe does not list any diseases as harmful to the species (DSEWPC, 2013). There is also no evidence to suggest the proposed disturbance would introduce a disease that would cause the species to decline. Additionally, precautions will be taken to ensure that the spread of disease does not occur. This includes following biosecurity measures as part of a Biosecurity Plan (see Section 7).	Unlikely
Interfere with the recovery of the species.	There are no formally adopted Recovery Plans for this species, but the Conservation Advice lists regional priority recovery actions that involve abatement/research of the following threats (DSEWPC, 2013): • Habitat loss, disturbance and modification; • Invasive weeds; • Trampling, browsing and grazing; • Animal predation or competition; and • Fire.	Unlikely

Criteria	Description	Criteria Triggered?
	Impacts to Potential Foraging Habitat for Australian painted snipe are limited to 1.3 ha of (2.4% of total habitat available). Other potential threats will be mitigated through implementation of the site-specific Construction Environmental Management Plan (CEMP) (see Section 7), through fire management, construction management, and biosecurity measures. Considering the potential impacts of the Proposed Action, along with proposed mitigation measures, the Proposed Action is unlikely to result in or exacerbate any of the threats outlined above.	
Significant Impact: Unlikely		

Diamond firetail

A significant impact assessment based on the guidance provided in the SIG 1.1 is presented in Table H.4. It has been concluded that the Proposed Action has the **potential** to have a significant impact on the diamond firetail.

TABLE H.4 SIGNIFICANT IMPACT ASSESSMENT FOR DIAMOND FIRETAIL

Criteria	Description	Criteria Triggered?
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;	Despite a large survey effort, the diamond firetail has not been observed within the Study Area. However, the species is considered as having the potential to occur due to suitable habitat being identified during field surveys. The total amount of habitat to be permanently impacted as a result of the Proposed Action is 95.8 ha (or 1.2%) of Potential Breeding and Foraging. Impacts will mostly involve clearing of small patches of remnant vegetation for WTGs as well as clearing for linear infrastructure. Given the high mobility of this species, habitat within the Study Area will remain largely connected in the landscape, and to higher quality habitat associated with adjacent state forests. Therefore, the Proposed Action is unlikely to lead to a long-term decrease in the size of any potentially occurring populations of diamond firetail.	Unlikely
Reduce the area of occupancy of an important population;	This species' area of occupancy is roughly estimated at 25,000 km^2 (DCCEEW, 2023b). The Proposed Action will lead to an impact to 95.8 ha, or 1.2% of the total available diamond firetail habitat within the Study Area which equates to 0.004% of the species area of occupancy. The broad habitat requirements of this species suggest that this species is likely to have high availability of habitat within the wider region. Although 95.8 ha of habitat will be impacted within the Study Area, the area of retained habitat within the Study Area is likely to continue to support any potentially occurring local populations. Therefore, the Proposed Action is unlikely to reduce the area of occupancy of any potentially occurring populations of diamond firetail.	Unlikely
Fragment an existing important population into two or more populations;	Impacts will mostly involve clearing of small patches of remnant vegetation for WTGs as well as clearing for linear infrastructure. Given the high mobility of this species, habitat within the Study Area will remain largely connected in the landscape, and to higher quality habitat associated with adjacent state forests. It is therefore unlikely that the impact to 95.8 ha, or 1.2% of the total available diamond firetail habitat within the Study Area, will result in a barrier to movement for this species, or fragment any existing populations into two or more populations.	Unlikely
Adversely affect habitat critical to the survival of a species;	Habitat critical to the survival of the diamond firetail has been described within the species Conservation Advice (DCCEEW, 2023b) and includes areas with: • Eucalypt, acacia or casuarina woodlands, open forests and other lightly timbered habitats; • Low tree density, few large logs, and little litter cover but high grass cover for foraging, roosting and breeding;	Potential

Criteria	Description	Criteria Triggered?
	• Drooping she-oak (*Allocasuarina verticillata*) within the Mt Lofty Ranges. According to the species conservation advice: • Habitat critical to the survival of diamond firetail should not be cleared, fragmented or degraded; • Any known or likely habitat (identified within the modelled distribution of the species and presented within the species conservation advice (DCCEEW, 2023b)), should be considered as habitat critical to the survival of the species; • Areas that are not currently occupied by the species due to recent disturbance (e.g. fire, grazing or human activity), but should became suitable again in the future, should also be considered habitat critical to the survival of the species (DCCEEW, 2023b). Despite a large survey effort, the diamond firetail has not been observed within the Study Area. Suitable habitat has been identified, though this Potential Habitat is at the northern extent of the species range within the 'may occur' modelled distribution of the species, therefore outside the 'known and likely habitat' identified within the species conservation advice (TSSC, Conservation Advice Geophaps scripta scripta squatter pigeon (southern), 2015). Based on the information provided above, habitat within the Study Area is considered potential habitat critical to the survival of the diamond firetail. However, the initial construction-phase clearing of diamond firetail habitat is likely to only represent a short-term disturbance to the species. Revegetation is expected to return the functionality of impacted habitat outside of the Operations Footprint, reducing the overall permanent impact to the species. As the species has the potential to occur in the Study Area, it is considered that impacted 95.8 ha (1.2%) of Potential Breeding and Foraging habitat constitutes habitat critical to the survival of the species, and as such the Proposed Action has the potential to adversely affect habitat critical to the survival of the species.	
Disrupt the breeding cycle of an important population;	Despite a large survey effort, the diamond firetail has not been observed within the Study Area. The species is considered as having the potential to occur within the Study Area, with potentially suitable breeding habitat determined to be present. Permanent impacts of the Proposed Action will be limited to 95.8 ha of Potential Breeding and Foraging (1.2% of habitat available within the Study Area). Clearing that occurs during the construction stage will be staged and pre-clearance surveys will identify any potential nests within suitable habitat. Disturbance to any active nests will be avoided/mitigated through micro-siting or, in a worst-case scenario, translocated to safer habitat. Therefore, the Proposed Action is unlikely to disrupt the breeding cycle of an important population.	Unlikely
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the	A total of 339.6 ha of diamond firetail Potential Breeding and Foraging Habitat is expected to be disturbed during construction. After post-construction rehabilitation, which is expected to return the functionality required for the species, the Proposed Action is expected to only impact 95.8 ha, or 1.2% of all available Potential Breeding and Foraging within the Study Area.	Unlikely

Criteria	Description	Criteria Triggered?
species is likely to decline;	It is expected that the small area of disturbance in the larger context of the landscape is unlikely to remove/isolate or decrease the quality of habitat that would result in species decline.	
Result in invasive species that are harmful to a Vulnerable species becoming established in the endangered species' habitat;	Invasive species such as feral cats (*Felis catus*) and European red foxes (*Vulpes vulpes*) are common pests encountered in Queensland and are particularly harmful to native threatened birds. These invasive species are known to occur in the Study Area. The Proposed Action will adopt and follow a Biosecurity Management Plan, as outline in Section 7. The activities related to the Proposed Action, both during construction and operation, will implement and follow biosecurity measures to reduce the risk of introducing new invasive species and to prevent the further spread of existing invasive species.	Unlikely
Introduce disease that may cause the species to decline; or	There is currently limited evidence of diseases causing detrimental effects to diamond firetail populations in Queensland. There is also no evidence to suggest the Proposed Action would introduce a disease that may cause the species to decline. Additionally, precautions will be taken to ensure that the spread of disease does not occur. This includes following biosecurity measures that are outlined in Section 7.	Unlikely
Interfere with the recovery of the species.	The Proposed Action is expected to result in permanent impacts to 95.8 ha of Breeding and Foraging Habitat (1.2% of habitat available within the Study Area). Despite a large survey effort, diamond firetail has not been observed within the Study Area. There are no formally adopted recovery plans for this species. However, the limited impact to potential habitat within the Study Area and the mostly linear nature of clearing associated with the Proposed Action is unlikely to affect the recovery of this species. Clearing is unlikely to adversely affect retained areas of suitable habitat, and mitigation measures such as micro-siting and pre-clearance surveys will be utilised. This will enable the species to continually traverse the landscape and utilise retained habitat, ensuring genetic viability of any potentially occurring local population. It is therefore unlikely the Proposed Action will interfere substantially with the recovery of the species.	Unlikely
Significant Impact: Potential		

Fork-tailed swift

A significant impact assessment based on the guidance provided in the SIG 1.1 is presented in in Table H.5. It has been concluded that the Proposed Action is **unlikely** to have a significant impact on the fork-tailed swift.

Considering the species nature as an aerial species in Australia, and proclivity to fly at RSA heights and above, there is a risk of WTG collision as a result of the Proposed Action. Therefore, should the species be observed in the Study Area, adaptive management measures will be undertaken to further prevent any impact to this species.

TABLE H.5 SIGNIFICANT IMPACT ASSESSMENT FOR THE FORK-TAILED SWIFT

Criteria	Description	Criteria Triggered?
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 whole Study Area is considered important habitat for this species but impacts to this habitat will not change its utility for the fork-tailed swift. This is because the species is an aerial forager, and its prey, insects, will not be dissuaded from the Study Area due to the Proposed Action's activities. Additionally, there is no significant impact threshold set out in DoE (2015b) for impacts to important habitat for this species, due to its aerial nature.	Unlikely
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	DoE (2015b) does not identify any invasive species as harmful to the Fork-tailed swift. This said, a biosecurity plan will be implemented for the Proposed Action, as well as other biosecurity measures (see Section 7). With such measures, it is unlikely that harmful invasive species become established in the Study Area.	Unlikely
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	The fork-tailed swift does not breed in Australia, nor is it considered to roost. Therefore, any occurrence of the species in the Study Area is likely to be a strict, flyover, aerial visitor which would not be impacted by the Proposed Action, apart from potential collision risks which will be adaptively managed as outlined in the BBMP. An ecologically significant proportion of fork-tailed swift is 100 individuals (for nationally significant) or 1,000 (for internationally significant) (DoE, 2015b). Considering the lack of observation, and the strict aerial nature of this species, the Study Area is unlikely to be a host to an ecologically significant proportion of this species. The Proposed Action is therefore unlikely to seriously disrupt the lifecycle of an ecologically significant proportion of the fork-tailed swift population.	Unlikely
Significant Impact: Unlikely		

APPENDIX I EXAMPLE OF UPDATED METHODOLOGY

Site	GPS Coordinates	Date	Time	Type	Weather	Common Name
BUS14		26/11/2025	13:15	PM	28 degrees, high wind, dusty, 2/8 cloud	Black Kite
BUS18		27/11/2025	13:34	MID	25 degrees, moderate wind, 1/8 cloud	Black Kite
BUS12		25/11/2025	9:03	AM	24 degrees, low wind, 1/8 cloud	Black Kite
BUS12		25/11/2025	9:03	AM	24 degrees, low wind, 1/8 cloud	Black Kite
BUS12		27/11/2025	15:10	PM	28 degrees, moderate wind, 1/8 cloud	Black Kite
BUS11		26/11/2025	10:05	MID	26 degrees, high wind, 2/8 cloud	Black Kite
BUS11		25/11/2025	9:40	AM	25 degrees, moderate wind, 1/8 cloud	Nankeen Kestrel
BUS10		25/11/2025	7:50	AM	21 degrees, low wind, 2/8 cloud	Nankeen Kestrel
BUS11		25/11/2025	9:40	AM	25 degrees, moderate wind, 1/8 cloud	Nankeen Kestrel
BUS14		26/11/2025	13:15	PM	28 degrees, high wind, dusty, 2/8 cloud	Nankeen Kestrel
BUS19		27/11/2025	11:22	MID	22 degrees, moderate wind, 6/8 cloud	Nankeen Kestrel
BUS10		25/11/2025	7:50	AM	21 degrees, low wind, 2/8 cloud	Nankeen Kestrel
BUS11		26/11/2025	10:05	MID	26 degrees, high wind, 2/8 cloud	Nankeen Kestrel
BUS09		28/11/2025	8:54	AM	20 degrees, still, thin cloud, 6/8 cloud	Wedge-tailed Eagle
BUS34		28/11/2025	11:05	MID	28 degrees, light wind, 6/8 cloud	Wedge-tailed Eagle
BUS38		27/11/2025	10:25	MID	18 degrees, moderate wind, 7/8 cloud	Wedge-tailed Eagle
BUS11		27/11/2025	14:30	PM	26 degrees, moderate wind, 1/8 cloud	Wedge-tailed Eagle
BUS15		27/11/2025	9:00	AM	18 degrees, moderate wind, 7/8 cloud	Wedge-tailed Eagle
BUS18		27/11/2025	13:34	MID	25 degrees, moderate wind, 1/8 cloud	Wedge-tailed Eagle
BUS11		26/11/2025	10:05	MID	26 degrees, high wind, 2/8 cloud	Wedge-tailed Eagle
BUS11		27/11/2025	14:30	PM	26 degrees, moderate wind, 1/8 cloud	Wedge-tailed Eagle
BUS02		26/11/2025	15:35	PM	29 degrees, high wind, 1/8 cloud	Wedge-tailed Eagle
BUS02		28/11/2025	11:48	MID	29 degrees, light wind, 6/8 cloud	Wedge-tailed Eagle
BUS02		28/11/2025	11:48	MID	29 degrees, light wind, 6/8 cloud	Wedge-tailed Eagle

Site	Scientific Name	TaxonSort	Number of Individuals	Distance (m) from observer	Direction (degrees) from observer
BUS14	*Milvus migrans*	*804*	1	1000	340
BUS18	*Milvus migrans*	*804*	1	600	150
BUS12	*Milvus migrans*	*804*	1	50	30
BUS12	*Milvus migrans*	*804*	2	70	30
BUS12	*Milvus migrans*	*804*	1	100	30
BUS11	*Milvus migrans*	*804*	1	450	70
BUS11	*Falco cenchroides*	*848*	1	150	260
BUS10	*Falco cenchroides*	*848*	1	1000	160
BUS11	*Falco cenchroides*	*848*	1	50	320
BUS14	*Falco cenchroides*	*848*	1	50	290
BUS19	*Falco cenchroides*	*848*	1	750	40
BUS10	*Falco cenchroides*	*848*	1	250	190
BUS11	*Falco cenchroides*	*848*	1	15	140
BUS09	*Aquila audax*	*781*	1	800	130
BUS34	*Aquila audax*	*781*	3	850	100
BUS38	*Aquila audax*	*781*	2	400	260
BUS11	*Aquila audax*	*781*	1	300	340
BUS15	*Aquila audax*	*781*	1	500	250
BUS18	*Aquila audax*	*781*	1	900	50
BUS11	*Aquila audax*	*781*	1	700	220
BUS11	*Aquila audax*	*781*	1	850	120
BUS02	*Aquila audax*	*781*	2	100	240
BUS02	*Aquila audax*	*781*	1	750	180
BUS02	*Aquila audax*	*781*	1	650	180

Site	Direction of travel (to nearest 10 degree	Flight height (0 - 5 minutes)	Flight height (5 - 10 minutes)
BUS14	150		
BUS18	90	100	
BUS12	220		30
BUS12	160		50
BUS12	200	200	
BUS11	340	15	
BUS11	240		
BUS10	260		
BUS11	160		
BUS14	350	18	
BUS19	330	20	
BUS10	290		15
BUS11	0		
BUS09	60		
BUS34	280	50	100
BUS38	260	50	100
BUS11	60		
BUS15	10		5
BUS18	300		300
BUS11	340		
BUS11	40	100	
BUS02	190	50	
BUS02	90		50
BUS02	90		

Site	Flight height (10 - 15 minutes)	Flight height (15 - 20 minutes)	Comments	Microhabitat
BUS14		15	flying	
BUS18			hunting	
BUS12	30		flying overhead	
BUS12			flying toward dam	
BUS12			flew overhead	
BUS11	60		flying	
BUS11		30	flying	
BUS10		40	flying	
BUS11		50	soaring	
BUS14			flying	
BUS19	30		flying	
BUS10	30		hunting	
BUS11	10		flying	
BUS09		10	flying	
BUS34	70	120	flying	
BUS38	100	120	flying	
BUS11		250	flying overhead	
BUS15			flying	
BUS18	300		soaring	
BUS11	80		flying	
BUS11			circling	
BUS02			flying	
BUS02	80		soaring	
BUS02	30		circling	

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