Yathroo Wind Farm

Preliminary Bird and Bat Adaptive Management Plan

Final

December 2025

umwelt

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Prepared by
Umwelt (Australia) Pty Limited

On behalf of
Neoen Australia Pty Limited

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Report No.: 24360/R16
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Executive Summary

Neoen Australia Pty Ltd is proposing the development of the Yathroo Wind Farm (the Project), located approximately 5 km south of Dandaragan and 120 km north of Perth, Western Australia. The Project will comprise up to 65 wind turbines with a maximum generation capacity of 500 MW, supported by a 400 MW/3200 MWh Battery Energy Storage System (BESS) and associated infrastructure.

This preliminary Bird and Bat Adaptive Management Plan (BBAMP) outlines the framework for managing and mitigating potential impacts to bird and bat species during the operational phase of the Project. It forms part of the broader environmental management strategy and has been developed in accordance with the Commonwealth and State legislative requirements, including the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and *Environmental Protection Act 1986* (EP Act).

The key objectives of this BBAMP are to:

- Predict and mitigate potential impacts to conservation significant bird and bat species.
- Establish ecological thresholds and impact triggers to guide adaptive management.
- Implement a robust monitoring program to assess species utilisation and mortality.
- Develop responsive mitigation measures to reduce impacts such as turbine collision and barotrauma.

Ecological Context

The Project Area spans 15,618 ha and comprises 12 fauna habitat types, with cleared land and scattered trees dominating the landscape. Other key fauna habitats for conservation significant species include wetland habitat, Marri-Jarrah forest, Flooded Gum forest, and Banksia woodland. Key sensitive environmental receptors in proximity to the Project Area include Guraga Lake, Namming Nature Reserve, and Moore River National Park.

Species Assessment

Field surveys conducted between 2024 and 2025 recorded 127 bird species, including ten conservation significant bird species, and seven bat species. No conservation significant bat species were identified. A qualitative collision risk assessment was undertaken for 50 species and identified two conservation significant bird species (Blue-billed Duck [*Oxyura australis*] and Peregrine Falcon [*Falco peregrinus*]) as having a 'High' risk of turbine collision. An additional six conservation significant bird species were assessed as 'Moderate' risk.

Monitoring and Management

A comprehensive monitoring and management program will be implemented during operations, including:

- Seasonal bird and bat utilisation surveys.
- Monthly carcass searches across 50% of turbines.
- Carcass detectability and persistence trials.
- Adaptive management responses triggered by defined impact thresholds for black-cockatoos and threatened shorebirds.

- Impact trigger thresholds for migratory shorebirds, other conservation significant species and non-listed species.

These thresholds are designed to initiate adaptive management responses when mortality or injury events are detected. For example, the confirmation of a single carcass, featherspot, or injured individual of a black-cockatoo species will trigger a formal investigation and reporting process to the relevant regulatory authorities.

Mitigation measures outlined in the BBAMP include turbine design considerations to reduce collision risk, controls on vegetation clearance to protect habitat, and a carrion removal program to minimise attraction of raptors to turbine areas. These measures are supported by detailed reporting requirements to ensure transparency and accountability throughout the life of the project.

Abbreviations

Abbreviation	Definition
AGL	Above ground level
BBAMP	Bird and Bat Adaptive Management Plan
BBUS	Bird and Bat Utilisation Survey
BC Act	*Biodiversity Conservation Act 2016* (WA)
BESS	Battery Energy Storage System
CR	Critically Endangered
Cth	Commonwealth
DBCA	Department of Biodiversity Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EN	Endangered
EP Act	*Environmental Protection Act 1986* (WA)
IDF	Indicative Disturbance Footprint
MI	Migratory
MNES	Matters of National Environmental Significance
OS	Other Specially Protected
P1–P4	Priority 1 – Priority 4 listed species by DBCA
PMST	Protected Matters Search Tool
RSA	Rotor swept area
VU	Vulnerable
WA	Western Australia

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1.0 Introduction

This preliminary Bird and Bat Adaptive Management Plan (BBAMP) has been prepared to provide an overview of the management and mitigation of risks to bird and bat species known and potentially occurring within the Yathroo Wind Farm (the Project). This primarily relates to species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), Western Australia's *Biodiversity Conservation Act 2016* (BC Act), or Priority species listed by the Department of Biodiversity, Conservation and Attractions (DBCA) but also includes non-listed fauna species assessed as at 'High' or 'Moderate' risk of collision.

This BBAMP forms part of an overarching framework for environmental management for the Project comprising several management plans prepared for construction, operation and decommissioning of the Project and/or specific environmental aspects. This BBAMP is preliminary only and seeks to support the Project's referral under the EPBC Act and Part IV of the *Environmental Protection Act 1986* (WA) (EP Act).

This BBAMP has been informed by baseline Bird and Bat Utilisation Surveys (BBUS) (completed in spring 2024, summer 2025, autumn 2025 and winter 2025), bird and bat data collected as part of baseline ecology assessments in October, November and December 2024, and targeted black-cockatoo and migratory habitat assessments in June, July and October 2025.

1.1 Background

Neoen Australia Pty Ltd (Neoen) is proposing to develop the Project, comprising a wind farm and supporting infrastructure, approximately 5 km south of the town of Dandaragan and 120 km north of Perth, WA (**Figure 1.1**).

The Project will involve the construction and operation of up to 65 wind turbines with a maximum production capacity of up to 500 MW, a Battery Energy Storage System (BESS) with a capacity of 400 MW/3200 MWh, and associated infrastructure.

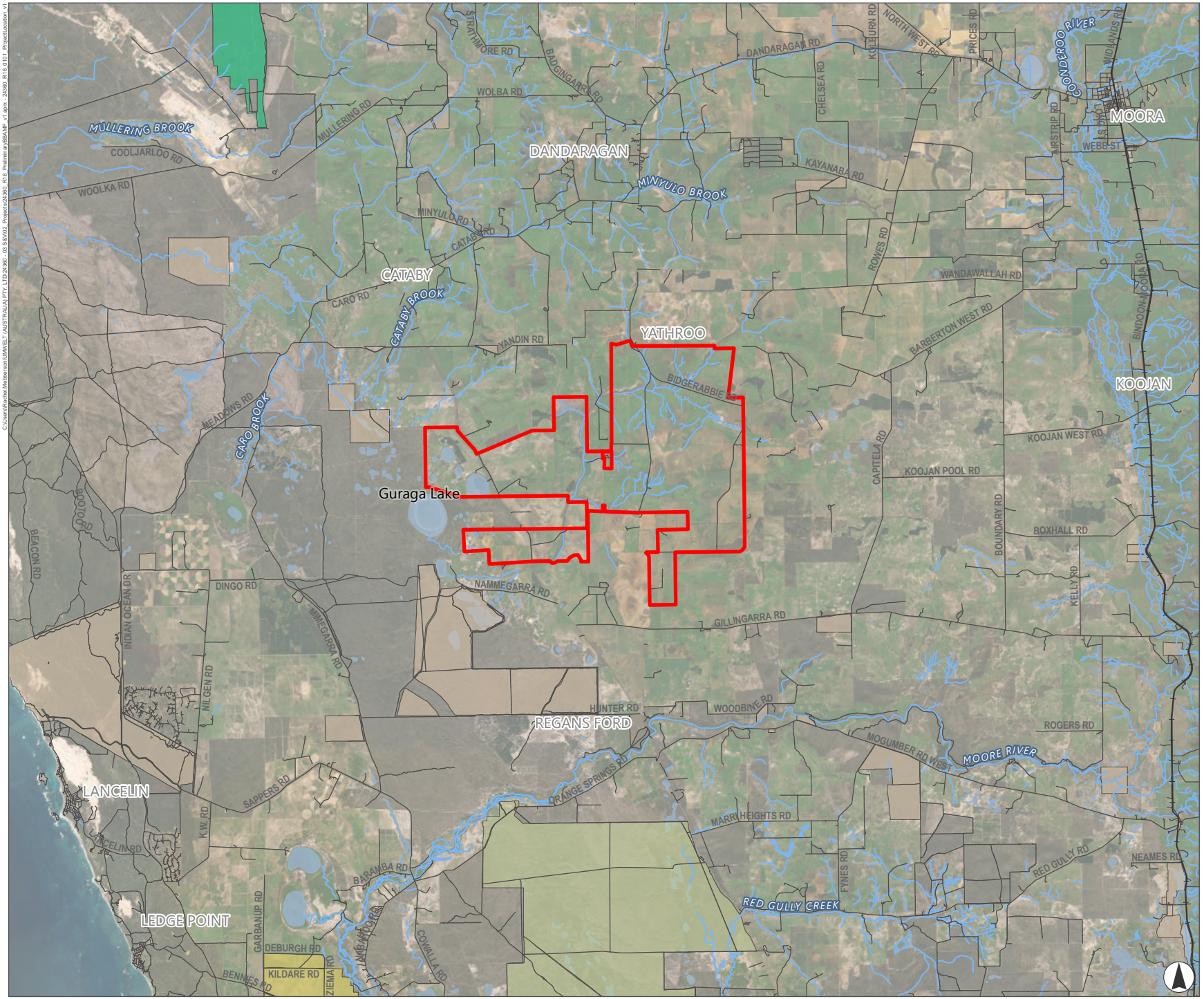


FIGURE 1.1

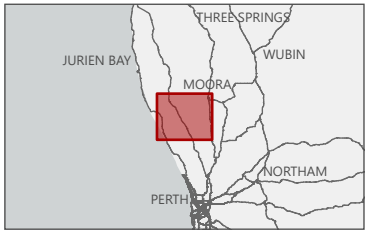
Project Location

Legend

- Project Area
- Railway
- Road
- Watercourse
- Waterbody

DBCA - Legislated Lands and Waters

- National Park
- Nature Reserve
- Conservation Park
- Section 5(1)(g) Reserve
- Section 5(1)(h) Reserve
- State Forest
- Directory of Nationally Important Wetlands



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Kilometres

Scale 1:320,000 at A4
GDA2020 MGA Zone 50

umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2024) Umwelt (2025)

1.2 Purpose and Objectives

The purpose of this preliminary BBAMP is to provide the Project with a framework regarding the adaptive management of potential impacts to birds and bats that are attributable to the operation of the Project. This preliminary BBAMP seeks to detail the mitigation and management procedures to be undertaken during operation of the Project, with a specific focus on reducing impacts to EPBC Act, BC Act, and DBCA Priority listed species.

The specific objectives of this BBAMP are to:

- Predict potential impacts to the site utilisation of EPBC Act, BC Act, and DBCA Priority listed bird and bat species and provide suitable mitigation measures.
- Provide impact trigger thresholds for EPBC Act, BC Act, and DBCA Priority listed bird and bat species based on best available ecological thresholds.
- Present the outcomes of the collision risk assessment, focussing on species which were deemed a 'High' or 'Very High' risk of collision.
- Present an overview of operational survey requirements, including further bird and bat site utilisation surveys as well as a carcass search program.
- Present the adaptive management framework to be initiated should an impact trigger be met.
- Outline the pathway for development of ongoing and preventative mitigation and management measures as well as reporting requirements.
- Continue to develop the understanding of the impacts to birds and bats associated with the construction and operation of the Project by assessing pre- and post-commissioning bird and bat data.
- Enable the success of a long-term approach to mitigating and managing potential impacts and potential changes to species' utilisation of the Project Area and its surrounds.

1.3 Statutory Framework

This preliminary BBAMP has been developed in accordance with the DCCEEW (DCCEEW, 2024b) Onshore Wind Farm Guidance and DCCEEW (DCCEEW, 2024a) Environmental Management Plan Guidelines. It is intended to support Project approvals under the EPBC Act and Part IV of the EP Act.

The legislative framework relevant to this preliminary BBAMP is summarised in **Table 1.1**.

Table 1.1 Relevant Legislation

Legislation	Agency	Summary	Project Relevance
Commonwealth			
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	Department of Climate Change, Energy, the Environment, and Water (DCCEEW)	The EPBC Act is Australia's key federal environmental legislation instrument. It outlines nine Matters of National Environmental Significance (MNES). Actions that adversely affect MNES may be deemed to be a controlled action under the EPBC Act.	The following MNES are relevant to the Project and this preliminary BBAMP: • Listed threatened species. • Listed migratory species. Additionally, the DCCEEW (2024a) draft Onshore Wind Farm Guidance was considered in the preparation of this preliminary BBAMP.
State (WA)			
Biodiversity Conservation Act 2016 (BC Act)	Department of Biodiversity, Conservation and Attractions (DBCA)	The BC Act provides statutory protection for species and ecological communities listed as threatened under the Act. The BC Act also provides other listings for species such as Conservation Dependent, Other Specially Protected and Migratory.	The following listed species are relevant to the Project and this preliminary BBAMP: • Listed threatened species. • Listed migratory species. • Listed Other Specially Protected species.
Environmental Protection Act 1986 (Part IV) (EP Act)	Environmental Protection Authority (EPA)	The EP Act serves as the principal State legislative framework for environmental management and protection in Western Australia. The EP Act also focuses on the conservation, preservation, protection, enhancement, and management of the environment. Proposed actions that may result in a significant impact to environmental factors defined by the State Environmental Protection Authority (EPA) must be referred to the EPA under Part IV of the EP Act and may require assessment before proceeding.	The following environmental factors are relevant to the Project and this preliminary BBAMP: • Terrestrial fauna.

1.4 Application of the Preliminary BBAMP

This preliminary BBAMP and the requirements outlined within will be applicable to all employees, contractors and visitors during the construction (inclusive of site preparation), operation and maintenance of the Project. Further information regarding the roles and responsibilities of key personnel are outlined in **Section 3.0**.

1.5 Environmental Outcomes

Specific environmental outcomes to be achieved through the implementation of this BBAMP and the associated components supporting each outcome, are provided in **Table 1.2**.

Table 1.2 Preliminary BBAMP Environmental Outcomes

Environmental Outcome	Section
Assess and improve understanding of potential site utilisation changes as a result of Project construction and operations	**Section 6.2**
Implement appropriate responses within an adaptive management framework to improve success of minimising potential impacts to bird and bat species where they occur	**Section 7.0**
Develop and implement mitigation and management measures to reduce the risk of turbine collision and barotrauma impacts on listed bird and bat species	**Section 8.0**

2.0 Project Overview

An overview of the Project elements and timing are provided in the following sections.

2.1 Project Description

The Project will comprise up to 65 wind turbines, a Battery Energy Storage System (BESS), operational and maintenance facility, permanent meteorological masts, communication towers, and all associated ancillary infrastructure. The turbine specifications used to inform this preliminary BBAMP are provided in **Table 2.1**.

Table 2.1 Wind Turbine Specifications

Feature	Specification
Maximum Hub Height	170 m AGL
Minimum Hub Height	150 m AGL
Rotor Diameter	182 m
Blade Length	91 m
Maximum Tip Height	261 m AGL
Minimum Tip Height	59 m AGL
Rotor Swept Area	26,015.53 m^2

2.2 Project Boundaries

There are two distinct boundaries referred to throughout this preliminary BBAMP which are illustrated on **Figure 2.1**. These boundaries are:

- The **Project Area** which refers to the boundaries of all involved land parcels where consent has been granted for construction and operation of the Project and comprises15,618 ha.
- The **Indicative Project Footprint (IDF)** which refers to the maximum area of land that will be cleared for installation of all Project infrastructure. It is based on the largest possible conceptual layout and comprises 730 ha.

2.3 Project Timing

Project construction will commence following the receipt of all necessary approvals which is anticipated in 2026. Construction activities are expected to take approximately 33 months, with commissioning of the Project expected to commence in 2029.

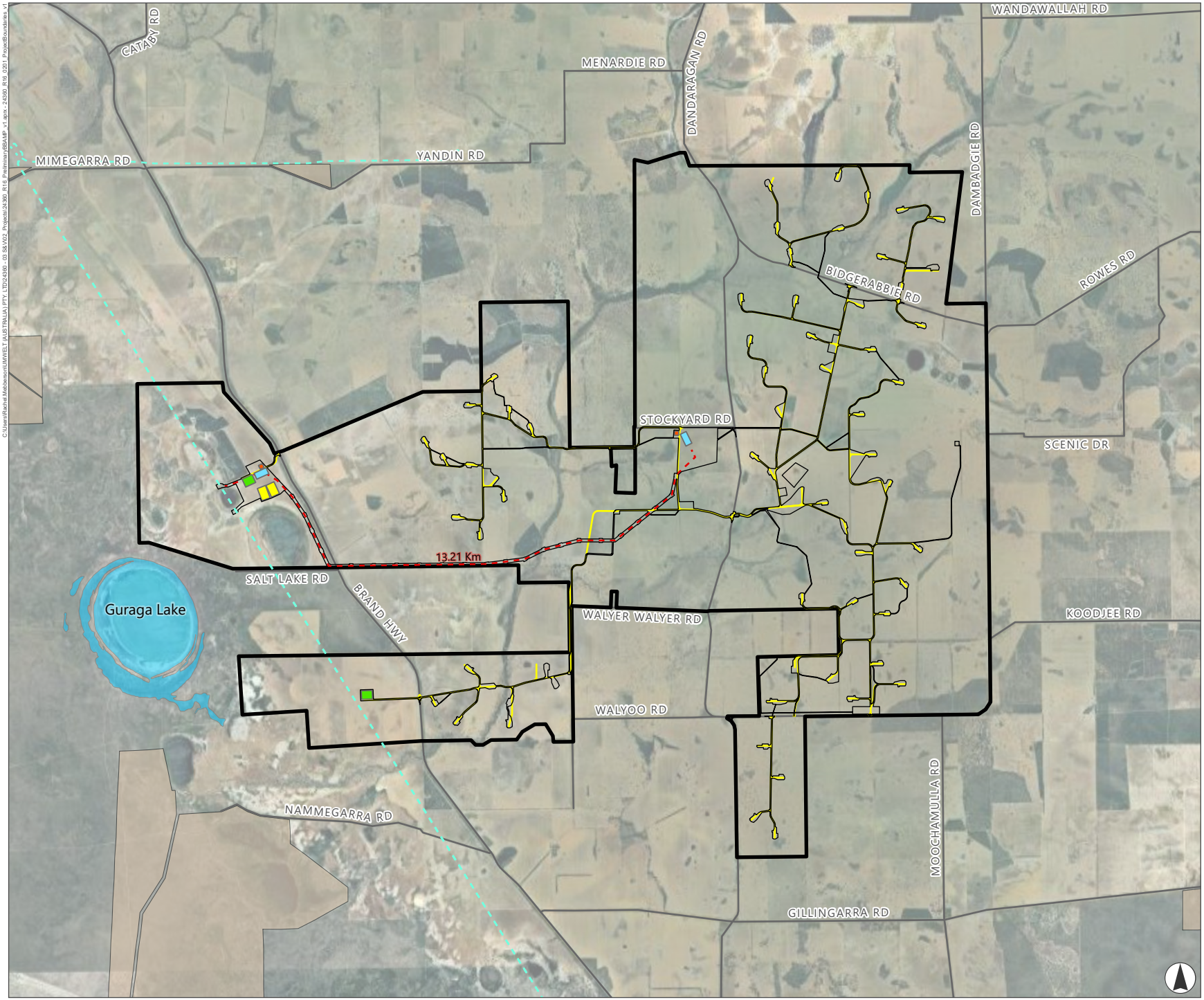


FIGURE 2.1

Project Boundaries

Legend

- Existing 132/330kv Transmission Line
- Disturbance Footprint
- BESS
- O&M Facility
- Substation
- Western Power Terminal
- Proposed 330kV transmission route - 13.21km
- Internal Roads and Underground Cabling (Permanent)
- Project Area
- Road
- Directory of Nationally Important Wetlands
- Nature Reserve

0 2 4

Kilometres

Scale 1:120,000 at A4
GDA2020 MGA Zone 50

umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2024) Umwelt (2025)

3.0 Roles and Responsibilities

The roles and responsibilities associated with implementation of this BBAMP are outlined in **Table 3.1**.

Table 3.1 Roles and Responsibilities

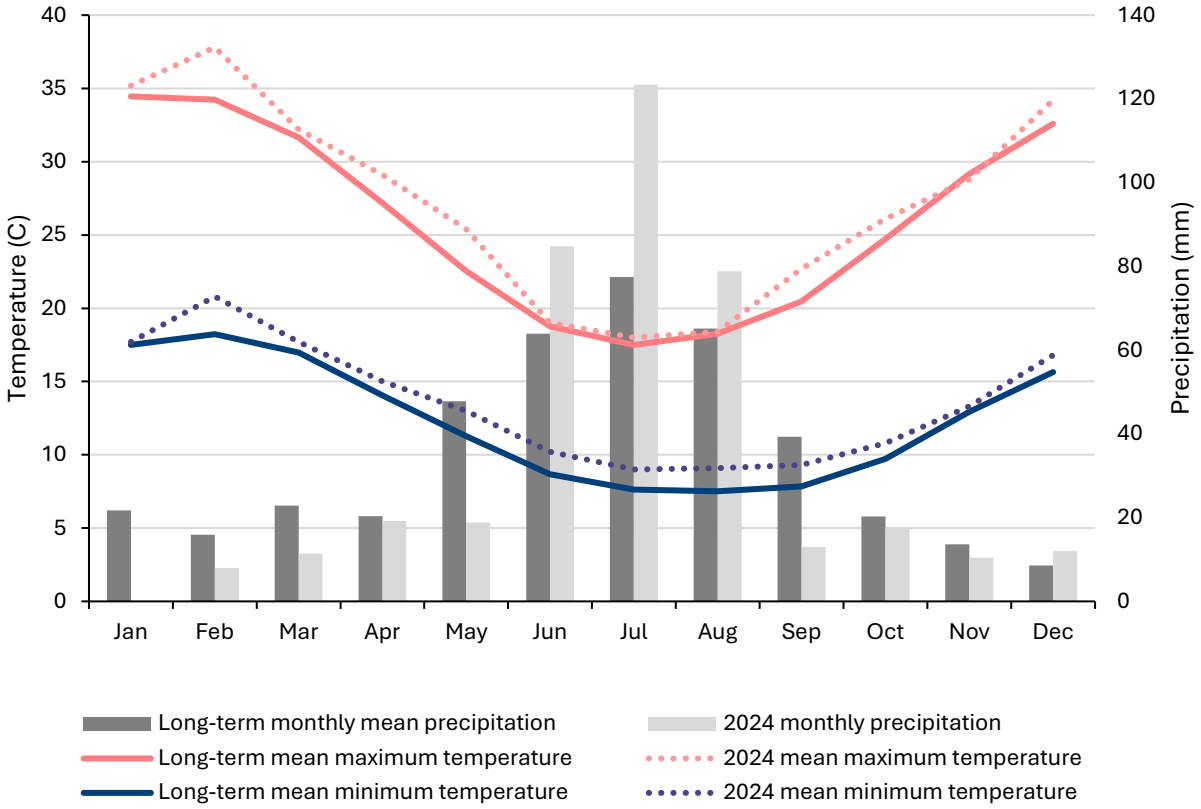
Role	Responsibility
The Approval Holder (Project owner and operator)	Implementation of the BBAMP and associated decision making.
Site Manager	The Site Manager is responsible to report any incidents or threatened species finds. Reporting of incidents, including incidental finds of threatened birds and bats carcasses, featherspots or injured individuals found by operational staff or landholders to the Site Environmental Advisor.
Site Environmental Advisor	All correspondence with DCCEEW and/or State regulator. This may include notification of incidents, identification of threatened species and BBAMP associated reporting. Appointing suitably qualified ecologists to implement the technical aspects of this BBAMP, coordination and oversight of the Supervising Ecologist. Audit and periodic review of the effectiveness of BBAMP and any corrective actions.
Supervising Ecologist	Implementation of the Adaptive Management Monitoring Program (**Section 6.0**), management of suitably qualified ecologists, training of site personnel, data analysis and reporting (**Section 9.0**).
All site personnel	Reporting of carcass, featherspot, or injured individuals found to the Site Environmental Advisor.

4.0 Receiving Environment

4.1 Site Characteristics

The Project Area is bisected by the boundary of two Interim Biogeographic Regionalisation of Australia (IBRA) bioregions; Geraldton Sandplains (GES) and Swan Coastal Plains (SWA). The Swan Coastal Plain and Geraldton Sandplains bioregions are characterised by a Mediterranean climate with hot, dry summers and cool, wet winters. The closest meteorological stations with long-term climate data are Badgingarra Station (Station No. 9037) approximately 70 km northwest of the Project Area and Barberton Station (Station No. 8005) approximately 30 km northeast of the Project Area (BOM, 2025). The long-term average temperatures from Badgingarra Station and long-term rainfall from Barbeton Station are presented on **Graph 4.1**. Long-term averages utilise a 30-year period (1994–2024).

Based on long-term climate data from 1994 – 2024, the region experiences its warmest months during December to February with maximum monthly averages ranging 32.6 to 34.5 °C. The coldest months are from June to September with minimum monthly averages ranging 7.5 to 8.7 °C. Temperatures in 2024 were largely typical for the region although higher monthly maximum and minimum temperatures were observed from December to February. Rainfall in the region peaks from June to August with the highest average precipitation in July (77.45 mm), however can vary significantly from year to year. Rainfall was higher in July of 2024 (123.4 mm) compared to the long-term average; however, the total annual rainfall (397.4 mm) in 2024 was slightly lower than long-term average of 420.75 mm.



Graph 4.1 Climatic Data for the Project Area Region (BOM, 2025)

The Project does not intersect any areas protected for the purposes of conservation. Key sensitive environmental receptors in proximity to the Project Area are illustrated on **Figure 1.1** and include:

- Guraga Lake which is listed as a Nationally Important Wetland and is located adjacent to the Project Area (DCCEEW, 2005). Guraga Lake is recognised as a major moulting area for Australian Shelduck (*Tadorna tadornoides*) and a breeding area for three species of waterbird/shorebird: Australian Shelduck, Grey Teal (*Anas gracilis*) and Red-capped Plover (*Charadrius ruficapillus*). The lake is also a major drought refuge area for waterbirds and considered an internationally important stop-over area for 15 waterbird species with large populations utilising the area (DEC, 2008).
- Namming Nature Reserve is protected for the purposes of flora and fauna conservation and is managed by DBCA – located approximately 2 km southwest of the Project Area.
- Moore River National Park – located approximately 10 km south of the Project Area.
- Bundarra, Eneminga, Jam Hill, Moochamulla and Quinns Hill Nature Reserves – all located within 10 km of the Project Area.
- Badgingarra National Park – located approximately 29 km northwest of the Project Area.

Twelve (12) fauna habitat types were identified within the Project Area (Umwelt, 2025a). The largest habitat type is the Cleared habitat (11,014 ha, 70.5%), mainly consisting of paddocks and areas of infrastructure. The second largest habitat type is Scattered Trees (2,282 ha, 14.6%). Key habitats for use by conservation significant fauna are:

- Wetlands and Waterbodies (2.6% and 0.6%, respectively) which provides important breeding, roosting, and foraging habitat for waterbirds and shorebirds (when present).
- Marri-Jarrah Forest (0.7%) which provides important breeding, roosting, and foraging habitat for black-cockatoo species, and breeding habitat or perching opportunities for the Peregrine Falcon (*Falco peregrinus*) in tall trees.
- Flooded Gum Forest (2.3%) which provides important breeding and roosting habitat for black-cockatoo species, and breeding habitat or perching opportunities for the Peregrine Falcon in tall trees.
- Banksia Woodland (1.1%) which provides important foraging habitat for black-cockatoo species.

4.2 Species Characteristics

A summary of bird and bat species characterisation within the Project Area is provided in the following sections.

4.2.1 Desktop Assessment

Desktop assessments were undertaken to predict the potential for Commonwealth and State listed (i.e. conservation significant) bird and bat species to utilise the Project Area and surrounds (Umwelt, 2025a, 2025b, 2025c). Desktop assessments also aimed to review the potential occurrence of all other known bird and bat species within the Project Area.

Desktop assessments used a 20 km buffer around the Project Area to identify previous records of species' occurrence (hereafter referred to as the 'Desktop Study Area'). The desktop assessments were also informed by both species characteristics (behaviour, seasonal occurrence, habitat utilisation, and flight paths and patterns) and site characteristics (habitat features and vegetation, geology and land systems, climatic conditions, wetlands and drainage areas, and conservation areas) to identify those species that are likely to occur. The following data sources were used:

- DCCEEW Protected Matters Search Tool.
- DBCA Threatened and Priority Fauna Database.
- Birdlife Australia Birdata Database.
- DBCA Dandjoo/NatureMap Database.
- Atlas of Living Australia Database.
- DWER IBSA database.

The results of the desktop assessment are summarised below.

Anticipated Bird Assemblage

A total of 192 bird species were identified within the Desktop Study Area based on database searches (Umwelt, 2025c). Of these species, 29 are considered conservation significant.

The most speciose avian families detected from database searches were Meliphagidae (honeyeaters – 14), Anatidae (ducks, geese, and swans – 13), Scolopacidae (snipe, sandpipers, godwits, curlew, stints and phalaropes – 13), and Accipitridae (hawks, eagles, and kites – 12).

Five (5) species were excluded from this total and from further consideration based on their ranges being outside of Western Australia, and in some cases outside of Australia. These records were therefore considered erroneous but first reviewed to ensure they had not undergone taxonomic change that was not reflected in the database search results.

Anticipated Bat Species Assemblage

A total of seven bat species were identified within the Desktop Study Area based on database searches (Umwelt, 2025c). This included two species in the family Molossidae (free-tailed bats) and five species in the family Vespertilionidae (evening bats).

One conservation significant species (Ghost Bat [*Macroderma gigas*]) has been excluded from this total and from further consideration. Records of this species identified by the desktop assessment are vouchered specimens recorded in 2007 by the Western Australian Museum. The Desktop Study Area is outside of the Ghost Bat's known range, and these records have likely been projected in error.

No other conservation significant bat species were identified from the desktop assessment.

4.2.2 Site Specific Assessment

The results of the desktop assessments were validated through a series of comprehensive site-specific field surveys, particularly the BBUS, conducted between 2024 and 2025. Suitably qualified ecologists with expertise in birds and/or bats completed each of the BBUS events**.** Other surveys undertaken to date include terrestrial vertebrate fauna assessments and targeted fauna habitat surveys (hereafter referred to as the 'field survey program'). A summary of the survey effort across the field survey program is illustrated on **Figure 4.1.**

Additionally, Neoen have commissioned targeted shorebird surveys which are currently being undertaken from September 2025 to March 2026. These additional surveys are not considered further in this current BBAMP, but their results will be incorporated into future iterations when available or as necessary.

The timing of surveys undertaken to date is presented in **Table 4.1.** In accordance with DCCEEW (2024b), BBUS were conducted across all seasons to provide sufficient baseline data on the utilisation of the Project Area and its surrounds by relevant species. BBUS were specifically timed to capture seasonal variation of species' presence within the Project Area, while also coinciding with the seasonal migration of conservation significant birds identified from desktop assessments, such as the Blue-billed Duck (*Oxyura australis*), Carnaby's Black-cockatoo (*Zanda latirostris*), and threatened and migratory shorebird species.

The BBUS program totalled 22 days of survey effort across four survey events. Methods employed during BBUS for birds included fixed-point counts, survey transects, targeted habitat assessments, and opportunistic observations. The method employed for bats included passive ultrasonic recorders deployed at approximately 2 m above ground level (AGL) to record presence/absence.

Table 4.1 Site Specific Surveys

Survey	Consultant	Description	Timing
Terrestrial Fauna Assessment	Umwelt	Basic Vertebrate Fauna Assessment	2 – 3 July 2024
BBUS Trip 1	Umwelt	Spring BBUS	9 - 15 September 2024
Terrestrial Fauna Assessment	Umwelt	Basic and Targeted Vertebrate Fauna Assessment	29 October - 5 November 2024
Terrestrial Fauna Assessment	Umwelt	Basic and Targeted Vertebrate Fauna Assessment	10 December 2024
BBUS Trip 2	Umwelt	Summer BBUS	13 -17 February 2025
BBUS Trip 3	Umwelt	Autumn BBUS	4 - 8 May 2025
Targeted Fauna Habitat Assessment	Umwelt	Conservation Significant Fauna Habitat Assessment	23 - 27 June 2025
Targeted Fauna Habitat Assessment	Umwelt	Conservation Significant Fauna Habitat Assessment	21 July 2025
BBUS Trip 4	Umwelt	Winter BBUS	21 - 25 July 2025
Targeted Fauna Survey	Umwelt	Targeted shorebird survey	23 September 2025
Targeted Fauna Habitat Assessment	Umwelt	Conservation Significant Fauna Habitat Assessment	13 -17 October 2025
Targeted Fauna Survey	Umwelt	Targeted shorebird survey	17 October 2025
Targeted Fauna Survey	Umwelt	Targeted shorebird survey	2 December 2025

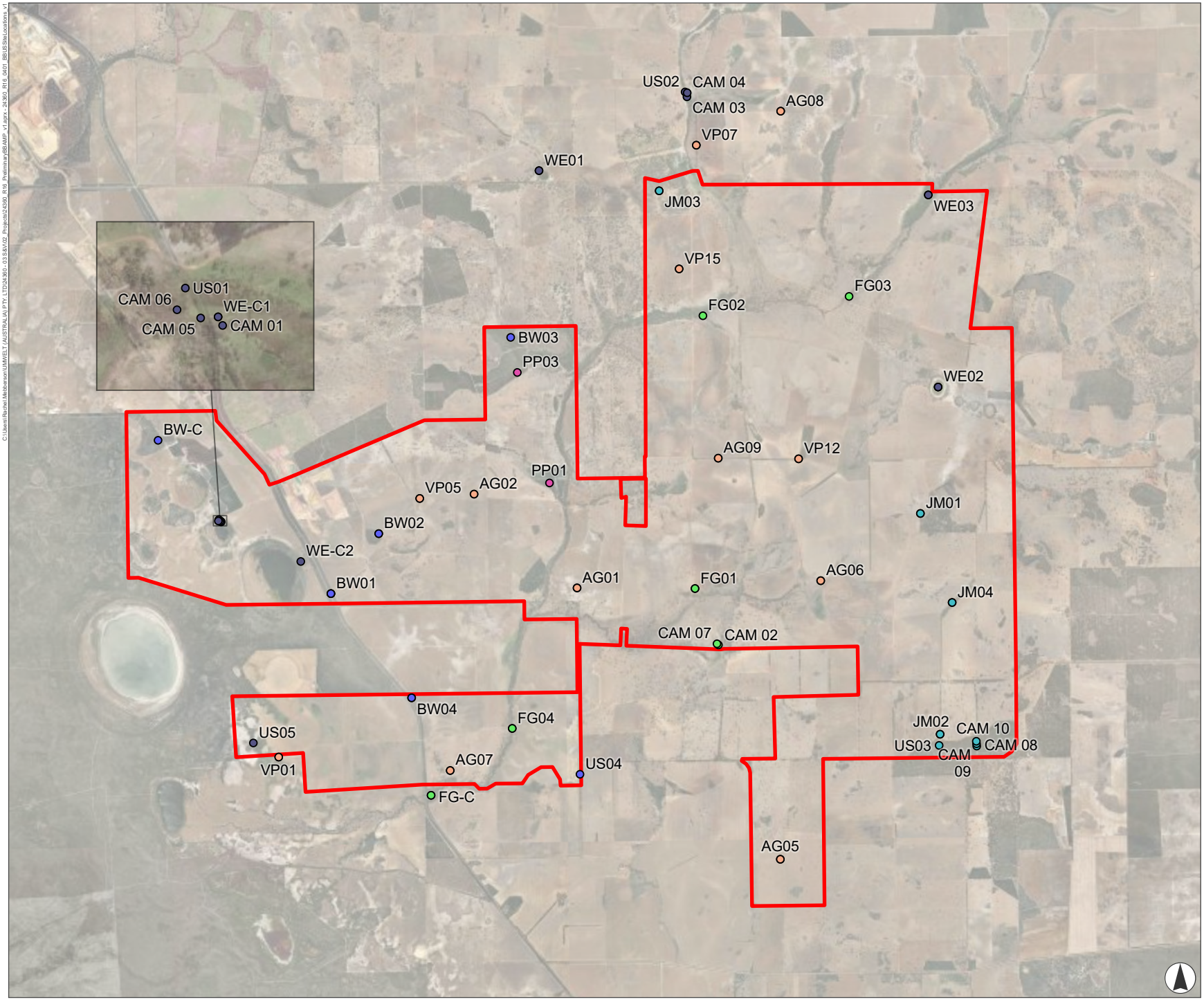


FIGURE 4.1

Bird and Bat Survey Site Locations

Legend

- Project Area

Bird and Bat Utilisation Survey Locations

- Agriculture
- Banksia Woodland
- Flooded Gum Floodplain
- Jarrah Marri Forest
- Pine Plantation
- Wetland

0 2 4

Kilometres

Scale 1:115,000 at A4
GDA2020 MGA Zone 50

umwelt

Image Source: ESRI Basemap (2025) | **Data Source:** NSW DFSI (2025)

4.3 Field Survey Results

4.3.1 Birds

4.3.1.1 Species Assemblage

A total of 127 bird species were recording during the field survey program, with ten of these being conservation significant.

4.3.1.2 Observed Bird Utilisation

General Observations

The most speciose families recorded were Anatidae (ducks, geese, and swans – 11), Meliphagidae (honeyeaters – 11), and Accipitridae (hawks, eagles, and kites – 8). Species recorded across all surveys were predominantly parrots and allies, woodland/scrubland birds, aerial feeders, and diurnal raptors and presented in **Table 4.2**.

Table 4.2 Generalised Bird Groups Recorded During Field Surveys

Groups	Example Species in Group
Aerial feeders	Tree Martin, Fairy Martin, Welcome Swallow, Black-faced Woodswallow, Masked Woodswallow
Diurnal raptors	Nankeen Kestrel, Peregrine Falcon, Wedge-tailed Eagle, Whistling Kite, Swamp Harrier
Nocturnal	Boobook Owl
Parrots and allies	Galah, Australian Ringneck, Carnaby's Black-cockatoo, Forest Red-tailed Black-cockatoo, Western Corella
Wetland birds	Blue-billed Duck, Grey Teal, Pacific Black-duck, White-necked Heron, Red-capped Plover, Sharp-tailed Sandpiper, Black-fronted Dotterel
Woodland/Scrubland birds (large)	Australian Magpie, Australian Raven, Crested Pigeon, Black-faced Cuckooshrike
Woodland/Scrubland birds (small)	Yellow-rumped Thornbill, Willie Wagtail, Magpie-lark, Purple-backed Fairywren, White-fronted Chat, Singing Honeyeater, Yellow-throated Miner

Species Abundance

The most commonly observed species during the BBUS program are presented in **Table 4.3**. A complete list of all bird species recorded is presented in Umwelt (2025c). It should be noted that records represent each observation of a species and does not represent the number of individuals present.

Table 4.3 Top 10 Species Ranked by the Total Number Observations

Common Name	Taxon	Spring Records	Summer Records	Autumn Records	Winter Records	Total
Australian Ringneck	*Barnardius zonarius*	78	80	114	143	415
Galah	*Eolophus roseicapilla*	103	44	59	84	290
Australian Raven	*Corvus coronoides*	70	49	93	58	270
Australian Magpie	*Gymnorhina tibicen*	44	27	60	55	186
Grey Fantail	Rhipidura *albiscapa*	2	22	77	60	161
Western Gerygone	*Gerygone fusca*	25	22	48	34	129
Western Corella	*Cacatua pastinator*	18	19	46	35	118
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	7	35	38	31	111
Tree Martin	*Petrochelidon nigricans*	4	41	34	32	111
Rufous Whistler	*Pachycephala rufiventris*	20	12	42	19	93

4.3.1.3 Conservation Significant Bird Species

Of the 127 species recorded during the field survey program, 10 are conservation significant species. An additional six conservation significant species were not recorded during the field survey program but were identified as having a 'Moderate' or 'High' likelihood of occurrence within the Project Area due to the availability of potential habitat and desktop records. Known or potentially occurring ('Moderate' or 'High' likelihood of occurrence) conservation significant species are presented in **Table 4.4**. Species with a 'Known' likelihood of occurrence are described further in the subsections below and their locations illustrated on **Figure 4.2**.

Table 4.4 Likelihood of Occurrence – Conservation Significant Species

Common Name	Scientific Name	WA Status	Cth Status
Known			
Black-tailed Godwit	*Limosa limosa*	MI	EN & MI
Blue-billed Duck	*Oxyura australis*	P4	-
Carnaby's Black-cockatoo	*Zanda latirostris*	EN	EN
Common Greenshank	*Tringa nebularia*	MI	EN & MI
Forest Red-tailed Black-cockatoo	*Calyptorhynchus banksii naso*	VU	VU
Peregrine Falcon	*Falco peregrinus*	OS	-
Red-necked Stint	*Calidris ruficollis*	MI	MI
Ruff	*Calidris pugnax*	MI	MI
Sharp-tailed Sandpiper	*Calidris acuminata*	MI	VU & MI
Wood Sandpiper	*Tringa glareola*	MI	MI
High			
Common Sandpiper	*Actitis hypoleucos*	MI	MI
Curlew Sandpiper	*Calidris ferruginea*	CR	CR & MI

Common Name	Scientific Name	WA Status	Cth Status
Glossy Ibis	*Plegadis falcinellus*	MI	MI
Pacific Golden Plover	*Pluvialis fulva*	MI	MI
Moderate			
Long-toed Stint	*Calidris subminuta*	MI	MI
Fork-tailed Swift	*Apus pacificus*	MI	MI

Note. MI=Migratory, EN=Endangered, P1–P4=Priority 1–4, VU= Vulnerable, OS=Other Specially Protected, CR=Critically Endangered.

Blue-billed Duck

The Blue-billed Duck is found on terrestrial wetlands in temperate regions that are freshwater to saline with extensive bordering vegetation, such as reedbeds or other dense vegetation, and waterbodies may be natural or artificial (Carboneras & Kirwan, 2020). It nests in rushes, sedges, Lignum (*Muehlenbeckia cunninghamii*) and paperbark Melaleuca (BirdLife Australia, 2023).

The Blue-billed Duck has been recorded within the Project Area and is likely to use wetland habitats within the Project Area during both the breeding and non-breeding season. The Blue-billed Duck is ranked as a Priority 2 (poorly-known species) taxon by DBCA (but is not presently listed under the EPBC Act and/or BC Act).

Carnaby's Black-cockatoo

The Carnaby's Black-cockatoo occurs in uncleared or remnant native eucalypt woodlands, especially those that contain salmon gum and wandoo, and in shrubland or Kwongan heathland dominated by hakea, dryandra, banksia and grevillea species. It also occurs in remnant patches of native vegetation on land otherwise cleared for agriculture (Saunders 1974, 1986). The species primarily forages in forests containing Marri (*Corymbia calophylla*), Jarrah (*Eucalyptus marginata*) or Karri (*E. diversicolor*) (Nichols & Nichols 1984; Saunders 1980) but also on a range of native and non-native plants, including pine plantations (Saunders 1974; Sedgwick 1968, 1973).

The Carnaby's Black-cockatoo has been recorded during every BBUS event undertaken to date as well as during terrestrial fauna surveys and targeted fauna habitat assessments. The species may use eucalypt woodland, banksia woodland, and pine plantation habitats for foraging and roost in tall trees near water sources. The species may also use mature Marri and Flooded Gum trees scattered in paddocks or in remnant vegetation (Marri-Jarrah Forest and Flooded Gum Forest habitats) for nesting.

Forest Red-tailed Black-cockatoo

The Forest Red-tailed Black-cockatoo (*Calyptorhynchus banksii naso*) prefers dense Jarrah, Karri and Marri forests.

An unidentified red-tailed black cockatoo subspecies was recorded during the Winter BBUS and also during the targeted fauna habitat assessment undertaken in June 2025 (Umwelt, 2025b). The Survey Area falls within the interzone of the ranges of two subspecies (Forest Red-tailed Black-cockatoo [*C. banksii naso*] and Western Red-tailed Black-cockatoo [*C. banksii escondidus*]). After a review of call recordings and secondary evidence (foraging material), these observations have been determined to most likely be the conservation significant subspecies listed as Vulnerable under the EPBC Act and BC Act, the Forest Red-tailed Black-cockatoo.

The species may use eucalypt woodland and banksia woodland habitats for foraging and may roost in tall trees near water sources when present.

Peregrine Falcon

The Peregrine Falcon (*Falco peregrinus*) has a cosmopolitan distribution worldwide and is uncommon but wide-ranging across Australia. Here, the species occurs in a diverse range of habitats such as rainforest to arid scrub, from coastal heath to alpine. Habitat often consists of cliffs, gorges, timbered watercourses, riverine, wetland plains, open woodlands, pylons, spires and buildings (Morcombe, 2004; Pizzey & Knight, 2012).

The Peregrine Falcon has been recorded during every BBUS event undertaken to date. The species may use all habitats within the Study Area for foraging and dispersal and may breed or perch in areas with tall trees.

Migratory Shorebirds

All migratory shorebird species recorded within the Project Area are non-breeding visitors to Australia and include the Black-tailed Godwit (*Limosa limosa*), Common Greenshank (*Tringa nebularia*), Red-necked Stint (*Calidris ruficollis*), Ruff (*Calidris pugnax*), Sharp-tailed Sandpiper (*Calidris acuminata*), and Wood Sandpiper (*Tringa glareola*). These species utilise a variety of wetland and other habitats within their non-breeding range for foraging, roosting and dispersal.

All species were recorded on a single occasion during the Summer BBUS event except for the Wood Sandpiper which was recorded during the terrestrial fauna assessment in October 2024 (Umwelt, 2025a). These species may use wetland habitats within the Project Area for foraging and roosting and may also use all remaining habitats for dispersal.

FIGURE 4.2

Conservation Significant Species' Locations

Legend

Project Area

Conservation Significant Species' Records

- Black-tailed Godwit (*Limosa limosa*)
- Blue-billed Duck (*Oxyura australis*)
- Carnaby's Black-Cockatoo (*Zanda latirostris*)
- Common Greenshank (*Tringa nebularia*)
- Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*)
- Peregrine Falcon (*Falco peregrinus*)
- Red-necked Stint (*Calidris ruficollis*)
- Ruff (*Calidris pugnax*)
- Sharp-tailed Sandpiper (*Calidris acuminata*)
- Wood Sandpiper (*Tringa glareola*)

Scale 1:110,000 at A4
GDA2020 MGA Zone 50

4.3.1.4 At-Risk Bird Species

A total of 23 non-conservation significant bird species were observed flying within the RSA, placing them at risk of turbine collision. These species, along with their maximum observed flight heights, are detailed in **Table 4.5**. The full bird and bat collision risk assessment is detailed in **Appendix A** and summarised in **Section 5.0**.

Table 4.5 Species Observed Flying at RSA Height

Scientific Name	Common Name	Maximum Flight Height (m AGL)
Straw-necked Ibis	*Threskiornis spinicollis*	400
Wedge-tailed Eagle	*Aquila audax*	300
Nankeen Kestrel	*Falco cenchroides*	202
Yellow-billed Spoonbill	*Platalea flavipes*	200
Whistling Kite	*Haliastur sphenurus*	180
Tree Martin	*Petrochelidon nigricans*	150
Welcome Swallow	*Hirundo neoxena*	150
Australian Raven	*Corvus coronoides*	120
Black-shouldered Kite	*Elanus axillaris*	100
Brown Falcon	*Falco berigora*	100
Little Eagle	*Hieraaetus morphnoides*	100
Little Pied Cormorant	*Microcarbo melanoleucos*	100
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	100
Australian Magpie	*Gymnorhina tibicen*	90
Little Black Cormorant	*Phalacrocorax sulcirostris*	80
Australian Pelican	*Pelecanus conspicillatus*	70
Australian Shelduck	*Tadorna tadornoides*	70
Dusky Woodswallow	*Artamus cyanopterus*	70
Australian Wood Duck	*Chenonetta jubata*	60
Galah	*Eolophus roseicapilla*	60
Swamp Harrier	*Circus approximans*	60
Western Corella	*Cacatua pastinator*	60
White-faced Heron	*Egretta novaehollandiae*	60

4.3.2 Bats

4.3.2.1 Species Assemblage

A total of seven (7) bat species were detected during the 2024 Spring and 2025 Summer BBUS. Three (3) call groups were unable to be resolved but represent potential species that have been confirmed. Bat call data from the remaining 2 BBUS have not yet been analysed. Bat species detected within the Survey Area are presented in **Table 4.6**.

Table 4.6 Bat Call Detections

Common Name	Scientific Name	Spring	Summer	Total
Gould's Wattled Bat	*Chalinolobus gouldii*	488	1,993	**2,481**
Chocolate Wattled Bat	*Chalinolobus morio*	5	19	**24**
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	25	67	**92**
Inland Broad-nosed Bat	*Scotorepens balstoni*	2	5	**7**
Southern Forest Bat	*Vespadelus regulus*	1,587	1,852	**3,439**
White-striped Free-tailed Bat	*Austronomus australis*	162	226	**388**
Western Free-tailed Bat	*Ozimops kitcheneri*	20	65	**85**
Unresolved Calls				
-	*C. gouldii* or *O. kitcheneri*	214	1,109	**1,323**
-	*V. regulus* or *Nyctophilus sp.*	27	26	**53**
-	*V. regulus* or *C. morio*	15	-	**15**

4.3.2.2 Anticipated Bat Utilisation

Although suitable for detection, the method of species identification via passive ultrasonic recordings at 2 m AGL is unsuitable for determining detailed species' flight behaviours. As such, the Project will employ precautionary principles to anticipate the extent of bat utilisation within the Project Area.

Species of bat including the White-striped Free-tailed Bat (*Austronomus australis*), Gould's Wattled Bat (*Chalinolobus* gouldii), and Western Free-tailed Bat (*Ozimops kitcheneri*) forage aerially above the canopy and as such are highly susceptible to injury or mortality as a result of turbines.

Given the large scale clearing in the broader region, suitable roosting and foraging habitat for microbats would be largely restricted to remnant vegetation and anthropogenic structures (e.g. shed or dwelling rooves). Some species of microbats in this area may roost in colonies, while some may roost in solitary.

4.3.2.3 Conservation Significant Bat Species

No conservation significant bat species (i.e. listed under the EPBC Act, BC Act, or as Priority species by DBCA) were recorded during the field survey program.

5.0 Bird and Bat Risk Assessment

A qualitative collision risk assessment was undertaken as part of the Project's broader bird and bat utilisation assessment and included the use of six criteria relating to collision likelihood and consequence (**Appendix A**). These criteria were either adopted or unchanged from a commonly referenced study that aimed to develop a science-based approach to aid decision-making regarding turbine collision risk for birds and bats in Victoria (Lumsden et al., 2019). Hence, the risk assessment evaluates the likelihood and consequence of blade strike by considering:

1. Published and observed data relating to species flight height
2. Frequency of species occurrence within the Project Area
3. Geographic population concentration
4. Demographic resilience
5. Population size and
6. Listed conservation status.

Any bird or bat species that met at least one of the following criteria were considered in the risk assessment:

- Bird and bat species listed under the EPBC Act, BC Act, or as Priority species by DBCA and were either:
    - recorded within the Project Area during the field survey program; or
    - deemed to have a 'Moderate' or 'High' likelihood of occurrence within the Project Area.
- Bird species recorded flying at RSA height during the field survey program or considered to have the potential to occur at RSA and recorded during field surveys (i.e. non-threatened raptor species).
- Bat species recorded within the Project Area or deemed to have a 'Moderate' or 'High' likelihood of occurrence and the potential to occur at RSA height.

The objective of the risk assessment was to assess the pre-mitigation collision risk for bird and bat species that are present or that may occur in the vicinity of the Project Area based on occurrence and flight data gathered from completed surveys and published literature. This assisted in identifying what species may require further consideration for impact assessment, mitigation and collision risk modelling.

The detailed risk assessment and an explanation of the criteria used to ascertain each relevant species likelihood and consequence of risk is documented in the collision risk assessment, provided in **Appendix A.**

Data collected during the bird and bat monitoring program (**Section 6.3**) may continue to be incorporated into the bird and bat risk assessment as necessary. Therefore, as additional field and desktop data becomes available throughout operation of the Project, the results of each assessment criteria may change, potentially affecting the outcome of the species overall risk rating.

5.1 Summary of Findings

The risk assessment considered 53 species, including species listed under the EPBC Act and/or BC Act, as well as non-threatened bird and bat species which are considered susceptible to turbine strike (i.e. observed to fly at RSA height).

A summary of the risk assessment results for all conservation significant species is provided in **Table 5.1** and the full risk assessment is presented in **Appendix A.**

Two (2) conservation significant bird species (Blue-billed Duck [*Oxyura australis*] and Peregrine Falcon [*Falco peregrinus*]) were considered to have a 'High' overall collision risk rating. A 'Moderate' overall collision risk rating was assigned to six conservation significant species, and the remaining eight species received a 'Minor' overall collision risk rating.

Table 5.1 Conservation Significant Species Risk Assessment Results

Common Name	Scientific Name	Cth Status	WA Status	Likelihood of Collision	Consequence of Collision	Overall Risk Rating
Blue-billed Duck	*Oxyura australis*	P4	-	Likely	Moderate	**High**
Peregrine Falcon	*Falco peregrinus*	OS	-	Likely	Moderate	**High**
Carnaby's Cockatoo	*Zanda latirostris*	EN	EN	Unlikely	High	**Moderate**
Forest Red-tailed Black Cockatoo	*Calyptorhynchus banksii naso*	VU	VU	Unlikely	Moderate	**Minor**
Fork tailed Swift	*Apus pacificus*	MI	MI	Likely	Low	**Moderate**
Glossy Ibis	*Plegadis falcinellus*	MI	MI	Possible	Low	**Minor**
Migratory Shorebirds						
Common Greenshank	*Tringa nebularia*	EN & MI	MI	Possible	Moderate	**Moderate**
Sharp-tailed Sandpiper	*Calidris acuminata*	VU & MI	MI	Possible	Moderate	**Moderate**
Black-tailed Godwit	*Limosa limosa*	EN & MI	MI	Possible	Moderate	**Moderate**
Curlew Sandpiper	*Calidris ferruginea*	CR & MI	CR	Possible	Moderate	**Moderate**
Red-necked Stint	*Calidris ruficollis*	MI	MI	Possible	Low	**Minor**
Wood Sandpiper	*Tringa glareola*	MI	MI	Possible	Low	**Minor**
Common Sandpiper	*Actitis hypoleucos*	MI	MI	Possible	Low	**Minor**
Long-toed Stint	*Calidris subminuta*	MI	MI	Possible	Low	**Minor**
Pacific Golden Plover	*Pluvialis fulva*	MI	MI	Possible	Low	**Minor**
Ruff	*Calidris pugnax*	MI	MI	Possible	Low	**Minor**

Note. P1 – P4=Priority 1–Priority 4 listed species by DBCA; OS=Other Specially Protected; EN=Endangered; VU=Vulnerable; MI=Migratory; CR=Critically Endangered.

6.0 Monitoring Program

Five (5) pre-commissioning BBUS have been undertaken within the Project Area between 2024 and 2025, with five other vertebrate fauna surveys and three targeted shorebird surveys completed during the same timeframe that collected targeted and incidental data on bird and bat species present.

The methodology for post commissioning surveys recommended within this preliminary BBAMP are provided below and are based on current information and industry guidelines. The recommended surveys include continuation of BBUS, carcass search programs, and ancillary surveys (trials). A desktop assessment of relevant database searches and literature will be completed prior to initiation of the monitoring program to ensure survey approach is current and suitable for achieving the outcomes and commitments of this plan.

6.1 Monitoring Program Schedule

An overview of the survey schedule for the different components of the bird and bat monitoring program is provided in **Table 6.1**.

Timing of the bird survey program will cover all seasons. Timing of the bat monitoring program has also been scheduled to coincide with the bird monitoring program.

Table 6.1 BBAMP Monitoring Schedule

Survey	Timing	Duration	Reference
Bird Site Utilisation Surveys	Seasonal surveys four times annually in accordance with the timing of previous surveys. Commencing within six months of all turbines being operational.	2 years	**Section 6.2.1**
Bat Site Utilisation Surveys	Seasonal surveys four times annually in accordance with the timing of previous surveys. Commencing within six months of all turbines being operational.	2 years	**Section 6.2.2**
Carcass Search Surveys	Surveys will occur monthly for an initial two-year period. Commencing within six months of all turbines being operational.	2 years	**Section 6.3**
Carcass Detectability Trial	Once every six months, beginning with or prior to the first carcass search survey.	1 year	**Section 6.4.1**
Carcass Persistence Trial	Once every six months, beginning with or prior to the first carcass search survey.	2 years	**Section 6.4.2**

6.2 Bird and Bat Site Utilisation Surveys

A summary of the operational BBUS program is provided in the following sections.

6.2.1 Bird Site Utilisation Surveys

Bird utilisation surveys will be conducted within six months of all turbines being commissioned. If necessary, surveys will be expanded to incorporate additional areas once new turbine groups have been commissioned, and the area is considered safe to do so. Surveys will be undertaken four times a year for an initial two year period, and the requirement for surveys to continue will be reviewed by the Supervising Ecologist after the initial two years of surveying. Survey timing will be aligned with that of pre-commissioning BBUS (**Table 4.1**) to coincide with the seasonal migration of EPBC Act and BC Act listed birds.

Survey methods will adopt the methodology of BBUS conducted between 2024 and 2025 to maintain consistency with baseline bird and bat surveys. For the purpose of reporting, any observation of a bird or birds flying at RSA height constitutes 'at-risk behaviour'.

6.2.2 Bat Site Utilisation Surveys

Bat utilisation surveys will be conducted within six months of all turbines being commissioned. If necessary, surveys will be expanded to incorporate additional areas once new turbine groups have been commissioned, and the area is considered safe to do so. The surveys will be conducted four times a year in conjunction with bird utilisation surveys and will continue for the first two years of operation. The requirement for bat utilisation surveys to extend beyond two years, will be reviewed by the Supervising Ecologist after the initial two years of surveying.

Bat site utilisation surveys will be conducted using the methodology adopted between 2024 and 2025.

6.3 Carcass Search Program

The key objective of the carcass search program is to monitor the frequency of bird and bat mortality due to collision or barotrauma associated with the Project from which the total number of mortalities can be estimated. Estimated frequency of mortality due to collision or barotrauma will be modelled and reported annually using inputs from the carcass search program to determine the range of actual mortalities that have occurred. These outputs can then be used to assess the accuracy of mortalities/featherspots/injured individuals recorded by the carcass search program and inform appropriate responses or extension of the program's implementation.

The methods to be employed as part of this program are detailed below. Reporting requirements relevant to the mortality assessment program are described in **Section 9.0**.

6.3.1 Turbine Selection

The same subset of 50% of turbines (up to 33) will be searched during each event over the life of the program. Turbines selected for searching will be randomised across the Project Area as all turbines are currently assumed to be of equal risk.

Where annual monitoring indicates that some turbines or areas may be at higher risk of collision than others, additional turbines may be selected for searching with consideration of the following factors:

- Turbines where prior mortality events of threatened or migratory species have been confirmed.
- Turbines that overlap or occur in proximity with habitat for threatened or migratory birds and bats.
- Turbines representative of different habitat types and landscape positions.

6.3.2 Survey Timing and Frequency

The carcass detection program will commence within six months of all turbines being commissioned and continue for a period of two years.

Carcass searches will be undertaken monthly, and the search program will be reviewed for efficacy after two years by the Supervising Ecologist, with the possibility of extension, pending review results. The efficacy requirement for extension will be based on a circumstance where there is a clear discrepancy between the anticipated and realised frequency of bird and bat mortality due to the operation of the wind turbines, or where deemed necessary as part of adaptive management measures (**Section 7.0**).

Incidental carcasses collected by operation crews or landowners between scheduled surveys will be stored in an on-site freezer, along with collection details and photographs being provided to the Supervising Ecologist for identification. Details on how to collect specimens, record observations and the best way to store carcasses in a freezer will be provided to operational staff during site inductions as specified in **Section 6.3.6**.

6.3.3 Search Area

The final search area engaged for the carcass search program will be determined based on the confirmation of final specifications of the proposed turbines and the method employed for carcass searches. Based on the proposed RSA used in the risk assessment as well as the findings of Hull and Muir (2010), Huso and Dalthorp (2014) and Prakash and Markfort (Prakash & Markfort, 2020), an indicative area with a radius of 120 m around the base of each turbine comprising an inner and outer search area (60 m radii, respectively) will be utilised.

6.3.4 Search Method

There are two potential search methods proposed, including the use of detection dogs and a human detection search method which are detailed in **Section 6.3.4.1** and **Section 6.3.4.2**.

6.3.4.1 Detection Dog Method

Trained detection dogs will be used if the climatic conditions and terrain of the search areas are suitable for a safe and effective canine search effort. As such, surveys conducted during summer months may need to be scheduled during the early and later part of the day to avoid hot weather. A detection dog team is comprised of at least one dog handler and detection dog who will undertake surveys.

The detection dog will be highly trained with recall and always be within sight or within audible distance of the handler. Detection dog teams will generally work from downwind to upwind across the 120 m radius (the 'search area'; see **Section 6.3.3**). Depending on the wind speed at the time of sampling, the width between transects used by the detection dog team will vary. This is because the scent cone being emitted by the carcass will become narrower during stronger wind and wider during lighter wind. As such, the distance between transects will vary from between 10 m and 30 m at the discretion of the trained detection dog handler (**Figure 6.1**).

The detection dog team will walk across the direction of the wind, allowing the dog to freely move across the search transect, while responding to commands of the handler. A GPS collar will be attached to the detection dogs to allow the handler to track movements in real time and ensure the entire search area has been sufficiently covered by the dog. Once the distance travelled by the dog is adequate and there are no clear coverage gaps, the team will move to the next wind turbine and repeat the process.

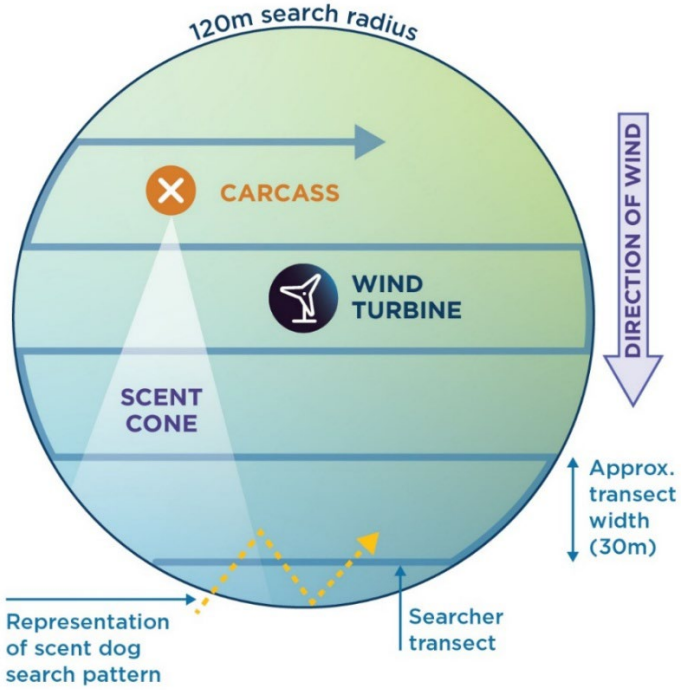


Figure 6.1 Detection Dog Method Search Area

6.3.4.2 Human Detection Method

Carcass searches will be conducted by ecologists experienced in bird and bat carcass identification. At each turbine search area, the observer will walk transects comprising an inner and outer search area (60 m radii, respectively) at each of the selected sites.

Carcass searches will be conducted as follows:

- The inner and outer search areas will be surveyed at each selected turbine (**Figure 6.2**).

The team will survey wind turbine locations with the intensity of searches varying based on distance from the wind turbine base with as follows:

- Inner zone = transects to be spaced every 6 m from base of turbine.
- Outer zone = transects to be spaced every 12 m from 60–120 m from base of turbine.

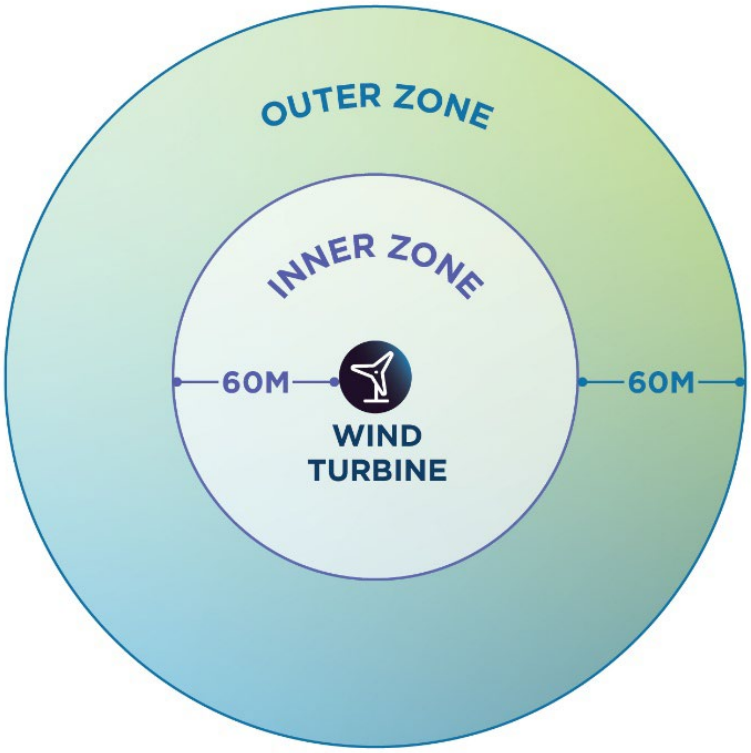


Figure 6.2 Human Detection Method Inner and Outer Turbine Search Area Zones

6.3.5 Unsearchable Areas

In certain situations, the topography surrounding wind turbines may present challenges to effective search and monitoring activities. Terrain such as steep slopes, dense vegetation, or rocky areas can limit access for both human surveyors and trained detection dogs. At turbines within such areas, searcher efficacy or carcass detectability (particularly if humans are used to search for carcasses rather than dogs) may vary.

Areas deemed as unsearchable for each turbine included in the carcass search program will be marked/mapped and a corrective factor equivalent to the remaining area unable to be surveyed will be applied to produce total bird and bat mortality estimates. Prior to implementing the searches, a statistician will be consulted regarding the corrective factor and the preferred method for recording the data for use in the mortality estimation.

Noting the landscape surrounding the Project turbines (i.e. primarily cleared paddocks), unsearchable areas are not likely.

6.3.6 Data Collection and Carcass Find Protocol

During the carcass search surveys and the carcass persistence trials (**Section 6.4**), data will be collected and recorded on predefined survey sheets, including online applications if appropriate.

The data will include (but is not limited to) general information such as basic survey and weather information, location-specific information including ground cover/substrate, and the extent of the search area that is accessible/searchable.

If a bird or bat carcass or featherspot is detected during a carcass search survey, the carcass or featherspot must be collected, photographed and stored (if a carcass), its location must be recorded on a GPS device, and the relevant data collection form completed. The carcass will then be placed in an on-site freezer dedicated to this purpose and clearly labelled as such, with the carcasses to be used in carcass detectability trials and carcass persistence trials (**Section 6.4**). Handling and collection of carcasses should consider the following:

- The carcass must be removed from the site by a person wearing rubber gloves and double bagged in clear plastic bags.
- The carcass must be photographed in such a way that it can be further identified, i.e. on a white background with an item or measuring tape for scale and adequate lighting.
- A label with the date, turbine number, species name (if known) and a unique specimen code must be placed in the second bag to allow cross-reference to the corresponding completed datasheet.
- The carcass will be transported to a dedicated on-site freezer where it will be retained for the purpose of either a second opinion on its identification, or for use in carcass persistence trials or carcass detectability trials.
- In cases where featherspots or carcasses cannot be identified, the following process will be undertaken:
    - Photos of the featherspot or carcass will be analysed by the Supervising Ecologist (including any colleagues) to definitively identify the find, including circumstances where the Supervising Ecologist allocated the identification to likely or probable confidence levels.
    - Methods to further definitively identify the featherspot or carcass could then involve sending photos of the find and/or the find itself to a species specialist or museum, or for DNA testing. DNA testing is not proposed to be used for carcasses or featherspots unless there is the potential it could be a threatened species.

All data collected during the carcass search program will be entered into a database. Data pertaining to incidental finds must also be retained in this database.

All carcasses collected must be kept (frozen) until the completion of all ancillary surveys as outlined in **Section 6.4**.

6.4 Ancillary Surveys

Ancillary surveys (trials) to test and measure both carcass persistence and searcher efficiency will be completed. These trials will help calibrate inputs for the calculations of mortality estimates and allow survey methods to be adjusted where appropriate.

6.4.1 Carcass Detectability Trials

The efficacy of the carcass detection program will be investigated using carcass detectability trials which aim to detect the degree of error present as a calibration factor for mortality estimates.

The detectability of carcasses under turbines can vary depending on a range of factors such as the efficacy of the observer, the size of the carcass, and the type of ground cover. Given this, carcass detectability trials will be undertaken to determine the efficacy of finding carcasses within different areas of the Project Area. These trials will correspond with periods of low and high grass or cropping cover as carcass detection by humans is limited by these visual restrictions. The assessor will be independent and suitably experienced.

Carcass detection trials will be undertaken twice across a 12 month period and commence immediately prior to or with the first carcass search survey. The trial can be undertaken concurrently with the carcass persistence trials and/or the carcass search surveys to maximise survey efficiency. If the carcass detection team undertaking the carcass search program (**Section 6.3**) changes, then new carcass detectability trials will be implemented to account for changes in detectability by personnel.

The broad methodology for carcass detectability trials includes:

- Birds and bats collected during the carcass detection program will be stored in an on-site freezer, suitable for storage during the carcass detectability trial. Where local deceased bird or bat carcasses are not available, other mammal and bird carcasses of similar size classes will be ethically sourced (e.g. from a pet food supply store or animal rehabilitation clinic).
- Carcasses of varying size and species (both bird and bat) will be randomly placed around the search zone of the turbines (**Figure 6.1** and **Figure 6.2**). The number of carcasses placed and associated turbines selected will be determined using a randomisation tool, though will total a minimum of 10 large birds (e.g. raptors), 10 medium sized birds, and 10 small sized birds, and 10 microbats per trial/season (**Table 6.2**). The location of the carcasses will be captured using a GPS.
- The ecologists or detector dog team, without the knowledge of the calibration survey, will undertake the carcass detection program as per the methodology described above.

This method enables results of the carcass detection program to be corrected using a calibration factor, derived from the number of placed carcasses found, divided by the number of carcasses placed. For example, if five carcasses of the original ten are found by the surveying team, the calibration factor of 0.5 (5/10) would apply to the results of the carcass detection program. In this example, it is assumed that 50% of the carcasses were missed and should be accounted for.

Table 6.2 Minimum Detectability Trial Replicates per Season/Trial

Season/Trial	Large-sized Birds	Medium-sized Birds	Small-sized birds	Microbats
Spring	10	10	10	10
Autumn	10	10	10	10

6.4.2 Carcass Persistence Trials

Birds and bats injured or killed through collision with turbines may be removed from search areas by scavengers such as varanids, raptors, ravens, dingoes, or introduced mammals. Carcass persistence trials allow the persistence rates of different-sized carcasses to be estimated and improve the estimation of mortality rates of birds and bats impacted via turbine collision.

The persistence trials will be undertaken once every six months.

To assess variation in scavenging rates across carcass sizes, three different size classes for birds will be used with an equal number of replicates per trial (**Table 6.2**). The various carcasses will be placed within the search zone of a selection of turbines within the Project Area and their location recorded via GPS. Each carcass will have a motion-detecting camera placed nearby to identify the species potentially scavenging the carcass and record the date and time that the carcass is removed as recommended by Ravache et al. (2024).

The motion-detecting cameras will be supplemented by physical carcass checks by suitably qualified ecologists or trained on-site personnel. The ecologists/on-site personnel will manually check the carcasses at 3 days and between 7-14 days following carcass placement. These checks will record whether the carcass is “intact” (i.e., does not appear to have been scavenged by a vertebrate predator) or “partially scavenged” (i.e., flesh and skeletal remains are found). Feather-spots will also be recorded, however will not contribute to the persistence correction factor as this may bias results (as scavenging has likely already occurred by the time feather-spots are found). Other relevant notes relating to scavenging (e.g. scavenger scats, feathers, bones, type of scavenging) will also be recorded.

Quantifying the mean and confidence interval of the time until the removal of carcasses is required for input into the calculation of mortality estimates. Carcass persistence will be examined through survival analysis using statistical analysis to estimate the survival function.

7.0 Impact Triggers and Adaptive Management

This section defines impact trigger levels, management response actions and reporting requirements for:

- Black-cockatoo species.
- Threatened shorebird species.
- Migratory species.
- Other conservation significant species.
- Non-conservation significant species.

The main objective of setting an impact trigger level is to achieve the overarching environmental outcome of avoiding direct and indirect impacts to bird and bat species or otherwise minimising these as much as reasonably possible.

7.1 Black-cockatoo Species

Through numerous surveys completed to date, black-cockatoos are the primary EBPC Act listed species occurring in the area. As described in **Section 5.0**, flight height data indicates that these species are unlikely to fly at RSA and as a result there is a low likelihood of turbine collision. However, given the presence of these species on site and noting their threatened status under the EPBC Act and BC Act, environmental outcomes have been nominated, along with early response criteria and trigger criteria. For each criterion, response actions, including monitoring and reporting requirements have also been proposed.

These are presented in **Table 7.1** to **Table 7.3** below.

Table 7.1 Environmental Outcome 1: The Project will not lead to a long-term decrease in the size of a population of black-cockatoos as a result of the Project

Environmental outcome: The Project will not lead to a long-term decrease in the size of a population of black-cockatoos as a result of the Project.			
Mitigation and Management Commitments			
• A minimum blade tip height of 59 m AGL will be applied to all wind turbines to minimise the risk of turbine collision noting the maximum flight height recorded for a black-cockatoo species within the Project area is 50 m AGL. • A carrion removal program will be implemented for the operational lifetime of the Project (refer **Table 8.1** of BBAMP). • A monthly carcass search program will be implemented for the first two years of operation, with the ongoing frequency reviewed as part of the adaptive management approach (refer **Table 9.1** of BBAMP). • Bird utilisation surveys will be conducted four times a year for an initial two-year period of operations, timed to align with pre-commissioning BBUS with ongoing frequency reviewed as part of the adaptive management approach (refer **Section 6.2** of BBAMP).			
Response Commitments			
Environmental Indicator	**Response Actions**	**Response Monitoring Timing & Frequency**	**Reporting**
Early response criteria: One confirmed black-cockatoo carcass, featherspot, or injured individual is found within 200 m of Project infrastructure	**Early response actions:** 1. Notify DBCA within 5 days of the early response criteria exceedance. 2. Complete a carcass search survey at all Project wind turbines within 2 km of the confirmed black-cockatoo carcass, featherspot, or injured individual detection (if the carcass, featherspot, or injured individual is recorded via carrion removal program or incidental observation). 3. Prepare an investigation report including details of the cause of death and an assessment of the impact on the species. Should the investigation report indicate that the death was likely as a result of turbine collision and is unlikely to be a one-off event then complete further targeted black cockatoo utilisation surveys.	• Carcass search survey within 2 months of exceeding the early response trigger. • Targeted black-cockatoo utilisation surveys undertaken quarterly for 12 months (to be informed by investigation).	• DBCA notification. • Carcass search record card. • Annual compliance report. • Early response exceedance report.
Early response criteria: Black-cockatoos observed flying at RSA as part of bird utilisation surveys	**Early response actions:** 1. Update the risk assessment criteria with cumulative flight height data to determine if risk of black-cockatoo turbine strike has increased. 2. Determine whether ongoing monitoring is required past the initial two-year period based on the updated risk assessment.	• Targeted black-cockatoo utilisation surveys undertaken quarterly for 12 months (depending on risk assessment).	• Annual compliance report. • Early response exceedance report.
Trigger criteria: Over a rolling 12-month period, 2 or more confirmed black-cockatoo carcasses, featherspots, or injured individuals are found within 200 m of Project infrastructure or, 4 confirmed black-cockatoo carcasses, featherspots, or injured individuals are found within 200 m of Project infrastructure since commencement of operations.	**Trigger actions:** **1.** Notify DBCA within 5 days of the trigger criteria exceedance. **2.** Prepare an investigation report including details of the cause of deaths, an assessment of the impact on the species, and an assessment of the collision risk profile at each turbine. **3.** Undertake a review of existing mitigation and management measures to determine their adequacy. Should mitigation measures be determined to be inadequate, undertake a 12 month trial of at least one of the following at turbines where black-cockatoo carcasses, featherspots, or injured individuals as a result of blade strike were recorded to determine effectiveness: **a.** Employ temporary shutdown periods during periods of high black-cockatoo usage within high-risk areas of the Project site. This could be informed by collision risk modelling (CRM) should sufficient data be available to develop a CRM. **b.** Install automatic detection systems (ADS), which trigger a shutdown of turbines when a black-cockatoo considered at risk of collision is identified nearby. **c.** Increase cut-in speed of wind turbines during periods of higher activity. **4.** Provide funding towards further understanding black-cockatoo movements in the South-west WA region and/or identifying alternative mitigation measures to reduce turbine blade strike. **5.** Increase frequency of targeted black-cockatoo utilisation surveys and carcass search surveys.	• Targeted black-cockatoo utilisation surveys undertaken quarterly for 12 months following exceedance of trigger criteria. • Carcass search surveys undertaken quarterly for 12 months following exceedance of trigger criteria.	• DBCA notification. • Annual compliance report. • Trigger exceedance report. • Annual carcass search report.

Table 7.2 Environmental Outcome 2: The Project will not result in a net loss of black-cockatoo foraging habitat within a 12 km radius of the Project Area

Environmental outcome: The Project will not result in a net loss of black-cockatoo foraging habitat within a 12 km radius of the Project Area.			
Mitigation and Management Commitments			
• No more than 23.05 ha of vegetation will be cleared. • No high-quality black-cockatoo foraging habitat will be cleared. • No more than 0.65 ha of vegetation with moderate to high black-cockatoo foraging value (Site condition score of 5) will be cleared. • Mitigation measures as outlined in the Project Construction Environmental Management Plan (CEMP) will be implemented to ensure clearing does not exceed approved limits, including demarcation of vegetation clearing areas to avoid over clearing, and clear identification of no-go zones. • Environmental offsets will be established under Part V of the EP Act Native Vegetation Clearing Permit process and will be prepared in accordance with the WA Environmental Offset Policy 2011 and Environment Offset Guidelines 2014.			
Response Commitments			
Environmental Indicator	**Response Actions**	**Response Monitoring Timing & Frequency**	**Reporting**
Early response criteria: Clearing exceeds any of: • 9.25 ha of native remnant vegetation (90% of approved) • 4.91 ha of native isolated remnant trees (90% of approved) • 4.55 ha of planted native trees (90% of approved) • 0.59 ha of vegetation with moderate to high black-cockatoo foraging value (90% of approved).	**Early response actions:** 1. Stop all clearing until review of outstanding clearing requirements to ensure the Project can be completed without exceeding the following permitted clearing limits: a. 10.28 ha of native remnant vegetation b. 5.45 ha of native isolated remnant trees c. 7.33 ha of planted vegetation (native and non-native) d. 0.65 ha of vegetation with moderate to high black-cockatoo foraging value (area included in the above vegetation clearing areas) 2. Adjust Project design to ensure the clearing limits are not exceeded.	• Within one week of completion of a clearing activity.	• Register of cleared areas. • Annual compliance report. • Early response exceedance report.
Trigger criteria: n/a	**Trigger actions:** n/a	n/a	n/a

Table 7.3 Environmental Outcome 3: The Project will not impact on the breeding cycle of black-cockatoos

Environmental outcome: The Project will not impact on the breeding cycle of black-cockatoos.			
Mitigation and Management Commitments			
• The Project will avoid clearing identified Rank 1 (trees with activity at hollow observed) and Rank 2 (trees with hollows of suitable size with chew marks visible) black-cockatoo breeding trees. • The Project will minimise clearing of Rank 3 (potentially suitable hollow visible but no chew marks present at entrance; or potentially suitable hollow suspected to be present) black-cockatoo breeding trees. Where it is discovered that a Rank 3 tree has been used or is in active use for nesting by black-cockatoos, a no-go zone will be established around the tree and the tree will not be cleared until the chick has naturally fledged and the breeding pair vacated. • Areas planned for native vegetation clearing will be inspected for native fauna immediately prior to undertaking land clearing by a suitably qualified fauna spotter. This will include ensuring that no trees being removed are housing black-cockatoos, chicks, or eggs. • If black-cockatoo nesting activity is identified, clearing will not occur within 50 m of the nesting activity. • Known black-cockatoo nesting trees within 50 m of clearing boundaries will be clearly tagged as "No-go zone" prior to clearing. • The above measures are included in the Construction Environmental Management Plan to be implemented as part of the Project. • Environmental offsets will be established under Part V of the EP Act Native Vegetation Clearing Permit process and will be prepared in accordance with the WA Environmental Offset Policy 2011 and Environment Offset Guidelines 2014.			
Response Commitments			
Environmental Indicator	**Response Actions**	**Response Monitoring Timing & Frequency**	**Reporting**
Early response criteria: Black-cockatoo nesting is identified within the clearing area.	**Early response actions:** 1. Establish a 'No-go zone' so that clearing will not occur within 50 m of the nesting activity. 2. Notify DBCA within 5 days of the nesting activity being identified. 3. Install artificial nest boxes in suitable habitat in the Project area in consultation with DBCA and at a minimum 1:1 ratio.	• Pre-clearance tree surveys no more than 72 hours prior to clearing commencing.	• DBCA notification. • Annual compliance report. • Early response exceedance reports.
Trigger criteria: n/a	**Trigger actions:** n/a	n/a	n/a

7.2 Threatened Shorebird Species

Three Threatened shorebird species (those listed as Threatened and Migratory under the EPBC Act) have been recorded in the Project Area and one additional species has a high likelihood of occurrence.

As described in **Section 5.0**, flight height data indicates that these species may occasionally fly at RSA and as a result there is a possible risk of turbine collision. Given the presence of these species on site and noting their threatened status under the EPBC Act and BC Act, environmental outcomes have been nominated, along with early response criteria and trigger criteria.

Impact trigger levels for Threatened shorebird species have been developed using guidance contained in the Department of Environment (2015) *Referral guideline for 14 birds listed as migratory species under the EPBC Act*. The referral guideline notes that actions which constitute serious disruption to an ecologically significant proportion of a population are those that are predicted to have annual mortality rates or affect breeding cycles of individuals meeting or exceeding 1% of the species population. The guideline also recommends that actions likely to meet or exceed 0.1% of the species population should be investigated further through more targeted surveys.

For this Project, 0.01% of the species flyway population (refer Driessen et al, 2025) has been used as the early response criteria for Threatened shorebird species, and 0.05% of the species flyway population has been used as the trigger criteria.

For each criterion, response actions, including monitoring and reporting requirements have also been proposed. These are presented in **Table 7.4** below.

Table 7.4 Environmental Outcome 1: The Project will not lead to a long-term decrease in the size of a population of Threatened shorebird species as a result of the Project

Environmental outcome: The Project will not lead to a long-term decrease in the size of a population of Threatened shorebird species as a result of the Project.			
Mitigation and Management Commitments			
• No turbines will be located within 3.5km of the wetlands west of Brand Highway where Threatened shorebirds have been recorded. • No wetland habitat mapped as likely to support Threatened shorebirds will be permanently cleared. • A carrion removal program will be implemented for the operational lifetime of the Project (refer **Table 8.1** of BBAMP). • A monthly carcass search program will be implemented for the first two years of operation, with the ongoing frequency reviewed as part of the adaptive management approach (refer **Table 9.1** of BBAMP). • Bird utilisation surveys will be conducted four times a year for an initial two-year period of operations, timed to align with pre-commissioning BBUS with ongoing frequency reviewed as part of the adaptive management approach (refer **Section 6.2** of BBAMP).			
Response Commitments			
Environmental Indicator	**Response Actions**	**Response Monitoring Timing & Frequency**	**Reporting**
Early response criteria: Carcasses, featherspots, or injured individuals for 0.01% of the species flyway population are found within 200 m of Project infrastructure	**Early response actions:** 1. Notify DBCA within 5 days of the early response criteria exceedance. 2. Complete a carcass search survey at all Project wind turbines within 2 km of the confirmed carcasses, featherspots, or injured individuals detection (if the carcasses, featherspots, or injured individuals are recorded via carrion removal program or incidental observation). 3. Prepare an investigation report including details of the cause of death(s) and an assessment of the impact on the species. Should the investigation report indicate that the death(s) were likely as a result of turbine collision and is unlikely to be a one-off event then complete further targeted shorebird utilisation surveys.	• Carcass search survey within 2 months of exceeding the early response trigger. • Targeted shorebird utilisation surveys undertaken monthly from October to March for a 6 month period (to be informed by investigation).	• DBCA notification. • Carcass search record card. • Annual compliance report. • Early response exceedance report.
Trigger criteria: Carcasses, featherspots, or injured individuals for 0.05% of the flyway population are found within 200 m of Project infrastructure	**Trigger actions:** 1. Notify DBCA within 5 days of the trigger criteria exceedance. **2.** Prepare an investigation report including details of the cause of deaths, an assessment of the impact on the species, and an assessment of the collision risk profile at each turbine. 3. Undertake a review of existing mitigation and management measures to determine their adequacy. Should mitigation measures be determined to be inadequate, undertake a 12 month trial of at least one of the following at turbines where Threatened shorebird carcasses, featherspots, or injured individuals as a result of blade strike were recorded to determine effectiveness: a. Employ temporary shutdown periods during periods of high Threatened shorebird usage within high-risk areas of the Project site. This could be informed by collision risk modelling (CRM) should sufficient data be available to develop a CRM. b. Install automatic detection systems (ADS), which trigger a shutdown of turbines when a Threatened shorebird considered at risk of collision is identified nearby. c. Increase cut-in speed of wind turbines during periods of higher activity. 4. Provide funding towards further understanding Threatened shorebird movements in the South-west WA region and/or identifying alternative mitigation measures to reduce turbine blade strike. **5.** Increase frequency of targeted shorebird utilisation surveys and carcass search surveys.	• Targeted shorebird utilisation surveys undertaken monthly from October to March for a 6 month period following exceedance of trigger criteria. • Carcass search surveys undertaken quarterly for 12 months following exceedance of trigger criteria.	• DBCA notification. • Annual compliance report. • Trigger exceedance report. • Annual carcass search report.

7.3 Migratory Species

7.3.1 Impact Trigger

Impact trigger levels for species listed under the EPBC Act as migratory have been developed using guidance contained in the Department of Environment (2015) *Referral guideline for 14 birds listed as migratory species under the EPBC Act*. The referral guideline notes that actions which constitute serious disruption to an ecologically significant proportion of a population are those that are predicted to have annual mortality rates or affect breeding cycles of individuals meeting or exceeding 1% of the species population. The guideline also recommends that actions likely to meet or exceed 0.1% of the species population should be investigated further through more targeted surveys.

For this Project, the impact trigger for a species listed as Migratory under the EPBC Act or BC Act is the confirmation of a number of carcasses, featherspots, or injured individuals that represents 0.05% of the species flyway population (refer Driessen et al, 2025), recorded either:

- Within the designated search area during the carcass search program.
- Within 200 m of Project infrastructure recorded as part of carrion removal procedures.
- Within 200 m of Project infrastructure recorded incidentally during other activities.

If expert identification (including DNA testing) is required to determine the species of a carcass or featherspot, then the impact trigger will occur from the date the carcass or featherspot is confirmed as a threatened species.

7.3.2 Response Requirements

If an impact trigger level for migratory species is met, a further investigation and reporting response is required. It is the responsibility of the person who discovered the carcass, injured individual or featherspot to notify the Site Environmental Advisor upon discovery, so the response can be initiated as per the process depicted in **Figure 7.1**.

As part of the response plan, Neoen will notify DCCEEW (for EPBC Act listed migratory species) and/or DBCA (for BC Act migratory species) of the event as soon as practicable (following confirmed species identification) but no later than five business days.

Following this, an investigation into contributing factors to the trigger will be undertaken by a suitably qualified ecologist (e.g. certain weather events, potential for a high-risk turbines). A report will be compiled by a qualified ecologist addressing the investigation of impacts relating to a specific trigger level being met and submitted to DCCEEW and/or DBCA as soon as practicable following the carcass, featherspot, or injured individual being identified (including if further DNA testing is required) (also refer to **Section 9.0**).

Figure 7.1 Decision Making Framework and Adaptive Management Approach

7.4 Other Conservation Significant Species

7.4.1 Impact Trigger

The impact trigger for a bird or bat species listed as Other Specially Protected (i.e. Peregrine Falcon) under the BC Act, or as Priority species by DBCA, is the confirmation **of** two carcasses, featherspots, or injured individuals across two consecutive months recorded either:

- Within the designated search area during the carcass search program.
- Within 200 m of Project infrastructure recorded as part of carrion removal procedures.
- Within 200 m of Project infrastructure recorded incidentally during other activities.

If expert identification (including DNA testing) is required to determine the species of a carcass or featherspot, then the impact trigger will occur from the date the carcass or featherspot is confirmed as a threatened species.

7.4.2 Response Requirements

If an impact trigger level for other conservation significant species is met, a further investigation and reporting response is required. It is the responsibility of the person who discovered the carcass, injured individual or featherspot to notify the Site Environmental Advisor upon discovery, so the response can be initiated as per the process depicted in **Figure 7.1**.

Neoen will notify DBCA (for all other conservation significant species) of the event as soon as practicable (following confirmed species identification) but no later than five business days.

Following this, an investigation into contributing factors to the trigger will be undertaken by a suitably qualified ecologist (e.g. certain weather events, potential for a high-risk turbines). A report will be compiled by a qualified ecologist addressing the investigation of impacts relating to a specific trigger level being met and submitted to DBCA as soon as practicable following the carcass, featherspot, or injured individual being identified (including if further DNA testing is required) (also refer to **Section 9.0**).

7.5 Non-listed Species Impact Trigger

The impact trigger for bird or bat species not listed under the EPBC Act or BC Act is the confirmation of **four carcasses, featherspots, or injured individuals** recorded at the **same** or **adjacent**[1] turbines within **two consecutive months**:

- During the carcass search program.
- As part of carrion removal procedures.
- Incidentally during other activities.

The impact trigger for non-listed species does not apply to introduced species or the following species which were the ten most abundant species recorded during previous BBUS events:

- Australian Magpie (*Gymnorhina tibicen*).
- Australian Raven (*Corvus coronoides*).
- Australian Ringneck (*Barnardius zonarius*).
- Galah (Eolophus roseicapilla).
- Grey Fantail (Rhipidura albiscapa).
- Rufous Whistler (Pachycephala rufiventris).
- Tree Martin (Petrochelidon nigricans).
- Western Gerygone (*Gerygone fusca*).
- Western Corella (*Cacatua pastinator*).
- Yellow-rumped Thornbill (*Acanthiza chrysorrhoa*).

7.5.1 Response Requirements

If an impact trigger level for a non-listed species is met, a further investigation is required to determine if a revised risk assessment of the species should be initiated as per **Section 7.4**. It is the responsibility of the person who discovered the carcass, injured individual or featherspot to notify the Site Environmental Advisor upon discovery. The impact trigger will occur from the date the find is reported to the Site Environmental Advisor.

7.6 Revised Risk Rating Management

Data collected during the bird and bat monitoring program will be assessed in accordance with the bird and bat collision risk assessment methodology outlined in **Appendix A** to build upon the understanding of the risk of turbine collision and barotrauma impacts. The collision risk assessment will be updated upon the two-year review and, if suitable, incorporated into the annual compliance report as specified in **Section 9.0**.

[1] This threshold is cumulative across adjacent turbines. For example, if one mortality, featherspot, or injured individual is confirmed at two separate turbines not adjacent to one another, and then another is confirmed the following month at a turbine adjacent to both turbines (i.e. between them) then this threshold is also triggered.

The risk assessment may also be revised on an ad-hoc basis in specific circumstances. If a conservation significant bird or bat species is observed during the monitoring program resulting in a change in the likelihood of occurrence (e.g. from 'Moderate' or 'High' to 'Known'), a species' conservation listing is changed by the relevant department, or an investigation into a non-listed species trigger exceedance recommends risk rating management , the following process will be initiated by the Site Manager and supported by the Site Environmental Advisor:

- Commissioning of a revised collision risk assessment to determine the revised risk rating for the species.
- Undertake a review of the current mitigation and management measures identified in the BBAMP and determine their adequacy to prevent impact to the species.
- Identify further mitigation and management measures to reduce the risk to the species based on turbine collision and barotrauma.
- For any species with a risk rating revised to 'Very High', where possible a Collision Risk Model (CRM) will be commissioned to determine the estimated number of collisions per year based on current Project operation.

Where the outcomes of the response involves changes to this BBAMP, those changes will be reported to DCCEEW and/or DBCA within three months in accordance with **Table 9.1**.

8.0 Mitigation and Management Measures

The purpose of this section is to provide details of mitigation measures to manage risk of the Project leading to a significant impact on bird and bat species. Additional measures may be implemented following the investigation of triggers being met and the BBAMP reviewed. The ongoing, preventative mitigation measures discussed in this plan are provided in **Table 8.1**.

Table 8.1 Project Mitigation Measures

Mitigation Measure	Description	Timing
Turbine design	Large turbines provide better visibility and have slower blade rotation speeds than smaller turbines. Providing a minimum turbine tip height of 59 m AGL will minimise the risk of turbine strike for black-cockatoo species which typically fly at canopy height.	Design stage
Controls before vegetation clearance	Before commencing clearance, careful planning must be made to limit disturbance to significant bird habitats: • Locating infrastructure within cleared agricultural land as much as possible road so that layouts were optimised to reduce clearing of vegetation (e.g. placement within cleared paddock). • Minimising creek crossings as part of the design, and where crossings are necessary utilising existing crossings so that clearing of riparian vegetation is reduced as far as possible. • Vegetation clearance areas will be clearly demarcated to avoid over-clearing within mapped habitat. • No-go zones within the Project Area will be clearly documented. • Measures to protect and recover fauna encountered during vegetation clearing will be outlined, including the presence of qualified fauna spotters. • Preclearance searches of habitat will be undertaken prior to clearing by a qualified fauna spotter, with habitat features/trees clearly identified and searched for fauna. This will include ensuring that no trees being removed are housing black-cockatoos, chicks, or eggs. • Micro-siting of Project infrastructure will aim to retain habitat trees where possible. • Habitat trees within the Final Project Footprint that can be safely retained will be marked with flagging tape and avoided. • Measures to replace/relocate habitat and resources that will be unavoidably lost will be outlined, including rehabilitation procedures for the decommissioning of temporary construction areas if those areas are not otherwise useful to the ongoing land use.	Design stage

Mitigation Measure	Description	Timing

Controls during vegetation clearance	During vegetation clearance, efforts to limit disturbance to significant bird habitats will include:
	• Vegetation clearing to be undertaken progressively and in stages so that only a small subset of the Project footprint is impacted at any one time. The clearing will be undertaken towards adjacent native vegetation to allow fauna to move into adjacent native vegetation ahead of the clearing activity.
	• Having a licenced fauna spotter to conduct searches during clearing activities within remnant vegetation types and native vegetation to ensure that no potential black-cockatoo nest trees being removed are housing black-cockatoos, chicks, or eggs.
	• Halting any activities where any listed bird and bat species are encountered during construction in proximity (<10 m) to their location until they are no longer present.
	• Halting vegetation clearing in areas where black-cockatoo species are located, and clearing will not resume until the species leaves the location on its own accord.
	• Implementing mitigation measures to limit and reduce indirect impacts (noise, dust, light emissions and traffic) to birds and bats:
	  ○ Restriction of construction hours to daylight periods where possible.
	  ○ Consideration of plant and equipment types, including muffler design and the use of alarms.
	  ○ Dust suppression techniques to minimise generation of duct (e.g., watering access roads).
	  ○ Speed limits on access roads, informed by appropriate signage as required.
	  ○ The inclusion of points of egress in any excavation areas that are left open for more than one night.
	  ○ Progressive clearing, limiting exposed areas to the immediate work zones.
	  ○ Consideration to the type and use of lighting (e.g., shielded lights on buildings, directing lighting away from habitat).
		During construction

Mitigation Measure	Description	Timing
Carrion removal	The presence of carrion around wind turbines attracts many bird species, particularly raptors, placing them at an elevated risk of collision with turbine blades. A carrion removal program will run for the operational lifetime of the Project and will apply to any carcass found within 200 m of turbines in accessible areas. The following procedure will be adopted: • The Site Environmental Advisor or another suitable person will be appointed as the carrion removal coordinator. This person will be responsible for the organisation of monthly inspections by appointed staff. Inspections will be completed by vehicle and/or on foot of accessible areas up to 200 m of turbines. All full-time employed site personnel will be trained on the carrion removal procedure. • All bird or bat carcasses should be stored in a double-wrapped plastic bag and placed in a freezer located on site with the appropriate information labelled for identification. • The following information will be collected for each bird or bat carcass: specimen number, GPS location, species, date and time, visible signs of injury, photographs of the carcass, weather conditions. • The location and date of discovery and date of removal of all non-bird or bat carcasses will be recorded and maintained in a database by the carrion removal coordinator. • Any feral or overabundant native animal control program implemented must include the removal of all carcasses from the Project. • Any carrion detected incidentally outside the carrion removal inspection is to be removed in a timely manner.	Throughout Project operations

9.0 Reporting Requirements

The proposed reporting requirements of this BBAMP are detailed in **Table 9.1**.

Table 9.1 BBAMP Reporting Requirements

Report	Description	Timing
Annual Carcass Search Program	Following each year of the carcass search program, the program findings will be compiled and submitted to the regulator/s within 3 months of survey completion. The report should detail the species impacted including: • Total carcasses/featherspots/injured individuals found for each species. • Locations of carcasses/featherspots/injured individuals found. • Dates carcasses/featherspots/injured individuals were found. • Details of any carcass/featherspots/injured individual finds that triggered impact levels. • Survey methodologies. • Results of detection/persistence trials. • Environmental/meteorological conditions. • Associated statistical analyses. Estimations of annual mortality rates of each EPBC Act or BC Act listed species will also be provided outlining: • 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. It is also necessary to include the calculation of annual mortality rates for all species (including non-listed species) which have recorded mortality in association with the Project. These calculations must consider and factor in the search area and associated effort, searcher efficiency, and carcass persistence rates. The number of carcasses of each species identified during the carcass search program which are utilised in the detectability trials will also be reported. Statistical analysis should be undertaken to provide estimates of the annual total number of collisions for each species in consideration of the carcass search area and effort and the observed carcass persistence times and observer detectability rates. A second report detailing the findings of the full 2-year entire carcass search program must be submitted to the regulator/s within 4 months of completion of 24 months of surveys.	Annually for 2 years, with final report provided within 4 months of survey completion.

Report	Description	Timing
Early Response / Impact Trigger Reporting	Regulators must be notified within 5 business days from when a relevant trigger threshold is met. The report outlining the investigation of the impact causing a specific trigger level to be met will be compiled by the contracted ecologist and must then be submitted to regulator/s as soon as practicable. The impact trigger report will include: • The impact trigger level that was reached. • The species and number of individuals involved in the impact trigger. • The date/s and location/s of recovered carcasses/featherspot. • Any identified ecological factors contributing to the impact trigger such as climate, presence of prey species/foraging opportunities, seasonal factors (i.e. migration). • Whether the event is likely to be rare or regular or may constitute an adverse impact on the species at the local, regional or total population scale. In cases where further monitoring or implementation of mitigation measures is deemed necessary through consultation with the regulator/s, the findings and effectiveness of such must be reported to regulator/s within three months of the commencement of monitoring / the implementation of mitigation measures / within another specified timeframe as determined through consultation with the regulator/s.	If an impact trigger occurs in accordance with **Section 7.1** or **Section 7.2**, DCCEEW will be notified within 5 business days via email. An impact trigger report will then be submitted as soon as practicable after the trigger level was reached.

10.0 References

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Appendix A

Bird and Bat Collision Risk Assessment

umwelt

Yathroo Wind Farm

Bird and Bat Utilisation Assessment

Final

November 2025

Yathroo Wind Farm

Bird and Bat Utilisation Assessment

Final

Prepared by
Umwelt (Australia) Pty Limited

On behalf of
Neoen Australia Pty Ltd

Project Director:	Cormac Collins
Project Manager:	Thomas De Silva
Report No.:	24360 / R06
Date:	November 2025

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Acknowledgement of Country

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Document Status

Rev No.	Reviewer Name	Date	Approved for Issue Name	Date
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V2	Cormac Collins	24/11/2025	Cormac Collins	26/11/2025

Executive Summary

Neoen Australia Pty Ltd proposes the development of the Yathroo Wind Farm (the Project), located approximately 120 km north of Perth in the Shire of Dandaragan, Western Australia. The Project will comprise up to 65 wind turbines, a Battery Energy Storage System (BESS), and associated infrastructure. Umwelt was commissioned to undertake ecological assessments to inform environmental approvals and guide project design.

This Bird and Bat Utilisation Assessment (BBUA) evaluates the potential pre-mitigation collision risk to bird and bat species from wind turbine operations. This assists in identifying what species may require further consideration for impact assessment, mitigation and collision risk modelling. The assessment draws on data from four seasonal Bird and Bat Utilisation Surveys (BBUS), terrestrial vertebrate fauna and habitat assessments, and desktop reviews of regional species records.

Approach

Collision risk to species was assessed using a matrix adapted from Lumsden et al. (2019) to suit impact assessments of Australian wind farms combining:

- Likelihood of Collision: Based on flight height and frequency of occurrence.
- Consequence of Collision: Based on conservation status, population size, demographic resilience, and geographic concentration.

Key Findings

A total of 50 species were assessed (43 bird species, 7 bat species) including:

- **Conservation significant birds**: 16 species assessed.
    - High Collision Risk:
        - Blue-billed Duck (*Oxyura australis* – Priority 4 listed by the Department of Biodiversity, Conservation and Attractions)
        - Peregrine Falcon (*Falco peregrinus* – Other Specially Protected under the *Biodiversity Conservation Act 2016* [BC Act])
    - Moderate Collision Risk: 6 species.
    - Minor Collision Risk: 8 species.
- **Raptors**:
    - Moderate: All 11 diurnal species assessed.
    - Minor: Boobook Owl (*Ninox boobook*).
- **Microbats**: All 7 species assessed received a ‘High’ collision risk rating.
- **Other at-Risk birds**: 15 species assessed.
    - High: Yellow-billed Spoonbill (*Platalea flavipes*).

- Moderate: 10 species
- Minor: 4 species.

Recommendations

It is recommended that this BBUA is updated following future BBUS events to reflect additional data gathered about species' occurrence and flight behaviours within the Project area.

Additionally, this information should be used to inform and prepare a Preliminary Bird and Bat Adaptive Management Plan (BBAMP) to identify and manage impacts to bird and bat species during operations of the Project.

Abbreviations

Abbreviation	Definition
ALA	Atlas of Living Australia
AGL	Above Ground Level
BBAMP	Bird and Bat Adaptive Management Plan
BC Act	Biodiversity Conservation Act 2016 (WA)
BESS	Battery Energy Storage System
BBUA	Bird and Bat Utilisation Assessment
BBUS	Bird and Bat Utilisation Survey
CR	Critically Endangered
Cth	Commonwealth
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment, and Water
EN	Endangered
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Cth)
MI	Migratory
OS	Other Specially Protected
P1–P4	Priority 1 – Priority 4 listed species by DBCA
PMST	Protected Matters Search Tool
RSA	Rotor Swept Area
VU	Vulnerable
WA	Western Australia

Contents

Figures

Tables

Appendices

1.0 Introduction

Neoen Australia Pty Ltd (Neoen) is proposing the development of the Yathroo Wind Farm (the Project) located approximately 120 kilometres (km) north of Perth in the Shire of Dandaragan. The Project is expected to comprise up to 65 wind turbines, a Battery Energy Storage System (BESS) and associated ancillary infrastructure.

Umwelt was commissioned by Neoen in 2024 to undertake ecological surveys to guide design feasibility and support State and Commonwealth environmental approvals for the Project. Bird and bata data gathered from Bird and Bat Utilisation Surveys (BBUS) and vertebrate fauna surveys undertaken from 2024–2025 have been used to prepare this Bird and Bat Utilisation Assessment (BBUA).

1.1 Project Description

The Project is located within the Shire of Dandaragan, approximately 120 km north of Perth, Western Australia. The Project is situated across several freehold properties around Brand Highway and Dandaragan Road, between Dandaragan, Cataby, and Regan's Ford. The Project will tie into existing 132/330 kV double circuit transmission infrastructure, which is scheduled to be upgraded to dual circuit 330 kV. This will provide network access and intersects the western portion of the Project.

1.1.1 Project Definitions

Two areas of study were defined for the Project and are relevant to this BBUA:

- The **Study Area**, provided by Neoen on 1 November 2024 (YTO-PRJ-PA-008), covers 17,213 ha and formed the basis of all BBUS and vertebrate fauna surveys undertaken to date (**Figure 1.1**).
- The **Desktop Study Area** included the Study Area plus an approximate 20 km buffer and was used to assess the broader environmental context of the Project and to undertake desktop assessments to inform the likelihood of occurrence of bird and bat species.

The locations of turbines within the Study Area have also been considered in assessing collision risk.

1.1.2 Turbine Specifications

The Project is proposed to consist of up to 65 wind turbines. The proposed wind turbines will have a horizonal axis with a rotor consisting of three blades with a proposed blade length of up to 91 metres (m). The rotor swept area (RSA) refers to the aerial swept zone of the rotating wind turbine blades. The proposed wind turbines will have a maximum hub height of 170 m and a minimum hub height of 150 m. Based on a maximum blade length of 91 m, the RSA could be located at a height of between 59 m and 261 m Above Ground Level (AGL). The wind turbine specifications provided by Neoen are presented in **Table 1.1** and illustrated on **Figure 1.2**.

Table 1.1 Wind Turbine Specifications

Feature	Maximum Specification
Maximum Hub height	170 m AGL
Minimum Hub Height	150 m AGL
Rotor diameter	182 m
Blade length	91 m
Max upper tip height	261 m AGL
Min lower tip height	59 m AGL
Swept Area	26,015.53 m^2

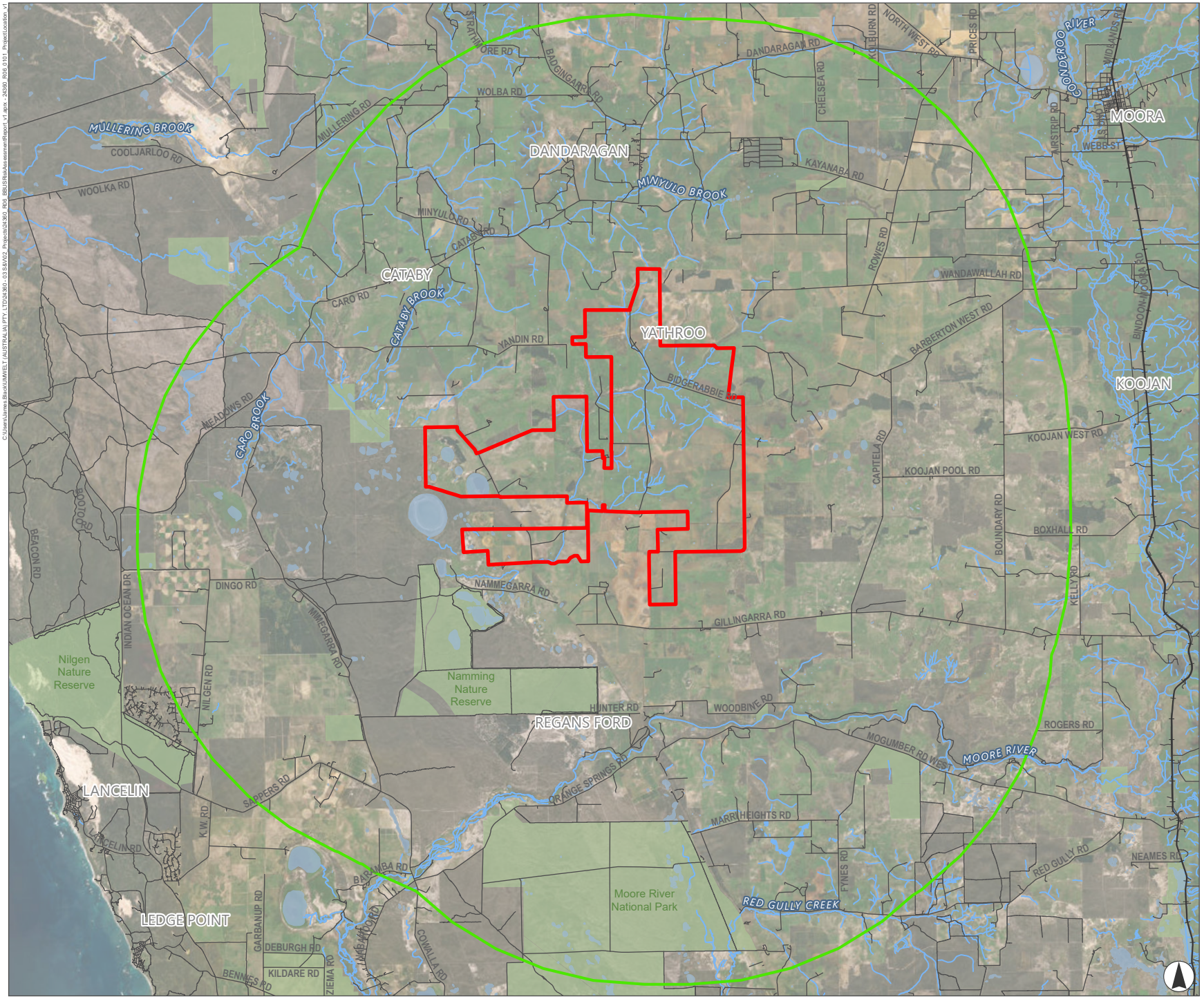
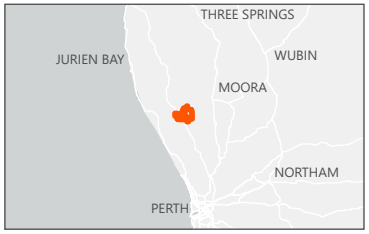


FIGURE 1.1

Survey Area

Legend

- Study Area
- Desktop Study Area
- National Park, Reserves and State Forests
- Railway
- Road
- Watercourse
- Waterbody



0 2 4

Kilometres

Scale 1:320,000 at A4
GDA2020 MGA Zone 50

umwelt

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2024) Umwelt (2025)

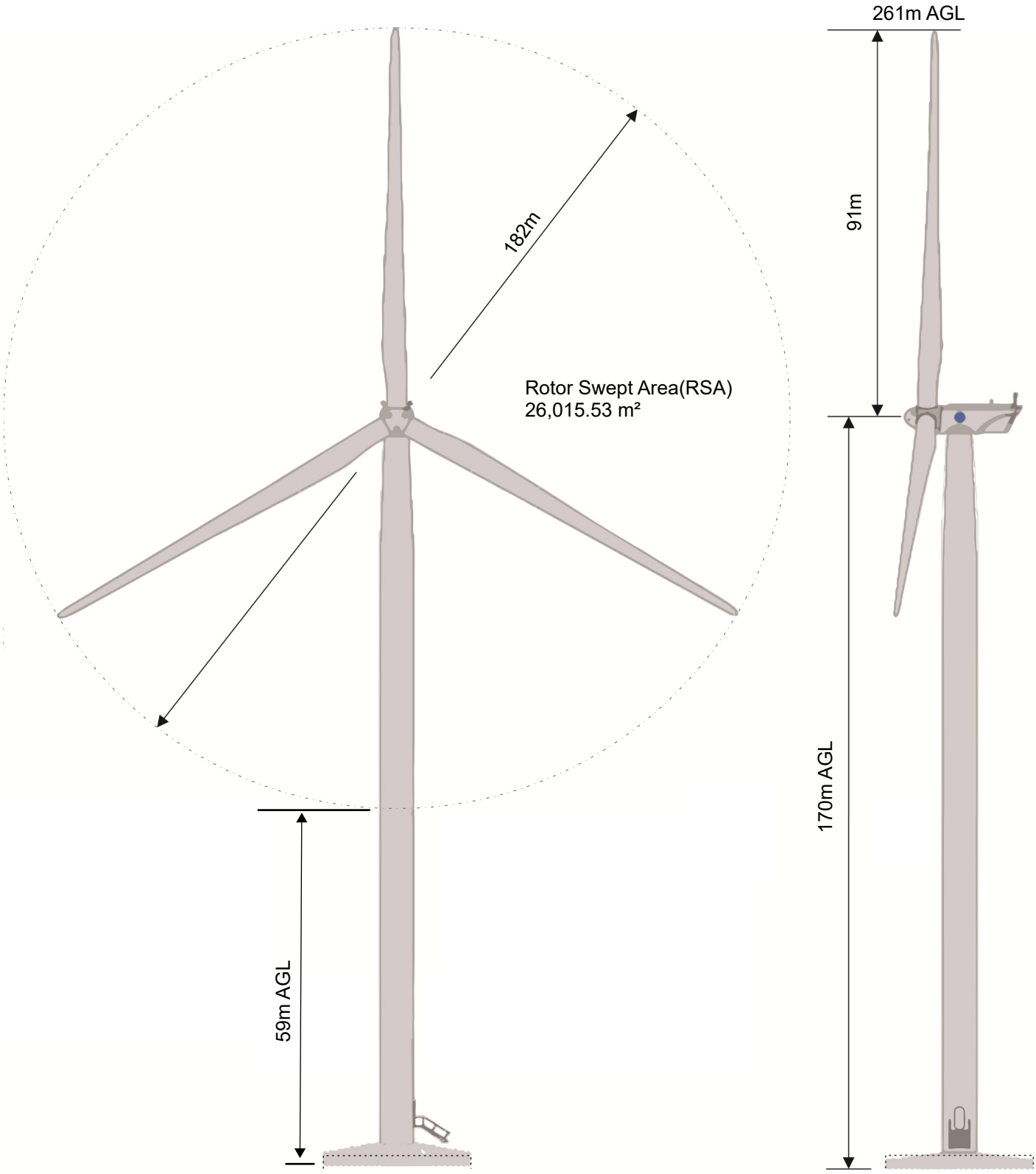


FIGURE 1.2

Turbine Specifications

1.2 Scope of Works

The objective of this BBUA is to assess the pre-mitigation collision risk for bird and bat species that are present or that may occur in the vicinity of wind turbines in the Study Area based on occurrence and flight data gathered from completed surveys and published literature. This assists in identifying what species may require further consideration for impact assessment, mitigation and collision risk modelling. The BBUA also summarises potential impacts to bird and bat species documented in published literature and outlines potential mitigation and management measures to be considered as part of the Project. To achieve this objective, the scope of this BBUA is to:

- Synthesise available data on the occurrence and flight characteristics of bird and bat species through a review of previous technical studies undertaken for the Project.
- Identify those bird and bat species that may be susceptible to blade strike from wind turbines through an analysis of flight behaviours recorded within the Study Area and a review of publicly available data and published literature.
- Identify potential impacts from wind turbine strike to bird and bat species and estimate the relative level of risk on species that are considered most at risk.
- Outline potential mitigation and management measures that have been employed at other wind farms to avoid or mitigate impacts of blade strike on birds and bats.

2.0 Methods

2.1 Previous Ecological Assessments

Three (3) field survey reports and associated data have been used to inform this BBUA. These field surveys captured the bird and bat utilisation, general fauna assemblages, and habitat values present within the Study Area, and were reviewed prior to this assessment and associated data used to inform the BBUA. Reports and associated data include:

- Yathroo Wind Farm: Basic and Targeted Fauna Assessment (Umwelt, 2025a)
- Yathroo Wind Farm: Targeted Fauna Habitat Assessment (Umwelt, 2025b)
- Yathroo Wind Farm: Year One Bird and Bat Utilisation Summary Report (Umwelt, 2025c).

An overview of the field surveys completed to date (hereafter referred to as the 'field survey program') is provided in **Table 2.1**. The relevant technical reports used to inform this BBUA provide a greater level of detail regarding field survey methodology, sample site locations, and field survey coverage than is presented here.

Table 2.1 Yathroo Wind Farm Field Survey Program

Survey	Consultant	Survey Details	Survey Dates
BBUS Trip 1	Umwelt	Spring BBUS	9–15 September 2024
Terrestrial Fauna Assessment	Umwelt	Basic and Targeted Vertebrate Fauna Assessment	29 October – 5 November 2024
Terrestrial Fauna Assessment	Umwelt	Basic and Targeted Vertebrate Fauna Assessment	10 December 2024
BBUS Trip 2	Umwelt	Summer BBUS	13–17 February 2025
BBUS Trip 3	Umwelt	Autumn BBUS	4–8 May 2025
Targeted Fauna Habitat Assessment	Umwelt	Conservation Significant Fauna Habitat Assessment	23–27 June 2025
Targeted Fauna Habitat Assessment	Umwelt	Conservation Significant Fauna Habitat Assessment	21 July 2025
BBUS Trip 4	Umwelt	Winter BBUS	21–25 July 2025

2.2 Likelihood of Occurrence Assessment

Likelihood of occurrence assessments were originally prepared by Umwelt (2025a) and Umwelt (2025c) and have been consolidated to reflect the results of the full field survey program undertaken to date. Umwelt (2025a; 2025d) provide a more detailed methodology for the likelihood of occurrence assessment than is presented here but an overview of the method is summarised below.

To accurately evaluate the potential occurrence of each conservation significant bird or bat species within the Study Area, the likelihood of occurrence assessments considered:

1. the habitat suitability provided within the Study Area, as well as
2. the abundance, age and proximity of desktop records nearest to the Study Area.

The assessment presented here provides the latest updated information available for the Project and is supported by all field survey program results. For detailed information on desktop database searches and records, see Umwelt (Umwelt, 2025a, 2025c).

The criteria governing the likelihood of occurrence assessment used to inform this BBUA are presented in **Table 2.2.**

Table 2.2 Likelihood of Occurrence Categories

Likelihood Category	Description
Known	The species has been recorded during the field survey program or from recent, reliable desktop records within the Study Area.
High	The Study Area contains suitable habitat and there are recent desktop records of the species occurring in close proximity to the Study Area. OR Species known distribution overlaps the Study Area which contains suitable habitat.
Moderate	The species is known from the broader area (Desktop Study Area) and some preferred habitat is present within the Study Area. Aerial foragers and other migratory birds that may overfly the Study Area are also included in this category.
Low	The species has been recorded within the Desktop Study Area however, there is limited habitat (i.e. quantity, type and quality) within the Study Area. This may include marginal and isolated habitat with limited ability for the species to access. OR The species may disperse through the Study Area infrequently and is unlikely to depend on the habitat for survival.
Very Low	The Study Area offers limited to no potential habitat for the species, is outside its known range, and/or is lacking broader habitat requirements.

2.3 Wind Turbine Collision Risk Assessment

The relative risk of wind turbine collision was estimated for species using the method described below.

2.3.1 Approach

The risk assessment considered the likelihood of species presence within the Study Area, the species conservation status and the flight characteristics of the species. Species that met any of the following criteria were included in the risk assessment:

- Conservation significant bird and bat species (i.e. listed under the EPBC Act, BC Act or as Priority species by DBCA) recorded within the Study Area or deemed to have a Moderate or greater likelihood of occurrence within the Study Area.

- Raptor species that are not conservation significant and were recorded within the Study Area or deemed to have a Moderate or greater likelihood of occurrence within the Study Area. Non-listed raptors are assessed as a group independent of whether they have conservation listing as they naturally occur in low numbers due to their high trophic order and exhibit flight behaviours likely to put them at-risk of blade strike.
- Microbats that are not conservation significant and were recorded within the Study Area or deemed to have a Moderate or greater likelihood of occurrence within the Study Area. Non-listed microbats are assessed as a group as they are known to be prone to blade strike and potential barotrauma.
- Bird species recorded flying at RSA height in the Study Area.
- Bat species recorded in the Study Area that have moderate or high potential to occur at RSA height.

2.3.2 Criteria for Estimating the Relative Risk of Collision

The relative risk for assessed species was estimated using two (2) criteria to ascribe likelihood of risk, and four (4) criteria to ascribe consequence of risk (**Table 2.3** and **Table 2.4**). This method was employed in a study that aimed to develop a science-based approach to aid decision-making regarding wind turbine collision risk for birds and bats in Victoria (Lumsden et al., 2019).

Each criterion was either adopted unchanged or adjusted for the purposes of this assessment to ensure each was relevant to specific aspects of the Project, for example geographic location. For the purposes of this assessment, Criteria A, C and F were slightly altered, Criterion B was substantially altered, and the thresholds and spatial scale for Criterion E were adjusted. Adjustments were primarily made to capture the necessary requirements of an impact assessment for wind farm projects within Australia. Further adjustments recognised the broader ecological study, such as making use of the likelihood of occurrence assessment where Lumsden et al. (2019) relied on a broader method of assessing a species habitat preference within a wind farm site.

Each species was ranked either 'Low', 'Moderate' or 'High' for each criterion depending on which was most appropriate in consideration of the assessed species' ecology and observed or predicted utilisation of the Study Area. Descriptions for each criterion are summarised in **Table 2.3** and **Table 2.4.** and outlined below. Detailed descriptions across each risk ranking are provided in **Table 2.5.**

Table 2.3 Criteria Used to Ascribe Likelihood of Risk

A	B
Known or likely frequency of flights within RSA height	Status or frequency of occurrence within the Study Area

Table 2.4 Criteria Used to Ascribe Consequence of Risk

C	D	E	F
Highly localised or concentrated population (for whole or part of lifecycle), such that siting of wind farm could have significant consequence to Western Australian, national or international population.	Impact on population relative to demographic capacity to replace fatalities (i.e., generalised combination of dispersal capacity of potential replacements, fecundity and generation time).	Known or estimated size of national or global population.	Listed conservation status under the EPBC Act and BC Act.

Criterion A (flight height) was assessed by identifying the frequency of flights observed between 59 m and 261 m AGL (RSA height range for the Project) in the Study Area and assessing this with consideration of observed and reported flight behaviour from elsewhere in Australia (where available). Given that flight height data for bird and bat species in Australia is limited and observational data from pre-construction surveys at wind farms sites is largely unavailable, estimates of flight height require an adequate number of observations from the assessed site coupled with consideration of expert opinion on known flight behaviour for each species assessed. This Criterion is important as flight height is the primary variable through which a relative estimate of collision risk can be reached.

Criterion B (status within Study Area) was assessed by determining the status or estimating the frequency of occurrence in the Study Area. This Criterion is included as it is an essential component for estimating overall blade strike risk. This Criterion was primarily assessed using the likelihood of occurrence results which was based on data from field surveys or in the absence of species observations, it was predicted based on historical and local observations, known ranges and/or presence of suitable foraging or nesting habitat.

Geomorphology of wetlands and turbine locations within the Study Area are considered for Criterion B assessments for migratory shorebird species. Wetlands in the western portion of the Study Area (west of Brand Highway) are located in the Lesueur Sandplain subregion which is comprised of coastal Aeolian and limestones, Jurassic siltstones and sandstones (often highly laterised) and alluvials associated with drainage systems (Desmond & Chant, 2002) and the resultant wetlands are nutrient rich and of high foraging value to shorebirds. To the east of Brand Highway lies the Dandaragan Plateau subregion (SWA01) which is composed of cretaceous marine sediments, mantled by sands and laterites (Desmond, 2001). The wetlands in this portion of the Study Area drain quickly and have lower nutrients and anecdotally the BBUS data supports this assessment with lower species diversity and lower abundance. Migratory shorebird species are likely to prefer wetlands located in the Lesueur Sandplain subregion and unlikely to fly eastward to the lower quality habitats, although there is the potential for some intermittent east to west bird movements. With this considered, Criterion B for migratory shorebirds who have only been found in the western portion of the Study Area is assigned as 'possible'.

Criterion C (geographic population concentration) was assessed by estimating the degree to which a species' population may be concentrated due to site related factors such as geographic location, habitat type, proximity to important habitat or roost locations (i.e., significant wetlands, roost caves) and how this relates to the specific landscape in which the Project is located. Lumsden et al. (2019) noted that this criterion is intended to account for situations where the degree to which a taxon is geographically concentrated may influence the risk posed by the particular location of a wind farm. Where large flocks or aggregations are involved the concentration of individuals may be for short seasonal periods but may nonetheless substantially heighten risk to a large portion of a species' total population. This is particularly important if a large proportion of a species' population passes through a localised area, such as a migratory corridor, over the course of each seasonal passage.

Criterion D (demographic resilience) was assessed through consideration of known aspects of each assessed species breeding biology and, most specifically, the nature of species' life-history traits. This criterion is included in the risk assessment as it is necessary to estimate the capacity to which a species may replace individuals lost to mortality resulting from blade strike.

Criterion E (population size) is included to account for the variation in the consequence of mortality of a given number of individuals between species. This, when assessed in combination with Criterion D, provides a measure through which the relative vulnerability of a species to loss of individuals can be estimated.

Criterion F (listed conservation status) refers to the status of bird and bat species listed under the EPBC Act or BC Act. In instances where a species listing differs between the state and Commonwealth legislation, for example one that is listed Vulnerable under the EPBC Act and Endangered under the BC Act, the higher threatened listing status is selected for the purposes of this assessment. The order of conservation status being Critically Endangered, Endangered, and Vulnerable. Species listed as Migratory and/or Marine under the EPBC Act, Other Specially Protected or Conservation Dependent under the BC Act, or Priority species by DBCA are not assigned a rank for this criterion.

Table 2.5 Descriptions of Each Criterion A–F

Rank	Likelihood		Rank	Consequence			
	Criterion A	**Criterion B**		**Criterion C**	**Criterion D**	**Criterion E**	**Criterion F**
Unlikely	Species that do not or rarely fly at RSA height.	Species that rarely occur in the Study Area.	**Low**	Species that are widely distributed within areas of suitable habitat and the habitat itself is relatively widely dispersed.	Species that form breeding territories and that have a reasonable proportion of the population as nonbreeding 'floaters' that can rapidly replace breeding territorial adults if lost; species that may or may not form breeding territories and that are short-lived and have high fecundity; species that have capacity for long range or widespread juvenile or sub-adult dispersal.	Total population (i.e., whether that corresponds to the national population of Australian endemics or a migrant's global population) is estimated to number more than 20,000 individuals.	Species not listed as Threatened under the EPBC Act or the BC Act.
Possible	Species which regularly fly below RSA height and occasionally fly at RSA height.	Species that occasionally occur in or occasionally move through the Study Area.	**Moderate**	Species that may be more widespread or have greater flexibility in the range of suitable habitat availability, but where a high proportion of their population is likely to be concentrated at sites where they do occur.	Species with life-history characteristics that sit between the low and high descriptions.	Total population is estimated to number between 5,000 and 20,000 individuals.	Species listed as Vulnerable under the EPBC Act or the BC Act.
Likely	Species in which a high proportion of flight activity is at RSA height.	Species that regularly occur in or regularly move through the Study Area.	**High**	Bat species that have major aggregations at a few caves, or bird or bat species that have either very restricted distributions or those where a substantial proportion of a population may move through certain areas (i.e. migratory pathways).	Species that form breeding territories but where there is limited capacity for a lost breeding adult to be readily replaced; species that do not form breeding territories and that are long-lived and/or have low fecundity; species that may have short-distance juvenile or sub-adult dispersal capacity only.	Total population is estimated to number less than 5,000 individuals.	Species listed as Endangered or Critically Endangered under the EPBC Act or the BC Act.

2.3.3 Estimating Overall Risk

Estimates of overall risk for each assessed species were determined by following an approach similar to that employed by Lumsden et al. (2019) with the most notable exception being the difference in spatial scale for which resulting estimates of risk are intended to be relevant to (i.e., state-wide vs site-specific). Elements of the likelihood and consequence of collision were combined to form an overall qualitative risk category and specific to the Project for the likelihood of collision (Unlikely/Possible/Likely) and the consequence of collision (Low/Moderate/High).

Likelihood of collision questions (Criterion A and B) and consequence of collision questions (Criterion C to F) were combined in a generally additive process to determine whether the overall likelihood and consequence of collisions was 'Low', 'Moderate', or 'High'.

Likelihood of Collision

The overall **likelihood of collision** was determined using the matrix presented in **Table 2.6.**

Table 2.6 Risk Likelihood Matrix

		Criterion B		
		Unlikely	**Possible**	**Likely**
Criterion A	**Unlikely**	Unlikely	Possible	Possible
	Possible	Possible	Possible	Likely
	Likely	Possible	Likely	Likely

*Note. *In cases where Criterion A risk is 'Unlikely' because the likelihood of flight at RSA is deemed highly unlikely based on knowledge of the species' flight behaviour and/or observations from the Study Area, the overall likelihood rating may be downgraded to 'Unlikely'. In cases where Criterion B risk is 'Unlikely' because the likelihood of occurrence is deemed very unlikely based on the distribution of the species, expert advice and/or supported by literature or records, the overall likelihood rating may be downgraded to 'Unlikely'.*

Consequence of Collision

The following describes how the **consequence of collision** was determined:

- **High**: At least two of Criteria C through F are 'High', or the consequence associated with Criterion C for localised concentration is 'High'. It was considered that the consequences of high mortality due to wind turbine collisions for species that have a limited distribution and/or have the capacity to be highly concentrated is sufficiently large such that, if a species' consequence associated with this element was 'High', the overall consequences of collision should also be set to High, irrespective of the consequence of the other criteria.
- **Moderate**: At least two of Criteria C through F were 'Moderate' and no more than one was 'High'.
- **Low**: At least three of Criteria C through F were 'Low'.

In cases where risk achieved equivalent ranking across two criteria, the higher risk rating was designated, e.g., two 'Moderate' and two 'High' criteria would result in a 'High' rating.

Overall Risk

Once the overall risk levels for the likelihood and consequence of collision specific to the Project had been assigned for a species, the results were then placed into a risk matrix to determine overall level of risk (**Table 2.7**).

Five categories of risk were used, namely 'Negligible', 'Minor', 'Moderate', 'High', and 'Very High', based on the combination of the scores for likelihood and consequence.

Table 2.7 Overall Risk Matrix

		Consequence of Collisions		
		Low	Moderate	High
Likelihood of Collisions	Unlikely	Negligible	Minor	Moderate
	Possible	Minor	Moderate	High
	Likely	Moderate	High	Very High

The overall risk rating assigned to a species is indicative of the level of concern for that species based on the likelihood of collisions and the consequence of those collisions prior to the implementation of any mitigation measures. A description of the overall risk ratings is provided in **Table 2.8**.

Table 2.8 Overall Risk Descriptions

Risk	Description	Response
Very High	• The species is **likely** to be involved in collisions within the Study Area, and a collision would have a **high consequence** for the species.	A Collision Risk Model (CRM) should be considered to be undertaken for the species if sufficient data is available. If data is insufficient, using a surrogate species may be appropriate if a suitable surrogate species is available. The species will require consideration for collision impacts as part of an impact assessment to identify suitable mitigation measures and will need to be addressed in the Project BBAMP.
High	• The species is **likely** to be involved in collisions within the Study Area, and a collision would have a **moderate consequence** for the species, **OR** • it is **possible** the species would be involved in collisions within the Study Area, and a collision would have a **high consequence** for the species.	The species will require consideration for collision impacts as part of an impact assessment to identify suitable mitigation measures and a CRM or alternative method to quantify collision risk may be required. The species may also need to be addressed in the Project BBAMP.

Risk	Description	Response
Moderate	• The species is **likely** to be involved in collisions within the Study Area, and a collision would have a **low consequence** for the species OR • It is **possible** the species would be involved in collisions within the Study Area, and a collision would have a **moderate consequence** to the species OR • The species is **unlikely** to be involved in collisions within the Study Area, but there would be a **high consequence** to the species.	Conservation significant species will require consideration for collision impacts as part of an impact assessment and may require mitigation measures.
Minor	• The species is **unlikely** to be involved in collisions within the Study Area, and a collision would have a **moderate consequence** for the species OR • It is **possible** the species would be involved in collisions within the Study Area, but a collision would have a **low consequence** to the species.	Conservation significant species may require some considerations for collision impacts as part of an impact assessment.
Negligible	• The species is **unlikely** to be involved in collisions within the Study Area, and any collision would have a **low consequence** to the species.	The species is unlikely to require consideration for collision impacts as part of an impact assessment.

It should be noted that the specific aspects of a species' life-history traits, ecology, population size or conservation status which inform the level of consequence from a collision differ from species to species. The detailed collision risk assessment (**Appendix B**) should be referred to when interpreting the consequence of a collision to a species. For example, in some instances a species' consequence of collision may be because of low population size and endangered conservation status and therefore a loss of any individual represents an impact to that species' ability to recover. In other instances, a species' consequence may be related to that species demographic resilience and geographic population concentration within the Study Area and therefore not only is a species less likely to be able to replace a lost breeding adult, but a higher proportion of the species' population may be at risk of collision due to their concentration within the Study Area.

3.0 Results

3.1 Likelihood of Occurrence Assessment

Species presented in **Table 3.1** include all conservation significant bird and bat species (i.e. listed under the EPBC Act, BC Act, or as Priority species by DBCA) which were assessed as:

- having a 'Known' likelihood of occurring due to being recorded during the field survey program
- having a 'High' likelihood of occurring
- having a 'Moderate' likelihood of occurring.

Likelihood of occurrence assessments reflect the results of the field survey program completed to date. Any conservation significant species that were determined as having a 'Very Low' or 'Low' likelihood of occurrence were not considered relevant to this BBUA. The detailed likelihood of occurrence for all conservation significant species identified during the desktop assessment or field survey program is provided in **Appendix A**.

A total of 11 conservation significant bird species had a 'Known' likelihood of occurrence within the Study Area and have been recorded at some stage during the field survey program. Four (4) bird species had a 'High' likelihood of occurrence and 2 received a 'Moderate' ranking based on the results of the desktop assessment presented in Umwelt (2025c).

Table 3.1 Likelihood of Occurrence

Common Name	Scientific Name	WA Status	Cth Status	Likelihood of Occurrence
Blue-billed Duck	*Oxyura australis*	P4	-	Known
Black-tailed Godwit	*Limosa limosa*	MI	EN & MI	Known
Carnaby's Black-Cockatoo	*Zanda latirostris*	EN	EN	Known
Common Greenshank	*Tringa nebularia*	MI	EN & MI	Known
Peregrine Falcon	*Falco peregrinus*	OS	-	Known
Red-necked Stint	*Calidris ruficollis*	MI	MI	Known
Ruff	*Calidris pugnax*	MI	MI	Known
Sharp-tailed Sandpiper	*Calidris acuminata*	MI	VU & MI	Known
Wood Sandpiper	*Tringa glareola*	MI	MI	Known
Forest Red-tailed Black-cockatoo	*Calyptorhynchus banksii naso*	VU	VU	Known
Common Sandpiper	*Actitis hypoleucos*	MI	MI	High
Curlew Sandpiper	*Calidris ferruginea*	CR	CR & MI	High
Glossy Ibis	*Plegadis falcinellus*	MI	MI	High
Pacific Golden Plover	*Pluvialis fulva*	MI	MI	High
Long-toed Stint	*Calidris subminuta*	MI	MI	Moderate
Fork-tailed Swift	*Apus pacificus*	MI	MI	Moderate

3.2 Risk Assessment

The results of the collision risk assessment for bird and bat species included as part of this risk assessment are summarised in **Table 3.2**, **Table 3.3**, **Table 3.4** and **Table 3.5** according to the criteria met for their inclusion. The full results of the collision risk assessment are provided in **Appendix A**.

Based on the Projects RSA height range (59-261 m AGL), information from the desktop assessment, and results of the field survey program undertaken to date, no species were assessed as having a 'Very High' overall collision risk rating for the Project.

Ten (10) species, including two (2) which are conservation significant (Blue-billed Duck and Peregrine Falcon),seven (7) within the microbats species group and one non-listed species (Yellow-billed Spoonbill) were considered to have a 'High' overall collision risk rating. A 'Moderate' overall collision risk rating was assigned to six conservation significant bird species as well as all 11 species in the diurnal raptors group. Ten (10) non-listed species recorded flying within RSA height during the BBUS program also received a 'Moderate' overall collision risk rating. The remaining 14 species received a 'Minor' overall collision risk rating.

Table 3.2 Conservation Significant Species Risk Assessment Results

Common Name	Scientific Name	Likelihood of Collision	Consequence of Collision	Overall Risk Rating
Blue-billed Duck	*Oxyura australis*	Likely	Moderate	**High**
Peregrine Falcon	*Falco peregrinus*	Likely	Moderate	**High**
Carnaby's Cockatoo	*Zanda latirostris*	Unlikely	High	**Moderate**
Forest Red-tailed Black Cockatoo	*Calyptorhynchus banksii naso*	Unlikely	Moderate	**Minor**
Fork tailed Swift	*Apus pacificus*	Likely	Low	**Moderate**
Glossy Ibis	*Plegadis falcinellus*	Possible	Low	**Minor**
Migratory Shorebirds				
Common Greenshank	*Tringa nebularia*	Possible	Moderate	**Moderate**
Sharp-tailed Sandpiper	*Calidris acuminata*	Possible	Moderate	**Moderate**
Black-tailed Godwit	*Limosa limosa*	Possible	Moderate	**Moderate**
Curlew Sandpiper	*Calidris ferruginea*	Possible	Moderate	**Moderate**
Red-necked Stint	*Calidris ruficollis*	Possible	Low	**Minor**
Wood Sandpiper	*Tringa glareola*	Possible	Low	**Minor**
Common Sandpiper	*Actitis hypoleucos*	Possible	Low	**Minor**
Long-toed Stint	*Calidris subminuta*	Possible	Low	**Minor**
Pacific Golden Plover	*Pluvialis fulva*	Possible	Low	**Minor**
Ruff	*Calidris pugnax*	Possible	Low	**Minor**

Table 3.3 Raptor Species Risk Results

Common Name	Scientific Name	Likelihood of Collision	Consequence of Collision	Overall Risk Rating
Diurnal Raptors				
Australian Hobby	*Falco longipennis*	Likely	Low	**Moderate**
Nankeen Kestrel	*Falco cenchroides*	Likely	Low	**Moderate**
Black-shouldered Kite	*Elanus axillaris*	Likely	Low	**Moderate**
Brown Falcon	*Falco berigora*	Likely	Low	**Moderate**
Brown Goshawk	*Accipiter fasciatus*	Likely	Low	**Moderate**
Little Eagle	*Hieraaetus morphnoides*	Likely	Low	**Moderate**
Spotted Harrier	*Circus assimilis*	Likely	Low	**Moderate**
Swamp Harrier	*Circus approximans*	Likely	Low	**Moderate**
Wedge-tailed Eagle	*Aquila audax*	Likely	Low	**Moderate**
Whistling Kite	*Haliastur sphenurus*	Likely	Low	**Moderate**
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	Likely	Low	**Moderate**
Nocturnal Raptors				
Boobook Owl	*Ninox boobook*	Possible	Low	**Minor**

Table 3.4 At-risk Species Risk Results

Common Name	Scientific Name	Likelihood of Collision	Consequence of Collision	Overall Risk Rating
Yellow-billed Spoonbill	*Platalea flavipes*	Likely	Moderate	**High**
Australian Magpie	*Gymnorhina tibicen*	Likely	Low	**Moderate**
Australian Pelican	*Pelecanus conspicillatus*	Likely	Low	**Moderate**
Australian Raven	*Corvus coronoides*	Likely	Low	**Moderate**
Australian Shelduck	*Tadorna tadornoides*	Likely	Low	**Moderate**
Australian Wood Duck	*Chenonetta jubata*	Likely	Low	**Moderate**
Little Pied Cormorant	*Microcarbo melanoleucos*	Likely	Low	**Moderate**
Straw-necked Ibis	*Threskiornis spinicollis*	Likely	Low	**Moderate**
Tree Martin	*Petrochelidon nigricans*	Likely	Low	**Moderate**
Welcome Swallow	*Hirundo neoxena*	Likely	Low	**Moderate**
White-faced Heron	*Egretta novaehollandiae*	Likely	Low	**Moderate**
Dusky Woodswallow	*Artamus cyanopterus*	Possible	Low	**Minor**
Galah	*Eolophus roseicapilla*	Possible	Low	**Minor**
Little Black Cormorant	*Phalacrocorax sulcirostris*	Possible	Low	**Minor**

Western Corella	*Cacatua pastinator*	Possible	Low	**Minor**

Table 3.5 Microbat Risk Results

Common Name	Scientific Name	Likelihood of Collision	Consequence of Collision	Overall Risk Rating
White-striped Free-tailed Bat	*Austronomus australis*	Likely	Moderate	**High**
Western Free-tailed Bat	*Ozimops kitcheneri*	Likely	Moderate	**High**
Gould's Wattled Bat	*Chalinolobus gouldii*	Likely	Moderate	**High**
Chocolate Wattled Bat	*Chalinolobus morio*	Likely	Moderate	**High**
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	Likely	Moderate	**High**
Inland Broad-nosed Bat	*Scotorepens balstoni*	Likely	Moderate	**High**
Southern Forest Bat	*Vespadelus regulus*	Likely	Moderate	**High**

4.0 Bird and Bat Potential Impacts

This section provides a high-level overview of common impacts to bird and bat species from wind farm projects. Prior to construction and operation of the Project, it is expected that Neoen will be required to develop a preliminary Bird and Bat Adaptive Management Plan (BBAMP) to manage these impacts along with site-specific and regional considerations of wind farm-species interactions in accordance with the DCCEEW (2024a) Onshore Wind Farm Guidance.

4.1 Collisions

Fauna mortality and injury at wind farms can result from birds or bats colliding with wind turbine blades, towers, nacelles, guy cable, power lines and meteorological masts. There are a range of factors that influence risk of collisions with such infrastructure (Drewitt & Langston, 2008) including:

- Physical attributes of a wind turbine generator (i.e. turbine dimensions, lighting).
- Species-specific variables (i.e. abundance, flight behaviour, turbine avoidance capacity).
- Biophysical attributes (i.e. landscape position, topography, vegetation type).

Factors falling under the latter two points are often interrelated and generally highly spatially and temporally variable by nature. Proximity to roost locations, migratory flight pathways and wetlands appear to be particularly important factors that influence bird and bat utilisation. A range of other factors not necessarily related to a site's biophysical state such as weather conditions (including wind speed, temperature and relative humidity) can also affect utilisation and therefore collision risk (see Amorim et al., 2012).

Data from Australia, Europe and North America indicate that the risk of collision is likely to be highest in any given area or landscape where species most susceptible to collision (i.e. migratory species, raptors, swifts, waterbirds, high flying microbats) most frequently occur, and lowest in areas where activity of such species is comparatively low. The consequence of mortality resulting from collision for any given species is largely influenced by the species' population size and life history traits such as longevity and fecundity which combine to determine a species' capacity to replace individuals lost.

4.2 Barotrauma

Barotrauma is a phenomenon in which rapid air pressure changes from rotating wind turbine blades are hypothesised to cause tissue damage to air-containing structures, most notably the lungs of bats (Baerwald et al., 2008). It has also been hypothesised that barotrauma can cause non-lethal debilitation, such as hearing impairments and other internal injuries that may result in bats succumbing to their injuries away from wind turbines (Lawson et al., 2020). Due to the unique respiratory anatomy of birds, they are considered less susceptible to barotrauma than that of mammals, specifically bats (Baerwald et al., 2008), however it is possible.

Research conducted in North America on the relative risk of barotrauma compared with direct collisions has resulted in mixed findings regarding the proportion of deaths that have been attributed to each factor (Ellison, 2012), though it appears the majority of fatalities are due to collisions (Grodsky et al., 2011; Rollins et al., 2012). Baerwald et al. (2008) found that barotrauma to the lungs and

possibly other organs accounted for 46% of bats killed by wind turbines, with 92% of the barotrauma in those bats displaying as haemorrhaging in the thoracic and/or abdominal cavities. However, Rollins et al. (2012) found that only 6% (5/81) of bats collected at a wind farm in Illinois had lesions possibly consistent with causation by barotrauma, leading the authors to conclude that "*traumatic injury is the major cause of bat mortality at wind farms, and, at best, barotrauma is a minor etiology*". Lawson (2020) used computational fluid-dynamics to model changes in air pressure around moving wind turbine blades to assess the likelihood of bats occurring within areas of extremely high or lower pressure. The modelled air pressures were also compared to those associated with mortality in rats to assess the likelihood of barotrauma resulting in lethal or sub-lethal injuries to bats. Barotrauma was determined unlikely to be a leading cause of death supporting the alternative hypothesis that collisions are more likely to be the predominant pathway for bat mortalities from operating wind turbines.

Due to the difficulty in diagnosing barotrauma unless the carcass is examined immediately after death, it is possible that cases attributed to barotrauma have been confused with traumatic injury associated with direct collisions. There is currently no published information on barotrauma in Australia.

5.0 Bird and Bat Management Actions

This section outlines the adaptive management approach and presents mitigation measures which will be considered as part of the development of a Project-specific BBAMP. The BBAMP will address Project impacts along with site-specific and regional considerations of wind farm-species interactions and will be prepared prior to the operation of the wind farm.

The Project BBAMP would be finalised through consultation with state and Commonwealth agencies as required.

5.1 Adaptive Management Approach

The aim of a BBAMP is to monitor and mitigate the potential impacts of wind turbine strike on birds and bats via trigger based, adaptive management in accordance with DCCEEW (2024a). Pre and post commissioning monitoring of bird and bat activity (including flight behaviours) is a key requirement of the plan and monitoring will inform a risk profile of each wind turbine to direct tailored management actions when and where required.

The objectives of a BBAMP are typically to:

- Provide an overview of pre-commissioning survey results for the Project.
- Present the outcomes of the collision risk assessment, focussing on species which were deemed a high or very high risk of collision impacts.
- Present an overview of post-commissioning survey requirements including further bird and bat utilisation surveys, as well as a carcass detection program.
- Provide proposed impact trigger thresholds for listed threatened and migratory species.
- Present the adaptive management framework to be initiated in the event that a trigger threshold is reached or exceeded.
- Outline ongoing and preventative mitigation and management measures, as well as reporting requirements.

5.2 Mitigation Measures

There are a range of mitigation measures employed at wind farms globally in efforts to reduce the impacts of operating wind turbines on birds and bats. These include measures designed to deter birds and bats from wind turbines, measures employed to minimise the attractiveness of wind turbines and measures used to lure birds and bats away from wind turbines. Other measures include altering the operation of wind turbines (i.e. slowing or stopping) such that the risk of birds and/or bats that do fly through a wind turbine's RSA may be at lower risk of impact. Despite the widespread implementation of several mitigation measures, there has been relatively little empirical research conducted on the efficacy of the majority of those measures employed (Gartman et al., 2016). Only a few mitigation measures specifically employed to reduce bird and bat collision risk overseas are regularly implemented in Australia and to date there has been no empirical research published on the effectiveness of the mitigation measures employed here.

This next section outlines the main mitigation measures that have been employed in Australia and/or overseas with a focus on cases where measures appear to be effective in reducing direct impacts, noting that the approved BBAMP will provide a more detailed plan for adaptive management actions to reduce impacts.

5.2.1 Carrion Removal

Removal of carrion from near wind turbines is undertaken at wind farms (particularly in Australia) to mitigate the risk of carrion feeders such as raptors and other scavengers colliding with wind turbines. Carrion removal programs typically involve regular searches of target areas for any animal carcasses. Regular searches and removal, limit the amount of time carcasses are present to attract scavengers and can be complemented by opportunistic identification by personnel undertaking unrelated work at a given wind farm.

Despite carrion removal programs being a key component of most bird and bat adaptive management plans prepared for wind farms in Australia, there is currently no publicly available information based on empirical research on their effectiveness. However, regular carrion removal is an established technique to reduce the presence of aerial scavengers employed in aviation to reduce the risk of aircraft bird strike (Australian Airports Association, 2016).

Further to carrion removal directly beneath wind turbines (i.e. on hardstands) it is also a common expectation that wind projects work with involved land holders to encourage the removal of farm carrion (i.e. deceased stock and pest species) from parcels of land directly surrounding wind turbines. Additionally, avoiding lambing seasons from occurring in parcels of land directly surrounding wind turbines is also encouraged. Both of these two mitigation elements however are directly linked to engagement and approval by involved land holders and their contracts with the wind project developer.

5.2.2 Painting Turbines

May et al. (2020) demonstrated in a North American onshore windfarm study, that painting one wind turbine blade black reduced the annual bird fatalities across a range of bird species by 71%, with the most pronounced effect for raptor species. Painting a turbine blade increased rotor visibility by reducing 'motion smear', the phenomenon where fast-moving objects appear to blend together.

It is noted that painting turbine blades may conflict with standard conditions of wind farm project approval (i.e. visual assessment), and this measure may require additional authorisation from regulators and special consideration from stakeholders.

5.2.3 Altering Cut-in Speed of Turbines (Curtailment)

Increasing the cut-in speed of wind turbines (the velocity at which wind turbines start producing electricity) appears to be the most effective mitigation measure for reducing microbat mortality partly because bat mortality rates are generally higher during nights with low wind speeds (Amorim et al., 2012; Kerns et al., 2005; Rydell et al., 2010). Investigations conducted in North America indicate that bat mortality can be reduced by increasing the cut-in speed with reductions in mortality ranging from 30% to 90% reported (E. B. Arnett et al., 2008, 2011; Baerwald et al., 2009). Similarly, Wellig et al. (2018) found that collision risk could be drastically reduced if nocturnal operation of wind turbines would be restricted to wind speeds above 5 ms-1 at a site in Switzerland.

A curtailment study was undertaken at the Cape Nelson North wind farm in southwest Victoria which reported similar results to international studies showing a significant decrease in bat mortality of 54% when curtailment measures were applied to the site (Bennett et al., 2022). This mitigation measure appears to be most effective at locations where there is a high frequency of flights undertaken at RSA such as in migratory pathways.

Nevertheless, curtailment measures are cited as the most successful measure in reducing wind turbine collisions globally, with typical reductions of up to 93% in recorded fatalities and have become standard practice in some areas of Europe for managing potential impacts to bat species (Florent & Bennett, 2024). It should be noted that wind turbine specifications may differ from the wind farms studied previously and the Project; therefore, there may be differences in the associated risks and mitigation of impacts achieved through these measures to bird and bat species.

5.2.4 Temporary Shut-down Periods

Employing temporary shutdown of wind turbines has been shown to be an effective measure for reducing fatalities of certain birds and bats (de Lucas et al., 2012; Gartman et al., 2016; Smallwood & Bell, 2020). While no species assessed as part of this BBUA have been directly researched, findings for other species from international wind farms may provide an indication of the suitability of this mitigation measure. For example, de Lucas et al. (2012) investigated mortality rates for Griffon vulture (*Gyps fulvus*) at 10 out of 13 wind facilities in Spain by conducting wind turbine shutdown programs from 2008 to 2009 and compared rates from a non-stop program in 2006 to 2007. The researchers found that selectively stopping a few wind turbines during a few months of the year can significantly reduce mortality rates by more than 50% (de Lucas et al., 2012; Muñoz et al., 2011).

This mortality reduction was achieved through short shutdown periods between the first two hours after sunrise until the last two hours before sunset, resulting in only a negligible reduction (0.07%) in energy production at the particular wind farm site (de Lucas et al., 2012). In another study, Smallwood & Bell (2020) found that employing wind turbine shutdown periods significantly reduced fatalities of bats but not of birds in the United States of America.

Temporary wind turbine shutdowns and curtailments specifically designed to reduce the risk of strike of a threatened bird species (Tasmanian Wedge-tailed Eagle [*Aquila audax fleayi*]) are employed at the Cattle Hill Wind Farm in Tasmania. These measures are implemented ad-hoc such as in instances where an individual is identified as at-risk of collision rather than being implemented seasonally or at specific times of the day. Although the effectiveness of these measures has not been formally published, the operators of Cattle Hill Wind Farm have reported that the system has effectively reduced collision mortalities for this species in the 18-month period prior to July 2025 (Vorath, 2025).

The method employed by the Cattle Hill Wind Farm is known as an automatic detection system (ADS). These systems trigger a shutdown of wind turbines when a bird considered at risk of collision is identified nearby. There are three primary types of ADS currently in use. The first, two-dimensional (2D) optic systems, generally analyse changes in pixel contrast across successive images to identify a moving object and subsequently uses the size of the object to classify it as a target.

The second, three-dimensional (3D) optic systems, is considered more accurate due to a combination of using a stereoscopic camera and 2D optical camera. This allows the ADS to assess the 3D trajectory of the targeted object. Both ADS rely primarily on manually programmed and/or artificial intelligence algorithms to classify at-risk objects as targets.

The third, radar technology, detects objects via the reflection of radio waves which allows a much larger detection range and deployment at night but currently only classifies targets based on approximate size classes (i.e. not species identification), or sometimes species groupings using their wingbeats. The effectiveness of these technologies in minimising or mitigating the risk of collision is still unconfirmed , and requires further investigation (Ballester et al., 2024).

6.0 Conclusion

In total, 43 bird species and 7 bat species have been assessed for collision risk based on the results of the likelihood of occurrence assessment and field survey program completed to date.

This includes:

- 16 conservation significant bird species recorded during the field survey program or considered to have a Moderate or High likelihood of occurrence
- 12 raptor species recorded during the field survey program
- 15 other non-listed or non-raptor species recorded during the field survey program flying within RSA height
- 7 (seven) microbat species that have been recorded during the field survey program.

The following results were found for conservation significant bird species that have been assessed:

- none were found to have a 'Very High' risk of wind turbine collision
- two (2) were found to have a 'High' risk of wind turbine collision (Blue-billed Duck and Peregrine Falcon)
- six (6) were found to have a 'Moderate' risk of wind turbine collision
- eight (8) were found to have a 'Minor' risk of wind turbine collision.

The diurnal raptor species all received a 'Moderate' collision risk rating, the only nocturnal raptor assessed (Boobook Owl) received a 'Minor' collision risk rating, and all microbat species received a 'High' collision risk rating.

It is recommended that future updates to this risk assessment should be undertaken following the completion of future BBUS to reflect additional data gathered regarding species occurrence, flight heights, and behaviours within the Study Area. The final risk assessment will comprise a key component of the impact assessment process and Project-specific BBAMP to support monitoring and management of potential impacts in accordance with DCCEEW (2024a).

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Appendix A

Detailed Likelihood of Occurrence

Table A.1 Detailed Conservation Significant Species' Likelihood of Occurrence

Scientific Name	Common Name	Cth Listing	WA Listing	ALA	BirdLife	DBCA	NatureMap	PMST	Ecologia	Recorded During Survey	Habitat Requirements	Likelihood of Occurrence
Known												
Oxyura australis	Blue-billed Duck	-	P4	X	X	X	X			X	The species is found on terrestrial wetlands in temperate regions, that are freshwater to saline with extensive bordering vegetation such as reedbeds or other dense vegetation, and waterbodies may be natural or artificial (Carboneras & Kirwan, 2020). It nests in rushes, sedges, Lignum *Muehlenbeckia cunninghamii* and paperbark Melaleuca (BirdLife Australia, 2023).	The Blue-billed Duck was recorded on two (2) occasions during the Summer and Autumn BBUS events. The species is likely to use wetland habitats within the Study Area during both the breeding and non-breeding season.
Limosa limosa	Black-tailed Godwit	EN & MI	MI		X					X	The Black-tailed Godwit is a non-breeding migrant to Australia. In Australia the Black-tailed Godwit occupies a primarily coastal habitat. The species is commonly found in sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats, or spits and banks of mud, sand or shell-grit; occasionally recorded on rocky coasts or coral islets. It is also found in shallow and sparsely vegetated, near coastal, wetlands, such as saltmarsh, salt flats, river pools, swamps, lagoons and floodplains. There are a few inland records, around shallow, freshwater and saline lakes, swamps, dams and bore-overflows. They also use lagoons in sewage farms and saltworks (Higgins & Davies, 1996).	A single Black-tailed Godwit was recorded during the Summer BBUS event. The species may use wetland habitats within the Study Area during the non-breeding season.
Calidris pugnax	Ruff	MI	MI		X					X	The Ruff is a rare but regular visitor to Australia, being recorded in all States and Territories. In Australia it is found on generally fresh, brackish of saline wetlands with exposed mudflats at the edges. It can also be found in terrestrial wetlands including lakes, swamps, pools, lagoons, tidal rivers, swampy fields and flood lands, and occasionally on sheltered coasts, in harbours, estuaries and seashores. They have been known to visit sewage farms and saltworks (Higgins & Davies, 1996).	A single Ruff was recorded during the Summer BBUS event. The species may use wetland habitats within the Study Area during the non-breeding season.
Calidris acuminata	Sharp-tailed Sandpiper	VU & MI	MI		X	X	X	X		X	The Sharp-tailed Sandpiper is a non-breeding migrant to Australia. In Australia, they prefer muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland and have been recorded on saltworks and sewage farms. They have been recorded on flooded paddocks, sedgelands and other ephemeral wetlands, leaving when they dry. Other habitats include intertidal mudflats in sheltered bays, inlets, estuaries or seashores, and also swamps and creeks lined with mangroves. They tend to occupy coastal mudflats mainly after ephemeral terrestrial wetlands have dried out, moving back during the wet season. Sometimes they occur on rocky shores and rarely on exposed reefs (Higgins & Davies, 1996).	The Sharp-tailed Sandpiper was recorded during the Summer BBUS event. The species may use wetland habitats within the Study Area during the non-breeding season.
Calidris ruficollis	Red-necked Stint	MI	MI	X	X	X	X			X	The Red-necked Stint is a non-breeding migrant to Australia. Here, it is mostly found in coastal areas, including in sheltered inlets, bays, lagoons and estuaries with intertidal mudflats, often near spits, islets and banks and, sometimes, on protected sandy or coralline shores. Occasionally they have been recorded on exposed or ocean beaches, and sometimes on stony or rocky shores, reefs or shoals. They have also been recorded on saltworks and sewage farms; saltmarsh; ephemeral or permanent shallow wetlands near the coast or inland, including lagoons, lakes, swamps, riverbanks, waterholes, bore drains, dams, soaks and pools in saltflats. They sometimes use flooded paddocks or damp grasslands and have occasionally been recorded on dry gibber plains, with little or no perennial vegetation (Higgins & Davies, 1996).	The Red-necked Stint was recorded during the Summer BBUS event. The species may use wetland habitats within the Study Area during the non-breeding season.

Scientific Name	Common Name	Cth Listing	WA Listing	ALA	BirdLife	DBCA	NatureMap	PMST	Ecologia	Recorded During Survey	Habitat Requirements	Likelihood of Occurrence
Tringa glareola	Wood Sandpiper	MI	MI	X		X	X			X	The Wood Sandpiper uses well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes. They are typically associated with emergent, aquatic plants or grass, and dominated by taller fringing vegetation, such as dense stands of rushes or reeds, shrubs, or dead or live trees, especially Melaleuca and River Red Gums *Eucalyptus camaldulensis* and often with fallen timber. They have also been known to frequent inundated grasslands, short herbage or wooded floodplains, where floodwaters are temporary or receding, and irrigated crops. This species has been recorded using artificial wetlands, including open sewage ponds, reservoirs, large farm dams, and bore drains (Higgins & Davies, 1996).	The Wood Sandpiper was recorded during the Basic and Targeted Fauna Survey in Spring 2024. The species may use wetland habitats within the Study Area during the non-breeding season.
Tringa nebularia	Common Greenshank	EN & MI	MI	X	X	X	X	X		X	The Common Greenshank does not breed in Australia; however, the species occurs in all types of wetlands in Australia (Higgins & Davies, 1996). It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass. Habitats include embayments, harbours, river estuaries, deltas and lagoons and are recorded less often in round tidal pools, rock-flats and rock platforms. The species uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and saltflats. It will also use artificial wetlands, including sewage farms and saltworks dams, inundated rice crops and bores (Higgins & Davies, 1996).	A single Common Greenshank was recorded during the Summer BBUS event. The species may use wetland habitats within the Study Area during the non-breeding season.
Falco peregrinus	Peregrine Falcon	-	OS	X	X	X	X			X	The Peregrine Falcon is uncommon but wide-ranging across Australia. Habitat is extremely diverse, from rainforest to arid scrub, from coastal heath to alpine. Habitat consists of cliffs, gorges, timbered watercourses, riverine, wetland plains, open woodlands, pylons, spires and buildings (Pizzey & Knight 2021; Morcombe 2004).	The Peregrine Falcon has been recorded during every BBUS event undertaken to date. The species may use the Study Area for foraging and dispersal and may breed in areas with tall trees.
Calyptorhynchus banksii naso	Forest Red-tailed Black-cockatoo	VU	VU	X	X		X			X	The Forest Red-tailed Black-Cockatoo inhabits the dense *Eucalyptus marginata* (Jarrah), *E. diversicolor* (Karri) and *Corymbia calophylla* (Marri) forests in the far southwest of WA. In the Wheatbelt region, they sometimes occupy *E. wandoo* (Wandoo), *E. salmonophloia* (Salmon Gum) or *E. salubris* (Gimlet) woodlands (Birdlife Australia, 2023d). The subspecies does not regularly undertake seasonal movements like other species of black-cockatoo found in southwest WA and will primarily undertake movements in response to the availability of resources. They are also known to breed almost year-round, using hollows of mature trees as nesting sites (Johnstone & Kirkby, 2019).	The Forest Red-tailed Black-Cockatoo was recorded during the Winter BBUS event and Basic and Targeted Fauna Survey. The species may use the Study Area for roosting, foraging, and breeding.
Zanda latirostris	Carnaby's Black-Cockatoo	EN	EN	X	X	X	X	X	X	X	Carnaby's Cockatoo is endemic to, and widespread in, the south-west of Western Australia. Breeding mainly occurs in the wheatbelt, from the Stirling Ranges north-west to near Three Springs, but has also been recorded on the coastal plain to the south-west, around Bunbury (Higgins 1999; Saunders 1974). Carnaby's Cockatoo occurs in uncleared or remnant native eucalypt woodlands, especially those that contain salmon gum and wandoo, and in shrubland or Kwongan heathland dominated by hakea, dryandra, banksia and grevillea species. It also occurs in remnant patches of native vegetation on land otherwise cleared for agriculture (Saunders 1974, 1986). The species forages seasonally in pine plantations in areas that receive high rainfall, e.g. the Swan Coastal Plain (Saunders 1974; Sedgwick 1968, 1973) and around the Perth metropolitan area on both native and non-native plants, such as liquid amber. It also forages in forests containing marri, jarrah or karri (Nichols & Nichols 1984; Saunders 1980).	The Carnaby's Black-Cockatoo has been recorded during every BBUS event undertaken to date. The species may use the Study Area for roosting, foraging, and breeding.

Scientific Name	Common Name	Cth Listing	WA Listing	ALA	BirdLife	DBCA	NatureMap	PMST	Ecologia	Recorded During Survey	Habitat Requirements	Likelihood of Occurrence
High												
Pluvialis fulva	Pacific Golden Plover	MI	MI			X	X				Within Australia, the Pacific Golden Plover is widespread in coastal regions, though there are also several inland records (in all states), sometimes far inland and usually along major river systems. In non-breeding grounds in Australia, they usually inhabit coastal habitats, and occasionally around inland wetlands. Pacific Golden Plovers usually occur on beaches, mudflats and sandflats (including vegetation such as mangroves, low saltmarsh such as *Sarcocornia*, or beds of seagrass) in sheltered areas including harbours, estuaries and lagoons, and in evaporation ponds in saltworks. They have also been recorded on islands, sand and coral cays and exposed reefs and rocks. They are less often recorded in terrestrial habitats, usually wetlands such as fresh, brackish or saline lakes, billabongs, pools, swamps and wet claypans, especially those with muddy margins and often with submerged vegetation or short emergent grass. Other terrestrial habitats inhabited include short (or, occasionally, long) grass in paddocks, crops or airstrips, or ploughed or recently burnt areas, and they are very occasionally recorded well away from water (Marchant & Higgins 1993).	The Pacific Golden Plover was detected from DBCA and NatureMap databases. The DBCA record was within the Study Area and is dated from 1991. The species may use wetland habitats within the Study Area during the non-breeding season.
Calidris ferruginea	Curlew Sandpiper	CR & MI	CR	X	X	X	X	X			The Curlew Sandpiper is a non-breeding migrant to Australia. In Australia, they mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They have also been 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 and forage at the edges of shallow pools and drains of intertidal mudflats and sandy shores. Curlew Sandpipers generally roost on bare dry 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 (Higgins & Davies, 1996).	The Curlew Sandpiper was detected from all database searches. The DBCA record was within the Study Area and is dated from 1991. The species may use wetland habitats within the Study Area during the non-breeding season.
Actitis hypoleucos	Common Sandpiper	MI	MI	X	X	X	X	X			The Common Sandpiper is a non-breeding visitor to Australia and can be found along all Australian coastlines and many inland areas. Habitats frequented by the Common Sandpiper include coastal and inland wetlands, estuaries and deltas of streams, mangroves, around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties (Geering et al., 2007; Higgins & Davies, 1996). Foraging habitat includes shallow water and on bare soft mud at the edges of wetlands, but sometimes into grassy areas adjoining wetlands (Higgins & Davies, 1996). 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 (Higgins & Davies, 1996).	The Common Sandpiper was detected from all database searches. The DBCA record was within the Study Area and is dated from 1990. The species may use wetland habitats within the Study Area during the non-breeding season.

Scientific Name	Common Name	Cth Listing	WA Listing	ALA	BirdLife	DBCA	NatureMap	PMST	Ecologia	Recorded During Survey	Habitat Requirements	Likelihood of Occurrence
Plegadis falcinellus	Glossy Ibis	MI	MI		X	X	X				Within Australia, the Glossy Ibis is generally located east of the Kimberley in Western Australia and Eyre Peninsula in South Australia. The species is also known to be patchily distributed in the rest of Western Australia. Their preferred habitat for foraging and breeding are freshwater marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation. The species is occasionally found in coastal locations such as estuaries, deltas, saltmarshes and coastal lagoons. Within Australia, the largest contiguous areas of prime habitat are inland and northern floodplains (Marchant & Higgins, 1990).	The Glossy Ibis was detected from the BirdLife, DBCA, and NatureMap databases. One recorded from the DBCA database is located within the Study Area from 1990, and another is from 1999 and is approximately 17 km from the Study Area. The species may use wetland habitats within the Study Area and flooded pastures or other wet areas during the non-breeding season.
Moderate												
Apus pacificus	Fork-tailed Swift	MI	MI					X			The Fork-tailed Swift is a non-breeding visitor to all states and territories of Australia, with scattered records along the coast of the Pilbara. This species is almost exclusively aerial and has been observed over inland plains, above foothills and in coastal areas in Australia. They have seldom been observed roosting on trees or the ground, and are thought to roost aerially. They often occur in areas of updraughts, such as along cliffs and have been overserved from less than 1 m to at least 300 m above the ground (Higgins, 1999).	The Fork-tailed Swift was detected from the PMST database only during the desktop assessment. An ad-hoc review of the Cornell Lab of Ornithology (2025) eBird database has identified a record 30 km southwest of the Study Area in Lancelin from April 2025. The record is considered to have low–moderate reliability, but it is considered likely the species may occasionally utilise the airspace above the Study Area for foraging or dispersing, particularly during favourable conditions.
Calidris subminuta	Long-toed Stint	MI	MI		X						The Long-toed Stint is a summer visitor to Australia where it occurs in a variety of terrestrial wetlands. They prefer shallow freshwater or brackish wetlands including lakes, swamps, river floodplains, streams, lagoons and sewage ponds. The species is also fond of areas of muddy shoreline, growths of short grass, weeds, sedges, low or floating aquatic vegetation, reeds, rushes and occasionally stunted samphire. It has also been observed at open, less vegetated shores of larger lakes and ponds and is common on muddy fringes of drying ephemeral lakes and swamps (Higgins & Davies, 1996). The Long-toed Stint forages on wet mud or in shallow water, often among short grass, weeds and other vegetation on islets or around the edges of wetlands. They occasionally feed on open water, well away from the shore although this is more common in drying ephemeral wetlands. They roost or loaf in sparse vegetation at the edges of wetlands and on damp mud near shallow water, and in small depressions in the mud (Higgins & Davies, 1996).	The Long-toed Stint was detected from the BirdLife database and suitable habitat is present within the Study Area. The species may use wetland habitats within the Study Area occasionally during the non-breeding season.

Scientific Name	Common Name	Cth Listing	WA Listing	ALA	BirdLife	DBCA	NatureMap	PMST	Ecologia	Recorded During Survey	Habitat Requirements	Likelihood of Occurrence
Low												
Limosa lapponica	Bar-tailed Godwit	MI	MI		X						The Bar-tailed godwit usually forages at the edge of water or in shallow water within tidal estuaries and harbours. Roosting tends to occur on large intertidal sandflats, spits and banks. Nest is a depression on a dry elevated site such as hummock, often between clumps of grass or under thickets.	The Bar-tailed Godwit was only detected from the BirdLife database. There are no other records within a 20 km radius, and the species prefers coastal habitats which do not occur within the Study Area.
Calidris canutus	Red Knot	VU & MI	EN					X			The Red Knot is a non-breeding migrant to Australia. In Australasia it mainly inhabits intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs. They are occasionally seen on terrestrial saline wetlands near the coast, such as lakes, lagoons, pools and pans, and recorded on sewage ponds and saltworks, but rarely use freshwater swamps. They rarely use inland lakes or swamps (Higgins & Davies, 1996).	The Red Knot was only detected from the PMST database. The Study Area may only provide marginal habitat for this species and is considered unlikely to support the species regularly.
Calidris melanotos	Pectoral Sandpiper	MI	MI		X			X			The Pectoral Sandpiper is a non-breeding visitor to Australia. In Australasia, it prefers shallow fresh to saline wetlands and has been recorded at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. The species is usually found in coastal or near coastal habitat but occasionally found further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire. They forage in shallow water or soft mud at the edge of wetlands (Higgins & Davies, 1996).	The Pectoral Sandpiper was detected from the BirdLife database and PMST database. The Study Area may only provide marginal habitat for this species and is considered unlikely to support the species regularly.
Pandion haliaetus	Osprey	MI	MI	X	X		X	X			The Osprey occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia. They require extensive areas of open fresh, brackish or saline water for foraging (Marchant & Higgins, 1993). They frequent a variety of wetland habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterholes. They exhibit a preference for coastal cliffs and elevated islands in some parts of their range, but may also occur on low sandy, muddy or rocky shores and over coral cays.	The Osprey was detected from the ALA, BirdLife, NatureMap and PMST databases. However, the Study Area may only provide scattered marginal habitat for the species and is considered unlikely to regularly support the species.
Falco hypoleucos	Grey Falcon	VU	VU	X				X			The Grey Falcon inhabits lightly timbered inland plains, especially stony plains and lightly timbered acacia scrubland, and along inland drainage systems (Morcombe, 2004; Pizzey & Knight, 2012). They also occur in gibber deserts, sand ridges, pastoral lands, timbered watercourses and seldom in the driest deserts (Pizzey & Knight, 2012). This species is considered scarce to rare and is usually found singularly or sometimes in pairs (Morcombe, 2004).	The Grey Falcon was detected from the ALA and PMST databases. The species is rarely recorded within the region and is considered unlikely to occur within the Study Area.
Very Low												
Arenaria interpres	Ruddy Turnstone	VU & MI	MI	X							The Ruddy Turnstone is a non-breeding migrant to Australia, being common throughout and widespread within the country. It is mainly found on coastal regions with exposed rock coastlines or coral reefs. It also inhabits platforms and shelves, often with shallow tidal pools and rocky, shingle or gravel beaches. It has also been found on sand, coral or shell beaches, shoals, cays and dry ridges of sand or coral, along estuaries, harbours, bays and coastal lagoons, among low saltmarsh or on exposed beds of seagrass, around sewage ponds and on mudflats (Higgins & Davies, 1996).	The Ruddy Turnstone was only detected from the ALA database and habitat within the Study Area is considered unlikely to support the species.

Scientific Name	Common Name	Cth Listing	WA Listing	ALA	BirdLife	DBCA	NatureMap	PMST	Ecologia	Recorded During Survey	Habitat Requirements	Likelihood of Occurrence
Botaurus poiciloptilus	Australasian Bittern	EN	EN	X		X	X				The Australasian Bittern's preferred habitat is freshwater wetlands and rarely in estuaries or tidal wetlands. with tall dense vegetation. It favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and reeds (e.g. Phragmites, *Cyperus*, *Eleocharis*, *Juncus*, *Typha*, *Baumea, Bolboschoenus*) or cutting grass (*Gahnia*) growing over a muddy or peaty substrate. In the southwest, the Bittern is largely confined to coastal areas, especially along the south coast. It also occurs around swamps, lakes, pools, rivers and channels fringed with lignum *Muehlenbeckia*, canegrass *Eragrostis* or other dense vegetation (Marchant & Higgins, 1990).	The Australasian Bittern was detected from ALA, DBCA, and NatureMap databases. Spatial occurrences for the species are located outside of the Study Area's bioregion and they are considered unlikely to occur within the Study Area despite suitable habitat being available.
Aphelocephala leucopsis	Southern Whiteface	VU	-					X			The Southern Whiteface occurs over most of mainland Australia south of the tropics. The species is described as preferring arid and semi-arid acacia and mallee woodland (Gregory, 2020). DCCEEW (2023) considers critical habitat as areas of relatively undisturbed open woodlands and shrublands with an understorey of grasses or shrubs (or both); habitat with low tree densities and an herbaceous understorey litter cover which provides essential foraging habitat; and living and dead trees with hollows and crevices which are essential roosting habitat (DCCEEW, 2023).	The Southern Whiteface was only detected from the PMST database. The Study Area lacks the preferred habitat for this species, and it is unlikely to occur.
Excluded												
Leipoa ocellata	Malleefowl	VU	VU			X	X	X			The Malleefowl occurs in semi-arid to arid shrublands and low woodlands, especially those dominated by mallee and/or acacias. They require a sandy substrate and abundance of leaf litter for breeding. Densities of the birds are generally greatest in areas of higher rainfall and on more fertile soils where habitats tend to be thicker and there is an abundance of food plants (Benshemesh, 2007).	The Malleefowl was detected from the BirdLife, DBCA, and NatureMap databases. These are likely historical records, and no suitable habitat remains within the Study Area due to extensive clearing.
Rostratula australis	Australian Painted Snipe	EN	EN					X			The Australian Painted Snipe has been recorded at wetlands in all states of Australia. It generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. It also uses 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). The Australian Painted Snipe sometimes utilises areas that are lined with trees, or that have some scattered fallen or washed-up timber (Marchant & Higgins, 1993).	The Australian Painted Snipe was only detected from the PMST database. No other records are present within the Study Area and the nearest DBCA record is over 20 km away and dated to more than 100 years ago.
Numenius madagascariensis	Far Eastern Curlew (Eastern Curlew)	CR & MI	CR					X			The Eastern Curlew is a large non-breeding migrant to Australia, found commonly along the north coast of Western Australia, but rarely south of Shark Bay. It is exclusively coastal and found on intertidal mudflats and sandflats, often with beds of seagrass, on sheltered coasts, especially estuaries, mangrove swamps, bays, harbours and lagoons (BirdLife International, 2024).	The Far Eastern Curlew was only detected from the PMST database. The species is a specialised marine/intertidal zone forager, and no suitable habitat is present within the Study Area.
Thalasseus bergii	Greater Crested Tern (Crested Tern)	MI	MI	X							Within Australia, the Crested Tern occurs along coastal Australia. It nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation. The species utilises offshore, estuarine areas, wetlands and mainland coastline (Higgins & Davies, 1996).	The Greater Crested Tern was only detected from the ALA database. The species is a marine species, and no suitable habitat is present within the Study Area.

Scientific Name	Common Name	Cth Listing	WA Listing	ALA	BirdLife	DBCA	NatureMap	PMST	Ecologia	Recorded During Survey	Habitat Requirements	Likelihood of Occurrence
Zanda baudinii	Baudin's Black-Cockatoo	EN	EN	X							Baudin's Cockatoo occurs in the south-west of WA. Their range varies substantially between the breeding and non-breeding seasons. During the breeding season (from October to January), the species nests in the far south-west of WA within jarrah, marri and karri forests. During the non-breeding season (from February), the range expands as flocks forage more widely, congregating on the central and northern parts of the Darling plateau, as far as Mundaring and Gidgegannup (Department of Climate Change, Energy, the Environment and Water (DCCEEW), 2024c; Saunders, 1974, 1979). Habitat mainly comprises eucalypt forests, especially jarrah (Eucalyptus marginata), marri (*Corymbia calophylla*) and karri forest (*Eucalyptus diversicolor*). They are less frequently recorded in woodlands of wandoo (*E. wandoo*), blackbutt (*E. patens*), flooded gum (*E. rudis*), yate (*E. cornuta*), partly cleared farmlands and urban areas.	The Baudin's Black-Cockatoo was only detected from the ALA database. The Study Area is outside of the known range of this species.
Motacilla cinerea	Grey Wagtail	MI	MI					X			The Grey Wagtail is a non-breeding summer visitor to Australia, mostly in the north. It is associated with running water, sandy, rocky streams in escarpments and rainforests, sewerage ponds, ploughfields and airfields (Pizzey & Knight, 2012).	The Grey Wagtail was only detected from the PMST database. The species is an extremely rare vagrant and is unlikely to occur within the Study Area.

Note. Species taxonomy and nomenclature follows the Western Australian Museum checklist with some modifications from the BirdLife Australia checklist.
ALA=Atlas of Living Australia (2025), BirdLife=BirdLife Australia (2025), DBCA=Department of Biodiversity, Conservation, and Attractions (2024a), NatureMap=Department of Biodiversity, Conservation, and Attractions (2024b), PMST=Department of Climate Change, Energy, the Environment, and Water (2024b), Ecologia=Ecologia (2017).

Appendix B

Detailed Collision Risk Assessment

Yathroo Wind Farm

Detailed Collision Risk Assessment

Final

November 2025

umwelt

Yathroo Wind Farm

Detailed Collision Risk Assessment

Final

Prepared by
Umwelt (Australia) Pty Limited

On behalf of
Neoen Australia Pty Ltd

Project Director: Cormac Collins
Project Manager: Tom de Silva
Report No.: 24360/R06
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Contents

Tables

1.0 Conservation Significant Species

This section presents the detailed risk assessment for all conservation significant bird species identified during the desktop assessment with a Moderate or High likelihood of occurrence, or those recorded during the field survey program.

1.1 Blue-billed Duck (*Oxyura australis*)

Priority 4 – Listed by DBCA

Information on the Blue-billed Duck from Australian Wind Farms

There are no published reports of Blue-billed Duck strikes with wind turbines at Australian wind farms within the species' range.

Likelihood and Consequence of Impacts

The overall risk rating for the Blue-billed Duck is 'High' based on a 'Likely' likelihood rating and a 'Moderate' consequence rating. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.1**.

- **Criterion A:** A 'Possible' rating has been considered appropriate for Criterion A. Flight height data from published literature or field surveys of the Blue-billed Duck is limited; however, the species is known to make longer distance movements between preferred breeding and foraging habitat and may occasionally occur at RSA during such movements. Reid et al. (2023) suggests that approximately 50% of the species' flight time occurs at altitudes between 30 m and 350 m AGL, with a further 10% of flight time spent above 350 m AGL.
- **Criterion B:** A 'Likely' rating has been considered appropriate for Criterion B. The species was recorded during both the Summer 2025 BBUS and Autumn 2025 BBUS with counts of up to 6 individuals during opportunistic censuses of wetland sites. The species is partially migratory and generally disperses from breeding areas in April or May, returning in July or August. Although, this can be dependent on favourable climatic conditions and in some instances the species will remain in breeding areas year-round (BirdLife Australia, 2023b). Therefore, it is considered likely that the species regularly occurs in, or moves through, the Study Area.
- **Criterion C:** A 'Moderate' rating has been considered appropriate for Criterion C. The Blue-billed Duck is somewhat dispersive and partially migratory, with general abandonment of breeding grounds following the breeding season. The species often concentrates in favourable areas until just before the start of next breeding season and may undertake widespread dispersal following exceptional flooding events (Carboneras & Kirwan, 2020b). Individuals may occasionally concentrate within areas of suitable breeding habitat; however, this habitat itself is not restricted to the Study Area when compared to the broader region.
- **Criterion D:** A 'Moderate' has been assigned to Criterion D. The life-history characteristics of Blue-billed Duck overlap with certain aspects of both the descriptions for a Low and High rating for Criterion D (BirdLife Australia, 2023b).

- **Criterion E:** A 'Moderate' ranking has been assigned to Criterion E. The total population of the Blue-billed Duck is estimated at 15,000 mature individuals with a low reliability (Garnett & Baker, 2021).
- **Criterion F:** A 'Low' rating has been assigned to Criterion F. The Blue-billed Duck is not listed under the EPBC Act and is listed as Priority 4 by DBCA.

Appendix Table B.1 Blue-billed Duck Risk Assessment

Likelihood			Consequence				
	Criterion A	Criterion B		Criterion C	Criterion D	Criterion E	Criterion F
Unlikely			**Low**				X
Possible	X		**Moderate**	X	X	X	
Likely		X	**High**				
Risk Rating							
Likelihood	Likely		**Consequence**	Moderate			
Overall Rating: High							

1.2 Carnaby's Black-Cockatoo (*Zanda latirostris*)

Endangered – EPBC Act and BC Act

Information on the Carnaby's Black-Cockatoo from Australian Wind Farms

There are no published reports of Carnaby's Black-Cockatoo strikes with wind turbines at Australian wind farms within the species' range.

Likelihood and Consequence of Impacts

The overall risk rating for the Carnaby's Black-Cockatoo is 'Moderate' based on an 'Unlikely' likelihood rating and a 'High' consequence rating. The likelihood rating for the species was downgraded to 'Unlikely' as it was considered highly unlikely that the species would occur at RSA based on knowledge of the species' flight behaviours. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.2.**

- **Criterion A:** An 'Unlikely' rating has been assigned to Criterion A. The Carnaby's Black-Cockatoo was observed flying on 42 occasions during the BBUS program, all of which were below RSA. The highest flight height recorded was 50 m AGL on 3 occasions. Black cockatoos are considered to rarely fly within RSA unless evading large predatory raptors or making longer distance movements.
- **Criterion B:** A 'Likely' rating has been assigned to Criterion B. The Carnaby's Black-Cockatoo has been recorded during all BBUS, sometimes in flocks of up to 200 individuals.
- **Criterion C:** A 'Moderate' rating has been considered appropriate for Criterion C. A high proportion of the Carnaby's Cockatoo population is likely to be concentrated at sites where they do occur; however, suitable habitat for the species is not itself concentrated within the Study Area compared to the broader region.

- **Criterion D:** A 'High' rating has been assigned to Criterion D. The life-history characteristics of the Carnaby's Cockatoo align with aspects of the description for a 'High' rating such as there being limited capacity to replace a lost breeding adult and it being a long-lived species with low fecundity (Rowley & Kirwan, 2022).
- **Criterion E:** A 'Low' rating has been assigned to Criterion E. The Carnaby's Cockatoo's total population is estimated to comprise of 34,000 mature individuals (Garnett & Baker, 2021).
- **Criterion F:** A 'High' rating has been assigned to Criterion F. The Carnaby's Cockatoo is listed as Endangered under both the EPBC and BC Act.

Appendix Table B.2 Carnaby's Black-Cockatoo Risk Assessment

Likelihood			Consequence				
	Criterion A	Criterion B		Criterion C	Criterion D	Criterion E	Criterion F
Unlikely	X		Low			X	
Possible			Moderate	X			
Likely		X	High		X		X
Risk Rating							
Likelihood	Unlikely*		Consequence	High			
Overall Rating: Moderate							

*The likelihood rating for the species was downgraded to 'Unlikely' as it was considered highly unlikely that the species would occur at RSA based on knowledge of the species' flight behaviours.

1.3 Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*)

Vulnerable – EPBC Act and BC Act

Information on the Forest Red-tailed Black Cockatoo from Australian Wind Farms

There are no published reports of Forest Red-tailed Black-Cockatoo strikes with wind turbines at Australian wind farms within the species' range.

Likelihood and Consequence of Impacts

The overall risk rating for the Forest Red-tailed Black-Cockatoo is 'Moderate' based on an 'Unlikely' likelihood rating and a 'Moderate' consequence rating. The likelihood rating for the species was downgraded to 'Unlikely' as it was considered highly unlikely that the species would occur at RSA based on knowledge of the species' flight behaviours. The rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.3**.

- **Criterion A:** An 'Unlikely' rating has been assigned to Criterion A. The Forest Red-tailed Black-Cockatoo was observed flying on 1 occasion during the BBUS program, with a maximum flight height of 4 m AGL. Black cockatoos regularly fly below the minimum RSA height of 59 m AGL and are likely to rarely fly within RSA unless evading large predatory raptors or making longer distance movements.

- **Criterion B:** A 'Possible' rating has been assigned to Criterion B. Although the Forest Red-tailed Black-Cockatoo was recorded during both the BBUS program and the Fauna Habitat Assessment, both in June and July of 2025, the Study Area is located outside of their core range, and they are only likely to occasionally occur in, or move through, the Study Area.
- **Criterion C:** A 'Low' rating has been considered appropriate for Criterion C. As the Study Area is not within the core range of the Forest Red-tailed Black-Cockatoo, it is considered unlikely for populations to become concentrated by habitats within the Study Area.
- **Criterion D:** A 'High' rating has been assigned to Criterion D. The life-history characteristics of the Forest Red-tailed Black-Cockatoo align with aspects of the description for a 'High' rating such as there being limited capacity to replace a lost breeding adult and being a long-lived species with low fecundity (Rowley et al., 2020).
- **Criterion E:** A 'Moderate' rating has been assigned to Criterion E. The Forest Red-tailed Black-Cockatoo's total population is estimated to comprise of 16,800 mature individuals (Garnett & Baker, 2021).
- **Criterion F:** A 'Moderate' rating has been assigned to Criterion F. The Forest Red-tailed Cockatoo is listed as Vulnerable under the EPBC Act and the BC Act.

Appendix Table B.3 Forest Red-tailed Black-Cockatoo Risk Assessment

Likelihood			Consequence				
	Criterion A	Criterion B		Criterion C	Criterion D	Criterion E	Criterion F
Unlikely	X		**Low**	X			
Possible		X	**Moderate**			X	X
Likely			**High**		X		
Risk Rating							
Likelihood	Unlikely*		**Consequence**	Moderate			
Overall Rating: Minor							

*The likelihood rating for the species was downgraded to 'Unlikely' as it was considered highly unlikely that the species would occur at RSA based on knowledge of the species' flight behaviours.

1.4 Fork tailed Swift (*Apus pacificus*)

Migratory – EPBC Act and BC Act

Information on the Fork-tailed Swift from Australian Wind Farms

There are 3 published reports of Fork-tailed Swift strikes with wind turbines at Australian wind farms within the species' range (Moloney et al., 2019; Nature Advisory, 2025).

Likelihood and Consequence of Impacts

The overall risk rating for the Fork-tailed Swift is 'Moderate' based on a 'Likely' likelihood rating and a 'Low' consequence rating. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.4**.

- **Criterion A:** A 'Likely' rating has been assigned to Criterion A. It is likely that a high proportion of the Fork-tailed Swift's flight activity is at RSA height. Reid et al. (2023) suggests that approximately 50% of the species' flight time occurs at altitudes between 30 m and 350 m AGL, with a further 25% of flight time spent above 350 m AGL. The species is a highly aerial insectivore that will spend much of its life 'on-the-wing', landing only when breeding.
- **Criterion B:** A 'Possible' rating has been assigned to Criterion B. Although no known records occur within the Desktop Study Area, the Fork-tailed Swift may occasionally occupy the airspace above the Study Area and has been assigned a 'Moderate' likelihood of occurrence (**Appendix A**). This species is known to occur within the region and may use the aerial space above patches of vegetation to forage on invertebrates. This species generally transits south along the coast and individuals have been recorded further inland, particularly during favourable weather conditions such as large storm fronts. The species is unlikely to depend on habitat present within the Study Area for survival.
- **Criterion C:** A 'Low' rating has been assigned to Criterion C. The Fork-tailed Swift does not utilise terrestrial habitats; however, may utilise the airspace above the Study Area while transiting or foraging. Population concentration is dependent on prey abundance which is linked to vegetation and other prey habitat. Areas in which this species congregates includes habitats with a high concentration of insect prey including the aerial space above woodlands and grasslands which may be sporadic and weather dependent. Habitats provided by the Study Area are not considered likely to functionally concentrate the population given the similarity in vegetation type and structure throughout the Project region.
- **Criterion D:** A 'Moderate' rating has been assigned to Criterion D. The Fork-tailed Swift are non-breeding visitors to Australia; however, the life-history characteristics of the species overlaps with certain aspects of both the descriptions for a 'Low' and 'High' rating (Chantler et al., 2020).
- **Criterion E:** A 'Low' rating has been assigned to Criterion E. Flocks of between 50,000 and 90,000 Fork-tailed Swift have been recorded in Australia. The Referral Guideline For 14 Birds Listed as Migratory Species Under the EPBC Act (Department of the Environment, 2015) indicate that up to 100,000 individuals may exists in the population.
- **Criterion F:** A 'Low' rating has been assigned to Criterion F. The Fork-tailed Swift is only listed as Migratory under the EPBC Act and the BC Act.

Appendix Table B.4 Fork-tailed Swift Risk Assessment

Likelihood			**Consequence**				
	Criterion A	**Criterion B**		**Criterion C**	**Criterion D**	**Criterion E**	**Criterion F**
Unlikely			**Low**	X		X	X
Possible		X	**Moderate**		X		
Likely	X		**High**				
Risk Rating							
Likelihood	Likely		**Consequence**	Low			
Overall Rating: Moderate							

1.5 Glossy Ibis (*Plegadis falcinellus*)

Migratory – EPBC Act and BC Act

Information on the Glossy Ibis from Australian Wind Farms

There are no published reports of Glossy Ibis strikes with wind turbines at Australian wind farms within the species' range.

Likelihood and Consequence of Impacts

The overall risk rating for the Glossy Ibis is 'Minor' based on a 'Possible' likelihood rating and a 'Low' consequence rating. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.5**.

- **Criterion A:** A 'Possible' rating has been assigned to Criterion A. Reid et al. (2023) suggests that approximately 50% of Glossy Ibis flight time occurs at altitudes between 30 m and 350 m AGL. The Glossy Ibis is likely to occasionally fly within RSA height during longer distance movements in search of suitable wetland habitat to support foraging requirements.
- **Criterion B:** A 'Possible' rating has been assigned to Criterion B. Although the species was not recorded during the field survey program, there is suitable habitat present within the Study Area and given the distribution of records in the surrounding region the species is considered to have a 'High' likelihood of occurrence (**Appendix A**).
- **Criterion C:** A 'Low' rating has been assigned to Criterion C. The Glossy Ibis is widely distributed within areas of suitable habitat during the non-breeding season and the habitat itself is widely dispersed; therefore, it is unlikely to be concentrated within the Study Area. The species may opportunistically occur within the Study Area in low numbers, particularly within flooded paddocks and potentially wetland habitats.
- **Criterion D:** A 'Low' rating has been assigned to Criterion D. The Glossy Ibis is a non-breeding visitor to WA and has the capacity for long range or widespread juvenile or sub-adult dispersal.
- **Criterion E:** A 'Low' rating has been assigned to Criterion E. The total Australian population of Glossy Ibis is estimated at over 100,000 birds (Davis Jr. & Kricher, 2020).
- **Criterion F:** A 'Low' rating has been assigned to Criterion F. The Glossy Ibis is only listed as Migratory under the EPBC Act and the BC Act.

Appendix Table B.5 Glossy Ibis Risk Assessment

Likelihood			Consequence				
	Criterion A	Criterion B		Criterion C	Criterion D	Criterion E	Criterion F
Unlikely			**Low**	X	X	X	X
Possible	X	X	**Moderate**				
Likely			**High**				
Risk Rating							
Likelihood	Possible		**Consequence**	Low			
Overall Rating: Minor							

1.6 Black-tailed Godwit (*Limosa limosa*)

Endangered – EPBC Act

Migratory – EPA Act

Information on the Black-tailed Godwit from Australian Wind Farms

There are no published reports of Black-tailed Godwit strikes at Australian wind farms within their range.

Likelihood and Consequence of Impacts

The overall risk rating for the Black-tailed Godwit is 'Moderate' based on a 'Possible' likelihood rating and 'Moderate' consequence rating. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.6**.

- **Criterion A:** A 'Possible' rating was assigned to Criterion A. Flight height information relevant to shorebirds is poorly understood, though it is known that they undertake long-distance flights at high altitudes between non-breeding and breeding ranges and may also do so between foraging or roosting sites in their non-breeding range. Therefore, it is considered likely that the Black-tailed Godwit may occasionally fly at RSA.
- **Criterion B:** An 'Unlikely' rating was assigned to Criterion B. Despite recordings of a single individual on one occasion, the Black-tailed Godwit is generally rare in southwest Western Australian and occur sporadically in low numbers when present (BirdLife Australia, 2023a).
- **Criterion C:** A 'Low' rating was assigned to Criterion C. The Black-tailed Godwit is unlikely to be concentrated by habitats present within the Study Area and a 'Low' rating has been considered appropriate for Criterion C. The species is most common along the northern coast of Australia with small numbers generally present elsewhere and only scattered records across the southwest of WA (Birdlife, 2023a).
- **Criterion D:** A 'Moderate' rating was assigned to Criterion D. The Black-tailed Godwit is a non-breeding visitor to Australia; however, the life-history characteristics of the species overlaps with certain aspects of both descriptions for a 'Low' and 'High' rating.
- **Criterion E:** A 'Low' rating has been applied to Criterion E. The East Asian-Australasian Flyway population of the Black-tailed Godwit is estimated at between 160,000 individuals (Hansen et al., 2021).
- **Criterion F:** A 'High' rating was assigned to Criterion F. The Black-tailed Godwit is listed as Endangered under the EPBC Act and Migratory under the EPBC Act.

Appendix Table B.6 Black-tailed Godwit Risk Assessment

Likelihood			Consequence				
	Criterion A	Criterion B		Criterion C	Criterion D	Criterion E	Criterion F
Unlikely		X	Low	X		X	
Possible	X		Moderate		X		
Likely			High				X
Risk Rating							

Likelihood		Consequence	
Likelihood	Possible	**Consequence**	Moderate
Overall rating: Moderate			

1.7 Common Greenshank (*Tringa nebularia*)

Endangered – EPBC Act

Migratory – EPBC Act & BC Act

Information on the Common Greenshank from Australian Wind Farms

There are no published reports of Common Greenshank strikes at Australian wind farms within their range.

Likelihood and Consequence of Impacts

The overall risk rating for the Common Greenshank is 'Moderate' based on a 'Possible' likelihood rating and a 'Moderate' consequence rating. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.7**.

- **Criterion A:** A 'Possible' rating was assigned to Criterion A. Flight height information relevant to shorebirds is poorly understood, though it is known that they undertake long-distance flights at high altitudes between non-breeding and breeding ranges and may also do so between foraging or roosting sites in their non-breeding range. Therefore, it is considered likely that the Common Greenshank may occasionally fly at RSA.
- **Criterion B:** A 'Possible' rating was assigned to Criterion B for the Common Greenshank. A Common Greenshank was recorded during an opportunistic wetland census at WE-C2 during the Summer BBUS but is unlikely to regularly move through, the Study Area based on the results of the desktop assessment and field survey program with the wetlands found to the east of Brand Highway and associated with the Dandaragan Plateau being considered poor quality for shorebird habitat (**Appendix A**).
- **Criterion C:** A 'Low' rating was assigned to Criterion C. The Common Greenshank is a non-breeding migrant to Australia where they occur in small flocks by themselves or sometimes on the margins of flocks of other species (Menkhorst et al. 2019). The species may opportunistically occur within flooded paddocks and wetland habitat, but the population is unlikely to be concentrated within the Study Area.
- **Criterion D:** A 'Moderate' rating has been applied to Criterion D. The Common Greenshank is a non-breeding visitor to Australia; however, the life-history characteristics of the species overlaps with certain aspects of both descriptions for a 'Low' and 'High' rating.
- **Criterion E:** A 'Low' rating has been applied to Criterion E. The East Asian-Australasian Flyway population of the Common Greenshank is estimated at 110,000 individuals (Hansen et al., 2021).
- **Criterion F:** A 'High' rating was assigned to Criterion F. The Common Greenshank is listed as Endangered under the EPBC Act and Migratory under the EPBC Act and the BC Act.

Appendix Table B.7 Common Greenshank Risk Assessment

Likelihood			Consequence				
	Criterion A	Criterion B		Criterion C	Criterion D	Criterion E	Criterion F
Unlikely			Low	X		X	
Possible	X	X	Moderate		X		
Likely			High				X
Risk Rating							
Likelihood	Possible		Consequence	Moderate			
Overall rating: Moderate							

1.8 Common Sandpiper (*Actitis hypoleucos*)

Migratory – EPBC Act & BC Act

Information on Common Sandpiper from Australian Wind Farms

There are no published reports of Common Sandpiper strikes at Australian wind farms within their range.

Likelihood and Consequence of Impacts

The overall risk rating for the Common Sandpiper is 'Minor' based on a 'Possible' likelihood rating and a 'Low' consequence rating. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.8**.

- **Criterion A:** A 'Possible' rating was assigned to all species assessed. Flight height information relevant to shorebirds is poorly understood, though it is known that they undertake long-distance flights at high altitudes between non-breeding and breeding ranges and may also do so between foraging or roosting sites in their non-breeding range. Therefore, it is considered likely that the Common Sandpiper may occasionally fly at RSA.
- **Criterion B:** A 'Possible' rating was assigned to Criterion B. The Common Sandpiper was not recorded during the field survey program but considered to have a 'High' likelihood of occurrence due to presence of suitable habitat and records identified within the Desktop Study Area (**Appendix A**).
- **Criterion C:** A 'Low' rating was assigned to Criterion C. The Common Sandpiper is a non-breeding migrant to Australia where it is widespread in low numbers. Habitats within the Wind Farm Area may be marginal at best. The population is unlikely to be concentrated within the Study Area.
- **Criterion D:** A 'Moderate' rating was assigned to Criterion D. The Common Sandpiper is a non-breeding visitor to Australia; however, the life-history characteristics of the species overlaps with certain aspects of both descriptions for a 'Low' and 'High' rating (van Gils, J., P. Wiersma, and G. M. Kirwan 2020)
- **Criterion E:** A 'Low' rating has been applied to Criterion E. The East Asian-Australasian Flyway population of the Common Sandpiper is estimated to 190,000 individuals (Hansen et al., 2021).
- **Criterion F:** A 'Low' rating was assigned to Criterion F. The Common Sandpiper is listed as Migratory under the BC Act and EPBC Act.

Appendix Table B.8 Common Sandpiper Risk Assessment

Likelihood			Consequence				
	Criterion A	Criterion B		Criterion C	Criterion D	Criterion E	Criterion F
Unlikely			**Low**	X		X	X
Possible	X	X	**Moderate**		X		
Likely			**High**				
Risk Rating							
Likelihood	Possible		**Consequence**	Low			
Overall rating: Minor							

1.9 Curlew sandpiper (*Calidris ferruginea*)

Migratory – EPBC Act & BC Act

Information on the Curlew Sandpiper from Australian Wind Farms

There are no published reports of Curlew Sandpiper strikes at Australian wind farms within their range.

Likelihood and Consequence of Impacts

The overall risk rating for the Curlew Sandpipe is 'Moderate' based on a 'Possible' likelihood rating and a 'Moderate' consequence rating. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.9**.

- **Criterion A:** A 'Possible' rating was assigned Criterion A. Flight height information relevant to shorebirds is poorly understood, though it is known that they undertake long-distance flights at high altitudes between non-breeding and breeding ranges and may also do so between foraging or roosting sites in their non-breeding range. Therefore, it is considered likely that the Curlew Sandpiper may occasionally fly at RSA.
- **Criterion B:** A 'Possible' rating was assigned to Criterion B. The Curlew Sandpiper was not recorded during the field survey program but considered to have a 'High' likelihood of occurrence due to presence of suitable habitat and records identified within the Desktop Study Area (**Appendix A**).
- **Criterion C:** A 'Low' rating was assigned to Criterion C. The Curlew Sandpiper is a non-breeding migrant to Australia and has an extensive non-breeding range stretching from West Africa to New Zealand. The Curlew Sandpiper predominantly favours intertidal mudflats in sheltered coastal areas and further inland along ephemeral and permanent lakes or waterholes and bore drains, usually with bare edges of mud or sand (https://doi.org/10.2173/bow.cursan.02). The species may utilise flooded paddocks and wetland habitat, but its population is unlikely to be concentrated within the Study Area.
- **Criterion D:** A 'Moderate' rating was assigned to Criterion D. The Curlew Sandpiper is a non-breeding visitor to Australia; however, the life-history characteristics of the species overlaps with certain aspects of both descriptions for a 'Low' and 'High' rating (Mlodinow, S. G. and F. Medrano 2023)

- **Criterion E:** A 'Low' rating has been applied to Criterion E. The East Asian-Australasian Flyway population of the Curlew Sandpiper is estimated at 90,000 individuals (Hansen et al., 2021).
- **Criterion F:** A 'High' rating was assigned to Criterion F. The Curlew Sandpiper is listed as Critically Endangered under the EPBC Act and BC Act and Migratory under the EPBC Act.

Appendix Table B.9 Curlew Sandpiper Risk Assessment

Likelihood			Consequence				
	Criterion A	Criterion B		Criterion C	Criterion D	Criterion E	Criterion F
Unlikely			**Low**	X		X	
Possible	X	X	**Moderate**		X		
Likely			**High**				X
Risk Rating							
Likelihood	Possible		**Consequence**	Moderate			
Overall rating: Moderate							

1.10 Long-toed Stint (*Calidris subminuta*)

Migratory – EPBC Act & BC Act

Information on the Long-toed Stint from Australian Wind Farms

There are no published reports of Long-toed Stint strikes at Australian wind farms within their range.

Likelihood and Consequence of Impacts

The overall risk rating for the Long-toed Stint is 'Minor' based on a 'Possible' likelihood rating and a 'Low' consequence rating. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.10**.

- **Criterion A:** A 'Possible' rating was assigned to Criterion A. Flight height information relevant to shorebirds is poorly understood, though it is known that they undertake long-distance flights at high altitudes between non-breeding and breeding ranges and may also do so between foraging or roosting sites in their non-breeding range. Therefore, it is considered likely that the Long-toed Stint may occasionally fly at RSA.
- **Criterion B:** A 'Possible' rating was assigned to Criterion B. The Pacific Golden Plover was not recorded during the field survey program but considered to have a 'Moderate' likelihood of occurrence due to presence of suitable habitat and records identified within the Desktop Study Area (**Appendix A**).
- **Criterion C:** A 'Low' rating was assigned to Criterion C. The Long-toed Stint is a non-breeding migrant to Australia where they take dispersive movements between temporary wetlands. The species primarily overwinters in southeast Asia where they prefer inland wetlands but are known to be relatively common in freshwater systems of southwest WA. The species may utilise flooded paddocks and wetland habitat, but its population is unlikely to be concentrated within the Study Area.

- **Criterion D:** A 'Moderate' rating was assigned to Criterion D. The Long-toed Stint is a non-breeding visitor to Australia; however, the life-history characteristics of the species overlaps with certain aspects of both descriptions for a 'Low' and 'High' rating).
- **Criterion E:** A 'Low' rating has been applied to Criterion E. The East Asian-Australasian Flyway population of the Long-toed Stint is estimated at 230,000 individuals (Hansen et al., 2021).
- **Criterion F:** A 'Low' rating was assigned to Criterion F. The Long-toed Stint is listed as Migratory under the EPBC Act and the BC Act.

Appendix Table B.10 Long-toed Stint Risk Assessment

Likelihood			Consequence				
	Criterion A	Criterion B		Criterion C	Criterion D	Criterion E	Criterion F
Unlikely			**Low**	X		X	X
Possible	X	X	**Moderate**		X		
Likely			**High**				
Risk Rating							
Likelihood	Possible		**Consequence**	Low			
Overall rating: Minor							

1.11 Pacific Golden Plover (*Pluvialis fulva*)

Migratory – EPBC Act & BC Act

Information on Pacific Golden Plover from Australian Wind Farms

There are no published reports of Pacific Golden Plover strikes at Australian wind farms within their range.

Likelihood and Consequence of Impacts

The overall risk rating for the Pacific Golden Plover is 'Minor' based on a 'Possible' likelihood rating and a 'Low' consequence rating. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.11**.

- **Criterion A:** A 'Possible' rating was assigned to Criterion A. Flight height information relevant to shorebirds is poorly understood, though it is known that they undertake long-distance flights at high altitudes between non-breeding and breeding ranges and may also do so between foraging or roosting sites in their non-breeding range. Therefore, it is considered likely that these species may occasionally fly at RSA.
- **Criterion B:** A 'Possible' rating was assigned to Criterion B. The Pacific Golden Plover was not recorded during the field survey program but considered to have a 'High' likelihood of occurrence due to presence of suitable habitat and records identified within the Desktop Study Area (**Appendix A**).
- **Criterion C:** A 'Low' rating was assigned to Criterion C. The Pacific Golden Plover is unlikely to be concentrated by habitats present within the Study Area and a 'Low' rating has been considered appropriate for Criterion C. The species is considered to be widespread but patchily distributed in most of Western Australia (Birdlife, 2023) and uses a wide range of habitats during the non-

breeding season, which itself is widely available (Johnson, O. W., P. G. Connors, and P. Pyle, 2024).

- **Criterion D:** A 'Moderate' rating was assigned to Criterion D. The Pacific Golden Plover is a non-breeding visitor to Australia; however, the life-history characteristics of the species overlaps with certain aspects of both descriptions for a 'Low' and 'High' rating.
- **Criterion E:** A 'Low' rating has been applied to Criterion E. The East Asian-Australasian Flyway population of the Pacific Golden Plover is estimated at 120,000 individuals (Hansen et al., 2021).
- **Criterion F:** A 'Low' rating was assigned to Criterion F. The Pacific Golden Plover is listed as Migratory under the EPBC Act and BC Act.

Appendix Table B.11 Pacific Golden Plover Assessment

Likelihood			Consequence				
	Criterion A	Criterion B		Criterion C	Criterion D	Criterion E	Criterion F
Unlikely			**Low**	X		X	X
Possible	X	X	**Moderate**		X		
Likely			**High**				
Risk Rating							
Likelihood	Possible		**Consequence**	Low			
Overall rating: Minor							

1.12 Red-necked stint (*Calidris ruficollis*)

Migratory – EPBC Act & BC Act

Information on the Red-necked stint from Australian Wind Farms

There are no published reports of the Red-necked stint strikes at Australian wind farms within their range.

Likelihood and Consequence of Impacts

The overall risk rating for the Red-necked stint is 'Minor' based on a 'Possible' likelihood rating and a 'Low' consequence rating. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.12**.

- **Criterion A:** A 'Possible' rating was assigned to Criterion A. Flight height information relevant to shorebirds is poorly understood, though it is known that they undertake long-distance flights at high altitudes between non-breeding and breeding ranges and may also do so between foraging or roosting sites in their non-breeding range. Therefore, it is considered likely that these species may occasionally fly at RSA.
- **Criterion B:** A 'Possible' rating was assigned to Criterion B. A total of 3 Red-necked stints were recorded during an opportunistic wetland census at WE-C2 during the Summer BBUS but is unlikely to regularly move through the Study Area based on the results of the desktop assessment and field survey program with the wetlands found to the east of Brand Highway (associated with the Dandaragan Plateau) being considered poor quality for shorebird habitat(**Appendix A**).

- **Criterion C:** A 'Low' rating was assigned to Criterion C. The Red-necked stint is unlikely to be concentrated within the Study Area. This species is a non-breeding migrant to Australia with immature birds usually remaining in non-breeding range throughout their first year and often moving inland after heavy rainfall. Adults show high fidelity between years to non-breeding sites and are commonly found on wide variety of freshwater, brackish and saltwater wetlands. The species may opportunistically occur within the Study Area, particularly within flooded paddocks, and potentially the wetland habitat.
- **Criterion D:** A 'Moderate' rating was assigned to Criterion D. The Red-necked stint is a non-breeding visitor to Australia; however, the life-history characteristics of the species overlaps with certain aspects of both descriptions for a 'Low' and 'High' rating.
- **Criterion E:** A 'Low' rating was assigned to Criterion E. The East Asian-Australasian Flyway population of the Red-necked stint is estimated at 475,000 individuals (Hansen et al., 2016).
- **Criterion F:** A 'Low' rating was assigned to Criterion F. The Red-necked stint is listed as Migratory under the EPBC Act and the BC Act.

Appendix Table B.12 Red-necked Stint Risk Assessment

Likelihood			Consequence				
	Criterion A	Criterion B		Criterion C	Criterion D	Criterion E	Criterion F
Unlikely			**Low**	X		X	X
Possible	X	X	**Moderate**		X		
Likely			**High**				
Risk Rating							
Likelihood	Possible		**Consequence**	Low			
Overall rating: Minor							

1.13 Ruff (*Calidris pugnax*)

Migratory – EPBC Act & BC Act

Information on the Ruff from Australian Wind Farms

There are no published reports of Ruff strikes at Australian wind farms within their range.

Likelihood and Consequence of Impacts

The overall risk rating for the Ruff and Ruff is 'Minor' based on a 'Possible' likelihood rating and a 'Low' consequence rating. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.13**.

- **Criterion A:** A 'Possible' rating was assigned to Criterion A. Flight height information relevant to shorebirds is poorly understood, though it is known that they undertake long-distance flights at high altitudes between non-breeding and breeding ranges and may also do so between foraging or roosting sites in their non-breeding range. Therefore, it is considered likely that these species may occasionally fly at RSA.

- **Criterion B:** An 'Unlikely' rating was assigned to Criterion B. The Ruff was recorded on 1 occasion within the Study Area, and the species is known to be a regular but rare visitor to Australia, only occurring sporadically within Western Australia (BirdLife Australia, 2023).
- **Criterion C:** A 'Low' rating was assigned to Criterion C. The Ruff is unlikely to be concentrated by habitats present within the Study Area. The species only occurs sporadically in Western Australia and does not commonly flock in large numbers within their non-breeding range (BirdLife Australia, 2023).
- **Criterion D:** A 'Moderate' rating was assigned to Criterion D. The Ruff is a non-breeding visitor to Australia; however, the life-history characteristics of the species overlaps with certain aspects of both descriptions for a 'Low' and 'High' rating.
- **Criterion E:** A 'Low' rating was assigned to Criterion E. The East Asian-Australasian Flyway population of the Ruff is estimated at between 25,000-100,000 individuals (Hansen et al., 2016).
- **Criterion F:** A 'Low' rating was assigned to Criterion F. The Ruff is not listed under the EPBC Act, BC Act, or as Priority species by DBCA.

Appendix Table B.13 Ruff Risk Assessment

Likelihood			Consequence				
	Criterion A	Criterion B		Criterion C	Criterion D	Criterion E	Criterion F
Unlikely		X	**Low**	X		X	X
Possible	X		**Moderate**		X		
Likely			**High**				
Risk Rating							
Likelihood	Possible		**Consequence**	Low			
Overall rating: Minor							

1.14 Sharp-tailed sandpiper (*Calidris acuminata*)

Vulnerable – EPBC Act

Migratory – EPBC Act & BC Act

Information on the Sharp-tailed sandpiper from Australian Wind Farms

There are no published reports of Sharp-tailed sandpiper strikes at Australian wind farms within their range.

Likelihood and Consequence of Impacts

The overall risk rating for the Sharp-tailed sandpiper is 'Moderate' based on a 'Possible' likelihood rating and a 'Moderate' consequence rating. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.14.**

- **Criterion A:** A 'Possible' rating was assigned to Criterion A. Flight height information relevant to shorebirds is poorly understood, though it is known that they undertake long-distance flights at high altitudes between non-breeding and breeding ranges and may also do so between foraging or roosting sites in their non-breeding range. Therefore, it is considered likely that this species may occasionally fly at RSA.
- **Criterion B:** A 'Possible' rating was assigned to Criterion B. A total of 5 Sharp-tailed sandpiper were recorded during an opportunistic wetland census at WE-C2 during the Summer BBUS but is unlikely to regularly move through the Study Area based on the results of the desktop assessment and field survey program with the wetlands found to the east of Brand Highway (associated with the Dandaragan Plateau) being considered poor quality for shorebird habitat (**Appendix A**).
- **Criterion C:** A 'Low' rating was assigned to Criterion C. The Sharp-tailed sandpiper is unlikely to be concentrated by habitats present within the Study Area. Most of the global population of Sharp-tailed sandpipers are estimated to migrate to Australia during the non-breeding season, where they have been recorded in all states and territories. This habitat preference largely correlates to the presence of water and as such they can occur in a wide array of locations. The species may opportunistically occur within the Study Area, particularly within flooded paddocks, and potentially the wetland habitat.
- **Criterion D:** A 'Moderate' rating was assigned to Criterion D. The Sharp-tailed sandpiper is a non-breeding visitor to Australia; however, the life-history characteristics of the species overlaps with certain aspects of both descriptions for a 'Low' and 'High' rating (Mlodinow, S. G., G. M. Kirwan, J. van Gils, and P. Wiersma 2025).
- **Criterion E:** A 'Low' rating was assigned to Criterion E. The East Asian-Australasian Flyway population of the Sharp-tailed Sandpiper is estimated at 85,000 individuals (Hansen et al., 2016).
- **Criterion F:** A 'Moderate' rating was assigned to Criterion F. The Sharp-tailed Sandpiper is listed as Vulnerable under the EPBC Act and Migratory under the BC Act and EPBC Act.

Appendix Table B.14 Sharp-tailed sandpiper Risk Assessment

Likelihood			Consequence				
	Criterion A	Criterion B		Criterion C	Criterion D	Criterion E	Criterion F
Unlikely			**Low**	X		X	
Possible	X	X	**Moderate**		X		X
Likely			**High**				
Risk Rating							
Likelihood	Possible		**Consequence**	Moderate			
Overall rating: Moderate							

1.15 Wood sandpiper (*Tringa glareola*)

Migratory – EPBC Act & BC Act

Information on the Wood sandpiper from Australian Wind Farms

There are no published reports of the Wood sandpiper strikes at Australian wind farms within their range.

Likelihood and Consequence of Impacts

The overall risk rating for the Wood sandpiper 'Minor' based on a 'Possible' likelihood rating and a 'Low' consequence rating. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.15.**

- **Criterion A:** A 'Possible' rating was assigned to Criterion A. Flight height information relevant to shorebirds is poorly understood, though it is known that they undertake long-distance flights at high altitudes between non-breeding and breeding ranges and may also do so between foraging or roosting sites in their non-breeding range. Therefore, it is considered likely that this species may occasionally fly at RSA.
- **Criterion B:** A 'Possible' rating was assigned to Criterion B. A total of 15 Wood sandpiper were recorded during the field survey program during an opportunistic wetland census at WE-C2, but the species are unlikely to regularly move through the Study Area based on the results of the desktop assessment and field survey program with the wetlands found to the east of Brand Highway (associated with the Dandaragan Plateau) being considered poor quality for shorebird habitat (**Appendix A**).
- **Criterion C:** A 'Low' rating was assigned to Criterion C. The population is unlikely to be concentrated by habitats within the Study Area with only a small proportion of the global population migrating to Australia during the non-breeding season. The species may opportunistically occur within the Study Area in low numbers, particularly within flooded paddocks, and potentially the wetland habitat.
- **Criterion D:** A rating of 'Moderate' was assigned to Criterion D. The Wood sandpiper is a non-breeding visitor to Australia; however, the life-history characteristics of the species overlaps with certain aspects of both descriptions for a 'Low' and 'High' rating (Mlodinow, S. G., G. M. Kirwan, J. van Gils, and P. Wiersma 2025).
- **Criterion E:** A 'Low' rating was assigned to Criterion E. The East Asian-Australasian Flyway population of the Wood Sandpiper is estimated at 130,000 individuals (Hansen et al., 2016).
- **Criterion F:** A 'Low' rating was assigned to Criterion F. The Wood sandpiper is listed as Migratory BC Act and EPBC Act.

Appendix Table B.15 Wood sandpiper Risk Assessment

Likelihood			Consequence				
	Criterion A	Criterion B		Criterion C	Criterion D	Criterion E	Criterion F
Unlikely			Low	X		X	X
Possible	X	X	Moderate		X		
Likely			High				
Risk Rating							
Likelihood	Possible		Consequence	Low			
Overall rating: Minor							

1.16 Peregrine falcon (*Falco peregrinus*)

Other Specially Protected – BC Act

Information on the Peregrine Falcon from Australian Wind Farms

There are 3 published reports of Peregrine Falcon strikes with wind turbines at Australian wind farms within the species' range (Moloney et al., 2019; Goldwind Australia, 2024).

Likelihood and Consequence of Impacts

The overall risk rating for the Peregrine Falcon is 'High' based on a 'Likely' likelihood rating and a 'Moderate' consequence rating. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.16.**

- **Criterion A:** A 'Likely' rating has been assigned to Criterion A. A high proportion of Peregrine Falcon's flight activity is likely to be at RSA height. While the species was not recorded flying within RSA during the BBUS program, raptors are known to fly within RSA height regularly when searching for prey, hunting, or moving across the landscape between areas of suitable habitat.
- **Criterion B:** A 'Likely' rating has been applied to Criterion B. The Peregrine Falcon was recorded on 10 occasions during the BBUS program and during every BBUS event; therefore, the species is likely to regularly occur in, or move through, the Study Area.
- **Criterion C:** A 'Low' rating has been assigned to Criterion C. The Peregrine Falcon is a cosmopolitan species and considered to be one of the most widespread warm-blooded terrestrial vertebrates (White et al., 2024). The species occupies a large variety of habitat types within Australia including urban areas and cleared landscapes with sufficient food availability. Its occurrence is largely dependent on nesting habitat and prey availability, which itself can be widely dispersed in the broader region. Therefore, the species is considered unlikely to be concentrated by habitats within the Study Area.
- **Criterion D:** A 'Moderate' rating has been assigned to Criterion D. The life-history characteristics of Peregrine Falcon overlap with certain aspects of both the descriptions for a 'Low' and 'High' rating for Criterion D (BirdLife Australia, 2023c).
- **Criterion E:** A 'Moderate' rating has been assigned to Criterion E. The total population size of the Peregrine Falcon in Victoria was estimated to be 300 to 350 breeding pairs based on a suggested density of approximately one pair per 650 to 750 km^2 (White et al., 1980). Based on this approximate density, the population is estimated to be approximately 18,000 individuals within the species' Australian distribution.
- **Criterion F:** A 'Low' rating has been assigned to Criterion F. The Peregrine Falcon is not listed under the EPBC Act and is listed as Other Specially Protected under the BC Act.

Appendix Table B.16 Peregrine Falcon Risk Assessment

Likelihood			Consequence				
	Criterion A	Criterion B		Criterion C	Criterion D	Criterion E	Criterion F
Unlikely			**Low**	X			X
Possible			**Moderate**		X	X	
Likely	X	X	**High**				
Risk Rating							
Likelihood	Likely		**Consequence**	Moderate			
Overall Rating: High							

2.0 Raptor Species

This section presents the detailed risk assessment for all raptor species recorded during the field survey program.

2.1 Diurnal Raptors

A total of 11 non-listed diurnal raptors were recorded within the Study Area during the field survey program. These species include:

- Australian Hobby (*Falco longipennis*)
- Black-shouldered Kite (*Elanus axillaris*)
- Brown Falcon (*Falco berigora*)
- Brown Goshawk (*Tachyspiza fasciata*)
- Little Eagle (*Hieraaetus morphnoides*)
- Nankeen Kestrel (*Falco cenchroides*)
- Spotted Harrier (*Circus assimilis*)
- Swamp Harrier (*Circus approximans*)
- Wedge-tailed Eagle (*Aquila audax*)
- Whistling Kite (*Haliastur sphenurus*)
- White-bellied Sea Eagle (*Haliaeetus leucogaster*).

Information on Diurnal Raptors from Australian Wind Farms

There have been published reports of turbine strikes for all diurnal raptor species assessed here at Australian wind farms within the species' range (Goldwind Australia, 2024; Hull et al., 2013; Moloney et al., 2019; Nature Advisory, 2025; Wood, 2017, 2020).

Likelihood and Consequence of Impacts

The overall risk rating for all diurnal raptor species assessed is 'Moderate' based on a 'Likely' likelihood rating and a 'Low' consequence rating. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.17**.

- **Criterion A:** A 'Likely' rating has been assigned to Criterion A for all species assessed. All species except for the Australian Hobby, Brown Goshawk, and Spotted Harrier were recorded flying within RSA during the BBUS program. However, it is likely that a high proportion of all these raptor's flight activity is at RSA height based on the known flight behaviours and hunting strategies of these species.

- **Criterion B:** A 'Possible' rating has been assigned to Criterion B for the Brown Falcon, Brown Goshawk, Spotted Harrier, and White-bellied Sea Eagle, all of which were only recorded on 1 or 2 occasions during the field survey program. A 'Likely' rating has been assigned for all remaining raptor species assessed here as they were recorded on numerous occasions within the Study Area across multiple surveys. These species are considered likely to regularly occur in, or move through, the Study Area.
- **Criterion C:** A 'Low' rating has been assigned to Criterion C for all species assessed. These species are widely distributed among areas of suitable habitat which itself is relatively widely dispersed.
- **Criterion D:** A 'Moderate' has been assigned to Criterion D for all species assessed. The life-history characteristics of these species overlap with certain aspects of both the descriptions for a 'Low' and 'High' rating for Criterion D.
- **Criterion E:** A 'Low' rating has been assigned to Criterion E for all species assessed. These species are considered to be generally common across their range and likely to have stable population numbers as they have not been classified as conservation significant species.
- **Criterion F:** A 'Low' rating has been assigned to Criterion F for all species assessed. None of these species are listed under the EPBC Act, BC Act, or as Priority species by DBCA. The Peregrine Falcon is listed as Other Special under the BC Act and is assessed separately above (see **Section A1.7**).

Appendix Table B.17 Diurnal Raptors Risk Assessment

Likelihood			**Consequence**				
	Criterion A	**Criterion B**		**Criterion C**	**Criterion D**	**Criterion E**	**Criterion F**
Unlikely			**Low**	All		All	All
Possible		BF, BG, SH, WBS	**Moderate**		All		
Likely	All	AH, BK, LE, NK, WTE, WK, WS	**High**				
Risk Rating							
Likelihood	All: Likely		**Consequence**	All: Low			
Overall Rating (All): Moderate							

2.2 Nocturnal Raptors

One nocturnal raptor species was recorded during the field survey program – the Boobook Owl (*Ninox boobook*).

Information on the Boobook Owl from Australian Wind Farms

There are no published reports of Boobook Owl strikes with wind turbines at Australian wind farms within the species' range.

Likelihood and Consequence of Impacts

The overall risk rating for the Boobook Owl is 'Minor' based on a 'Possible' likelihood rating and a 'Low' consequence rating. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.18**.

- **Criterion A:** An 'Unlikely' rating has been assigned to Criterion A. While flight height data is not available for the Boobook Owl from the BBUS program or published literature, their foraging strategy involves perching in vegetation to ambush passing prey on the ground (Olsen et al., 2023) and a majority of their flights are likely to be below RSA.
- **Criterion B:** A 'Possible' rating has been assigned to Criterion B. The Boobook Owl was recorded opportunistically on 1 occasion and is considered to occasionally occur within the DE, utilising available habitat for hunting and roosting.
- **Criterion C:** A 'Low' rating has been assigned to Criterion C as the Boobook Owl is unlikely to be concentrated by habitats within the Study Area and the species is widespread across Australia. The species inhabits forests and woodlands (Olsen et al., 2023), and habitat within the Study Area suitable for foraging includes all areas which support vegetation or rock cover for potential prey species (predominantly small mammals, reptiles and insects) which itself is widespread and abundant in the general region.
- **Criterion D:** A 'Moderate' rating has been assigned to Criterion D. The life-history characteristics of the Boobook Owl overlap with certain aspects of both the descriptions for a Low and High rating for Criterion D and
- **Criterion E:** A 'Low' rating has been assigned to Criterion E. The size of the Boobook Owl's population is unknown. However, given these species' widespread distribution across Australia, non-threatened status, and available density estimates, it is likely that all species' populations are greater than 20,000 (BirdLife International, 2025).
- **Criterion F:** A 'Low' rating has been assigned to Criterion F. The Boobook Owl is not listed under the EPBC Act, BC Act, or as Priority species by DBCA.

Appendix Table B.18 Boobook Owl Risk Assessment

Likelihood			Consequence				
	Criterion A	Criterion B		Criterion C	Criterion D	Criterion E	Criterion F
Unlikely	X		**Low**	X		X	X
Possible		X	**Moderate**		X		
Likely			**High**				
Risk Rating							
Likelihood	Possible		**Consequence**	Low			
Overall Rating: Minor							

3.0 At-risk Species

This section presents the detailed risk assessment for all non-listed and non-raptor bird species recorded within RSA during the field survey program. Species are presented individually or grouped under family or genus where multiple species were recorded.

3.1 Australian Magpie (*Gymnorhina tibicen*)

Information on the Australian Magpie from Australian Wind Farms

There are numerous published reports from at least 8 wind farms of Australian Magpie strikes with wind turbines at Australian wind farms (Goldwind Australia, 2024; Moloney et al., 2019; Nature Advisory, 2020, 2025; Wood, 2017, 2020).

Likelihood and Consequence of Impacts

The overall risk rating for the Australian Magpie is 'Moderate' based on a 'Likely' likelihood rating and a 'Low' consequence rating. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.19**.

- **Criterion A:** A 'Possible' rating was assigned to Criterion A. The Australian Magpie is likely to occasionally occur at RSA and was recorded on one occasion during BBUS within RSA range.
- **Criterion B:** A 'Likely' rating was assigned to Criterion B. The Australian Magpie was recorded on 186 occasions during the BBUS program, and it is highly likely that this species regularly occurs in or moves through the Study Area.
- **Criterion C:** A 'Low' was assigned to Criterion C. The Australian Magpie is widely distributed within its range, and the species habitat is also widely distributed. This species is unlikely to be concentrated within the Study Area.
- **Criterion D:** A 'Low' rating was assigned to Criterion D. Australian Magpies breed as a pair or group and maintain a territory year-round, with young birds either dispersing or staying in the family territory to assist with breeding (Russell et al., 2020).
- **Criterion E:** A 'Low' rating was assigned to Criterion E. The total population of the Australian Magpie is unknown but is thought to be increasing (BirdLife International, 2018a), and this species is common and widespread throughout Australia.
- **Criterion F:** A 'Low' rating was assigned to Criterion F. The Australian Magpie is not listed under the EPBC Act, BC Act, or as Priority species by DBCA.

Appendix Table B.19 Australian Magpie Risk Assessment

Likelihood			Consequence				
	Criterion A	Criterion B		Criterion C	Criterion D	Criterion E	Criterion F
Unlikely			Low	X	X	X	X
Possible	X		Moderate				
Likely		X	High				
Risk Rating							
Likelihood	Likely		Consequence	Low			
Overall Rating: Moderate							

3.2 Australian Pelican (*Pelecanus conspicillatus*)

Information on the Australian Pelican from Australian Wind Farms

There is 1 published report of an Australian Pelican strike with wind turbines at an Australian wind farm (Hull et al., 2013).

Likelihood and Consequence of Impacts

The overall risk rating for the Australian Pelican is 'Moderate' based on a 'Likely' likelihood rating and a 'Low' consequence rating. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.20**.

- **Criterion A:** A 'Possible' rating was assigned to Criterion A. The Australian Pelican was recorded on one occasion flying within RSA and often makes longer distance flights over varied habitat in search of suitable wetlands for foraging and breeding. The Australian Pelican is likely to occasionally occur at RSA.
- **Criterion B:** A 'Likely' rating was assigned to Criterion B. The Australian Pelican was recorded on three occasions during the BBUS program. Given the number of waterbodies present and the species' regular longer distance movements, it is likely that this species regularly occurs in or moves through the Study Area.
- **Criterion C:** A 'Low' rating was assigned to Criterion C. The Australian Pelican is widely distributed within its range, and the species' habitat is also widely distributed. This species is unlikely to be concentrated within the Study Area.
- **Criterion D:** A 'Moderate' rating was assigned to Criterion D. The life-history characteristics of the Australian Pelican overlap with certain aspects of both the descriptions for a Low and High rating for Criterion D. They can be highly dispersive in response to environmental conditions (Elliott et al., 2020).
- **Criterion E:** A 'Low' rating was assigned to Criterion E. The total population of the Australian Pelican is estimated to be well above 20,000 individuals within its Australian distribution. Current estimates suggest between 46,700 - 200,000 mature individuals (BirdLife International, 2024a).
- **Criterion F:** A 'Low' rating was assigned to Criterion F. The Australian Pelican is not listed under the EPBC Act, BC Act, or as Priority species by DBCA.

Appendix Table B.20 Australian Pelican Risk Assessment

Likelihood			Consequence				
	Criterion A	Criterion B		Criterion C	Criterion D	Criterion E	Criterion F
Unlikely			Low	X		X	X
Possible	X		Moderate		X		
Likely		X	High				
Risk Rating							
Likelihood	Likely		Consequence	Low			
Overall Rating: Moderate							

3.3 Australian Raven (*Corvus coronoides*)

Information on Australian Raven from Australian Wind Farms

There are 5 published reports of Australian Raven strikes with wind turbines at Australian wind farms (Moloney et al., 2019; Wood, 2020).

Likelihood and Consequence of Impacts

The overall risk rating for the Australian Raven is 'Moderate' based on a 'Likely' likelihood rating and a 'Low' consequence rating. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.21**.

- **Criterion A:** A 'Possible' rating was assigned to Criterion A. The Australian Raven is likely to occasionally occur at RSA and was recorded flying within RSA on two occasions.
- **Criterion B:** A 'Likely' rating was assigned to Criterion B. The Australian Raven was recorded on 270 occasions during the field study program and it is highly likely that this species regularly occurs in or moves through the Study Area.
- **Criterion C:** A 'Low' rating was assigned to Criterion C. The Australian Raven is widely distributed within its range, and the species habitat is also widely distributed. This species is unlikely to be concentrated within the Study Area.
- **Criterion D:** A 'Low' rating was assigned to Criterion D. The life-history characteristics of the Australian Raven generally align with a 'Low' rating for Criterion D as adult breeding pairs are largely sedentary, but juveniles, immatures, and non-breeding adults can form mobile flocks that disperse up to several hundreds of kilometres (Debus, 2020).
- **Criterion E:** A 'Low' rating was assigned to Criterion E. The total population of the Australian Raven is unknown but is thought to be increasing (BirdLife International, 2024b). This species is common and widespread.
- **Criterion F:** A 'Low' rating was assigned to Criterion F. The Australian Raven is not listed under the EPBC Act, BC Act, or as Priority species by DBCA.

Appendix Table B.21 Australian Raven Risk Assessment

Likelihood			Consequence				
	Criterion A	Criterion B		Criterion C	Criterion D	Criterion E	Criterion F
Unlikely			Low	X	X	X	X
Possible	X		Moderate				
Likely		X	High				
Risk Rating							
Likelihood	Likely		Consequence	Low			
Overall Rating: Moderate							

3.4 Cockatoos and Corellas (*Cacatuidae*)

Two (2) species of cockatoo and corella were recorded flying at RSA during the field survey program:

- Galah (*Eolophus roseicapilla*)
- Western Corella (*Cacatua pastinator*).

Information on the Galah and Western Corella from Australian Wind Farms

There are 4 records of Galah strikes with wind turbines at Australian wind farms within the species' range and no records of Western Corella strikes (Moloney et al., 2019; Wood, 2020).

Likelihood and Consequence of Impacts

The overall risk rating for both species is 'Minor' based on a 'Possible' likelihood rating and a 'Low' consequence rating. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.23**.

- **Criterion A:** An 'Unlikely' rating was assigned to Criterion A. The Galah was recorded flying within RSA on 2 occasions out of 182 flight observations. The Western Corella was observed flying within RSA on 2 occasions out of 73 flight observations. It is considered both species are only likely to rarely occur at RSA.
- **Criterion B:** A 'Likely' rating was assigned to Criterion B. The Galah was recorded on 290 occasions and the Western Corella on 118 occasions during the BBUS program. Both species are likely to regularly occur in or move through the Study Area.
- **Criterion C:** A rating of 'Low' was assigned to Criterion C. Both species are widely distributed within their range, which itself is also widely distributed. Therefore, the population of either species is unlikely to be concentrated within the Study Area.
- **Criterion D:** A rating of 'Moderate' was assigned to Criterion D. The life-history characteristics of the Galah overlap with certain aspects of both the descriptions for a Low and High rating for Criterion D. Galahs are highly sociable and can form large flocks that travel between roosting and feeding areas. Juvenile birds tend to disperse widely (Rowley & Boesman, 2020). The Western Corellas are highly sociable and can form large flocks that travel between roosting and feeding areas. Immature birds tend to form nomadic flocks which range far from their natal areas (Rowley & Kirwan, 2020).

- **Criterion E:** A rating of 'Low' was assigned to Criterion E. The total population for both species is unknown but thought to be increasing (BirdLife International, 2018c, 2024j). Both species are common and widespread across their ranges.
- **Criterion F:** A rating 'Low' was assigned to Criterion F. Neither species is listed under the EPBC Act, BC Act, or as Priority species by DBCA.

Appendix Table B.22 Galah and Western Corella Risk Assessment

Likelihood			Consequence				
	Criterion A	Criterion B		Criterion C	Criterion D	Criterion E	Criterion F
Unlikely	All		**Low**	All		All	All
Possible			**Moderate**		All		
Likely		All	**High**				
Risk Rating							
Likelihood	All: Possible		**Consequence**	All: Low			
Overall Rating (All): Minor							

3.5 Cormorants (*Phalacrocoracidae*)

Two (2) species of cormorant were recorded flying at RSA during the field survey program:

- Little Black Cormorant (*Phalacrocorax sulcirostris*)
- Little Pied Cormorant (*Microcarbo melanoleucos*).

Not listed under the EPBC Act, BC Act, or as a Priority species by DBCA.

Information on Little Black Cormorant and Little Pied Cormorant from Australian Wind Farms

There are no published reports of Little Black Cormorant or Little Pied Cormorant strikes with wind turbines at Australian wind farms within the species' range.

Likelihood and Consequence of Impacts

The overall risk rating for the Little Black Cormorant is 'Minor' based on a 'Possible' likelihood rating and a 'Low' consequence rating. The overall risk rating for the Little Pied Cormorant is 'Moderate' based on a 'Likely' likelihood rating and a 'Low' consequence rating. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.24**.

- **Criterion A:** A 'Possible' rating was assigned to Criterion A for both species. Both species were observed within RSA on 2 occasions, and it is considered possible that both may occasionally occur at RSA during longer distance movements between suitable habitat.
- **Criterion B:** A 'Possible' rating was assigned to Criterion B for the Little Black Cormorant and a 'Likely' rating for the Little Pied Cormorant. The Little Black Cormorant was only recorded on 4 occasions, with 3 of these observations being of a single individual. The Little Pied Cormorant was recorded on 9 occasions during the Spring, Summer and Autumn BBUS with a total of 23 individuals observed.

- **Criterion C:** A 'Low' rating was assigned to Criterion C for both species. Neither species is likely to be concentrated within the Study Area as they are widely distributed across suitable habitat which itself is also widely distributed (Orta, Christie, et al., 2020; Orta, Jutglar, et al., 2020).
- **Criterion D:** A 'Low' rating was assigned to Criterion D for both species. The Little Black Cormorant has been recorded breeding in all months and breeds in colonies, often comprising up to100 pairs but occasionally up to 1,000 and lay clutches of 2-6 eggs (Orta, Christie, et al., 2020). The Little Pied Cormorant may possibly breed all year round depending on local water conditions. It breeds in widespread small colonies, has extensive juvenile dispersal and lay clutches of 3-5 eggs (Orta, Jutglar, et al., 2020).
- **Criterion E:** A 'Low' rating was assigned to Criterion E for both species. The Little Black Cormorant has an estimated population of between 23,300 - 683,000 mature individuals (BirdLife International, 2024f). The total population of the Little Pied Cormorant is unknown, but the species is considered to be common and widespread (Orta, Jutglar, et al., 2020) and likely greater than 20,000 individuals.
- **Criterion F:** A 'Low' rating was assigned to Criterion F for both species. Neither species is listed under the EPBC Act, BC Act, or as Priority species by DBCA.

Appendix Table B.23 Little Black Cormorant and Little Pied Cormorant Risk Assessment

Likelihood			**Consequence**				
	Criterion A	**Criterion B**		**Criterion C**	**Criterion D**	**Criterion E**	**Criterion F**
Unlikely			**Low**	All	All	All	All
Possible	All	LBC	**Moderate**				
Likely		LPC	**High**				
Risk Rating							
Likelihood	LBC: Possible LPC: Likely		**Consequence**	All: Low			
Overall Rating (LBC): Minor							
Overall Rating (LPC): Moderate							

3.6 Ibis and Spoonbills (*Threskiornithidae*)

Two (2) species of ibis and spoonbill were recorded flying at RSA during the field survey program:

- Straw-necked Ibis (*Threskiornis spinicollis*)
- Yellow-billed Spoonbill (*Platalea flavipes*).

Information on the Straw-necked Ibis and Yellow-billed Spoonbill from Australian Wind Farms

There are 4 published reports of Straw-necked Ibis strikes with wind turbines at Australian wind farms and no published reports of Yellow-billed Spoonbill strikes (Moloney et al., 2019; Wood, 2017).

Likelihood and Consequence of Impacts

The overall risk rating for the Straw-necked Ibis is 'Moderate' based on a 'Likely' likelihood rating and a 'Low' consequence rating. The overall risk rating for the Yellow-billed Spoonbill is 'High' based on a

'Likely' likelihood rating and a 'Moderate' consequence rating. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.25**.

- **Criterion A:** A 'Likely' rating was assigned to Criterion A for the Straw-necked Ibis. The Straw-necked ibis was recording flying at RSA during 11 out of 13 flight observations. Flight heights were up to 400 m AGL on one occasion, and of a flock of 200 individuals flying up to 120 m AGL on another occasion. A 'Possible' rating was assigned for the Yellow-billed Spoonbill. The Yellow-billed Spoonbill was recorded flying at RSA between 150 – 200 m AGL on one occasion out of two flight observations during the BBUS program.
- **Criterion B:** A 'Likely' rating was assigned to Criterion B for both species. The Straw-necked Ibis was recorded on 16 occasions during the Spring, Autumn, and Winter BBUS events. The Yellow-billed Spoonbill was recorded on 7 occasions during the Spring, Summer, and Autumn BBUS events. It is likely that both species regularly occur in, or move through, the Study Area.
- **Criterion C:** A 'Low' rating was assigned to Criterion C for both species. The Straw-necked Ibis has a broad range of habitat preferences and will utilise all terrestrial habitats within their range, being most common in pastures, cultivation, irrigation areas, grasslands, open forests and natural wetlands (Matheu et al., 2020a). The Yellow-billed Spoonbill also has a broad range of habitat preferences, utilising inland wetlands including shallow swamps, flooded pastures, watercourses and drainage lines, and the shallow margins of lakes (Matheu et al., 2020b). Habitats for both species are well represented across the broader region.
- **Criterion D:** A 'Moderate' rating was assigned to Criterion D for both species. The life-history characteristics of both species overlap with certain aspects of both the descriptions for a 'Low' and 'High' rating for Criterion D. Straw-necked ibis have been recorded breeding from August to December in southern regions and breed in colonies, often of several thousand pairs, laying clutches of 2-5 eggs (Matheu et al., 2020a). The Yellow-billed Spoonbill have been recorded breeding from September to January in southern regions and disperse widely once breeding has finished. The species often breeds in loose colonies and usually lay 3 eggs (Matheu et al., 2020b).
- **Criterion E:** A 'Low' rating was assigned to Criterion E for the Straw-necked Ibis and a 'Moderate' rating assigned for the Yellow-billed Spoonbill. The total population of the Straw-necked Ibis is unknown, but the species is considered to be widespread and common across its range. It breeds in large colonies and its range has increased due to the conversion of land to agriculture (Matheu et al., 2020a). The estimated total population of the Yellow-billed Spoonbill is 10,000-25,000 individuals (BirdLife International, 2024k) and a 'Moderate' rating is considered appropriate.
- **Criterion F:** A 'Low' rating was assigned to Criterion F for both species. Neither species are listed under the EPBC Act, BC Act, or as Priority species by DBCA

Appendix Table B.24 Straw-necked Ibis and Yellow-billed Spoonbill Risk Assessment

Likelihood			Consequence				
	Criterion A	Criterion B		Criterion C	Criterion D	Criterion E	Criterion F
Unlikely			**Low**	All		SI	All
Possible	YS		**Moderate**		All	YS	
Likely	SI	All	**High**				
Risk Rating							
Likelihood	All: Likely		**Consequence**	SI: Low			

Likelihood	Consequence
	YS: Moderate
Overall Rating (SI): Moderate	
Overall Rating (YS): High	

Note. SI=Straw-necked Ibis, YS=Yellow-billed Spoonbill.

3.7 Martins and Swallows (*Hirundinidae*)

Two (2) species of martins and swallows were recorded flying at RSA during the field survey program:

- Tree Martin (*Petrochelidon nigricans*)
- Welcome Swallow (*Hirundo neoxena*).

Information on the Tree Martin, and Welcome Swallow from Australian Wind Farms

There are 6 published reports of Tree Martin strikes with wind turbines at Australian wind farms and 5 published reports of Welcome Swallow strikes (Goldwind Australia, 2024; Moloney et al., 2019; Nature Advisory, 2025).

Likelihood and Consequence of Impacts

The overall risk rating for all species assessed is 'Moderate' based on a 'Likely' likelihood rating and a 'Low' consequence rating. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.26**.

- **Criterion A:** A 'Possible' rating was assigned to Criterion A for all species assessed. The Tree Martin and Welcome Swallow were both recorded flying within RSA on 2 occasions during the BBUS program. These species are likely to occasionally occur at RSA when foraging or dispersing through the Study Area.
- **Criterion B:** A 'Likely' rating was assigned to Criterion B for all species assessed. The Tree Martin was recorded on 111 occasions during the field survey program. The Welcome Swallow was recorded on 47 occasions during the field survey program. All species are considered likely to regularly occur in, or move through, the Study Area.
- **Criterion C:** A 'Low' rating was assigned to Criterion C for all species assessed. These species are considered widely distributed across suitable habitat, which itself is widely distributed. Therefore, these species' populations are unlikely to be concentrated within the Study Area.
- **Criterion D:** A 'Low' rating was assigned to Criterion D for all species assessed. Tree Martins nest solitarily or in loose colonies, laying a clutch of 3-5 eggs, and reusing nests in successive years. They are present all year in southwestern Australia with some passage movement in Spring and Autumn and often gather in large flocks and roosts following breeding (Turner, 2020b). Welcome Swallows are usually considered resident in Western Australia, although some seasonal movements or partial migration may occur. They generally nest solitarily or in small colonies and lay clutches of 2-7 eggs and (Turner, 2020c).
- **Criterion E:** A 'Low' rating was assigned to Criterion E for all species assessed. The total population of these species is unknown; however, they are considered generally common and widespread with stable populations (BirdLife International, 2024e, 2024i; Turner, 2020c).
- **Criterion F:** A 'Low' rating was assigned to Criterion F for all species assessed. None of the species assessed are listed under the EPBC Act, BC Act, or as Priority species by DBCA.

Appendix Table B.25 Tree Martin, and Welcome Swallow Risk Assessment

Likelihood			Consequence				
	Criterion A	Criterion B		Criterion C	Criterion D	Criterion E	Criterion F
Unlikely			**Low**	All	All	All	All
Possible	All		**Moderate**				
Likely		All	**High**				
Risk Rating							
Likelihood	All: Likely		**Consequence**	All: Low			
Overall Rating (All): Moderate							

3.8 Dusky Woodswallow (*Artamus cyanopterus*)

Not listed under the EPBC Act, BC Act, or as a Priority species by DBCA

Information on the Dusky Woodswallow from Australian Wind Farms

There is 1 published report of a Dusky Woodswallow strike with wind turbines at an Australian wind farm within the species' range (Moloney et al., 2019).

Likelihood and Consequence of Impacts

The overall risk rating for Dusky Woodswallow is 'Minor' based on a 'Possible' likelihood rating and a 'Low' consequence rating. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.27**.

- **Criterion A:** A 'Possible' rating was assigned to Criterion A for both species assessed. Both species were recorded flying within RSA on 1 occasion during the field survey program.
- **Criterion B:** A 'Possible' rating was assigned to Criterion B for both species assessed. Both species were only recorded once during the field survey program and are likely to occasionally occur, or move through, the Study Area.
- **Criterion C:** A 'Low' rating was assigned to Criterion C for both species assessed. These species are widely distributed across suitable habitat, which itself is widely distributed within the broader region.
- **Criterion D:** A 'Moderate' rating was assigned to Criterion D for both species assessed. The life-history characteristics of these species overlap with certain aspects of both the descriptions for a 'Low' and 'High' rating for Criterion D. The Dusky Woodswallow is mainly resident in Western Australia, breeds from August to February (mainly October to December), lays a clutch of 2–3 eggs, and occasionally breeds cooperatively (Rowley & Russell, 2020a). The Masked Woodswallow breeds from July to March (predominantly September to December) either nesting solitarily or in a loose colony and will lay a clutch of two to three eggs with a nestling period of 12–13 days (Rowley & Russell, 2020b).
- **Criterion E:** A 'Low' rating was assigned to Criterion E. The total population size of these species is unknown, but both are described as widespread and common (BirdLife International, 2024d, 2024h), and are likely to have populations greater than 20,000 individuals.

- **Criterion F:** A 'Low' rating was assigned to Criterion F. Neither species are listed under the EPBC Act, BC Act, or as Priority species by DBCA.

Appendix Table B.26 Dusky Woodswallow and Masked Woodswallow Risk Assessment

Likelihood			Consequence				
	Criterion A	Criterion B		Criterion C	Criterion D	Criterion E	Criterion F
Unlikely			**Low**	All		All	All
Possible	All	All	**Moderate**		All		
Likely			**High**				
Risk Rating							
Likelihood	All: Possible		**Consequence**	All: Low			
Overall Rating (All): Minor							

3.9 Ducks, Geese, and Swans (*Anatidae*)

Two (2) species of ducks were recorded flying at RSA during the field survey program:

- Australian Shelduck (*Tadorna tadornoides*)
- Australian Wood Duck (*Chenonetta jubata*).

Information on the Australian Shelduck and Australian Wood Duck from Australian Wind Farms

There are 5 published reports of Australian Wood Duck strikes with wind turbines at Australian wind farms within the species' range (Goldwind Australia, 2024; Nature Advisory, 2020). There are no published reports of Australian Shelduck strikes.

Likelihood and Consequence of Impacts

The overall risk rating for both species assessed is 'Moderate' based on a 'Likely' likelihood rating and a 'Low' consequence rating. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.28**.

- **Criterion A:** A 'Possible' rating was assigned to Criterion A for both species assessed. Both species were recorded within RSA on 1 occasion and may fly at RSA when moving between areas of suitable habitat.
- **Criterion B:** A 'Likely' rating was assigned to Criterion B for both species assessed. The Australian Shelduck was recorded on 37 occasions and the Australian Wood Duck on 25 occasions during the BBUS program. Both species are likely to regularly occur in, or move through, the Study Area.
- **Criterion C:** A 'Low' rating was assigned to Criterion C for both species assessed. These species are widely distributed across their range and suitable habitat is itself also widely distributed. Therefore, the population of these species is unlikely to be concentrated within the Study Area.

- **Criterion D:** A 'Moderate' rating was assigned to Criterion D for both species assessed. The life-history characteristics of these species overlap with certain aspects of both the descriptions for a 'Low' and 'High' rating for Criterion D. The Australian Shelduck breeds from June to December and there can be wide range dispersal after breeding (Carboneras & Kirwan, 2020a). The Australian Wood Duck generally commences breeding in July or August, but the season can be variable depending on conditions and may occur year-round. Movements of this species can be highly dispersive in more ephemeral habitat but more localised in wetter areas (Carboneras & Kirwan, 2020c).
- **Criterion E:** A 'Low' rating was assigned to Criterion E for both species assessed. The estimated population of the Australian Shelduck is 101,000-827,000 mature individuals with an increasing trend (BirdLife International, 2024c). The estimated population of the Australian Wood Duck is 66,000-670,000 mature individuals with a stable long term trend (BirdLife International, 2024g)
- **Criterion F:** A 'Low' rating was assigned to Criterion F for both species assessed. Neither species is listed under the EPBC Act, BC Act, or as Priority species by DBCA.

Appendix Table B.27 Australian Shelduck and Australian Wood Duck Risk Assessment

Likelihood			Consequence				
	Criterion A	Criterion B		Criterion C	Criterion D	Criterion E	Criterion F
Unlikely			**Low**	All		All	All
Possible	All		**Moderate**		All		
Likely		All	**High**				
Risk Rating							
Likelihood	All: Likely		**Consequence**	All: Low			
Overall Rating (All): Moderate							

3.10 White-faced Heron (*Egretta novaehollandiae*)

Not listed under the EPBC Act, BC Act, or as a Priority species by DBCA

Information on the White-faced Heron from Australian Wind Farms

There is 1 published reports of White-faced Heron strikes with wind turbines at Australian wind farms within the species' range (Nature Advisory, 2025).

Likelihood and Consequence of Impacts

The overall risk rating for the White-faced Heron is 'Moderate' based on a 'Likely' likelihood rating and a 'Low' consequence rating. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.29**.

- **Criterion A:** A 'Possible' rating was assigned to Criterion A. The White-Faced Heron was observed at RSA height on 1 occasion during the BBUS program and may fly at RSA when making longer distance movements between suitable habitat.
- **Criterion B:** A 'Likely' rating was assigned to Criterion B. The White-faced Heron was recorded on 27 occasions during all BBUS events, and it is likely that this species regularly occurs in or moves through the Study Area.

- **Criterion C:** A 'Low' rating was assigned to Criterion C. The White-faced Heron is widely distributed within its range and the species habitat is also widely distributed. This species' population is unlikely to be concentrated within the Study Area.
- **Criterion D:** A 'Moderate' rating was assigned to Criterion D. The life-history characteristics of the White-faced Heron overlap with certain aspects of both the descriptions for a 'Low' and 'High' rating for Criterion D. The White-faced Heron has been recorded breeding from October to December in southern regions. While breeding success is poorly known, there was a mean success of just 1.4 young per nesting attempt in one study. Nestlings fledge between 38-42 days after hatching but remain with parents much longer. Although the species is largely sedentary, they are capable of wide-ranging dispersive movements (Martínez-Vilalta et al., 2020).
- **Criterion E:** A rating of 'Low' was assigned to Criterion E. The total population of the White-faced Heron is unknown, but the species is considered to be widespread and common and has benefitted from the conversion of land to agriculture and widespread irrigation (Martínez-Vilalta et al., 2020). It is considered likely that the total population is likely to be above 20,0000 individuals.
- **Criterion F:** A rating of 'Low' was assigned to Criterion F. The White-faced Heron is not listed under the EPBC Act, BC Act, or as Priority species by DBCA.

Appendix Table B.28 White-faced Heron Risk Assessment

Likelihood			Consequence				
	Criterion A	Criterion B		Criterion C	Criterion D	Criterion E	Criterion F
Unlikely			Low	X		X	X
Possible	X		Moderate		X		
Likely		X	High				
Risk Rating							
Likelihood	Likely		Consequence	Low			
Overall Rating: Moderate							

4.0 Microbat Species

A total of 7 non-listed microbat species were recorded within the Survey Area. These species include:

- **Chocolate Wattled Bat (*Chalinolobus morio*)**
- **Gould's Wattled Bat (*Chalinolobus gouldii*)**
- Inland Broad-nosed Bat (*Scotorepens balstoni*)
- **Lesser Long-eared Bat (*Nyctophilus geoffroyi*)**
- **Southern Forest Bat (*Vespadelus regulus*)**
- Western Free-tailed Bat (*Ozimops kitcheneri*)
- **White-striped Free-tailed Bat (*Austronomus australis*).**

Information on Non-listed Microbats from Australian Wind Farms

While no published data has been identified on microbat turbine strikes in Western Australia, recorded turbine strikes have been published elsewhere within Australia for species emboldened in the list above (Moloney et al., 2019; Nature Advisory, 2020, 2025; Wood, 2017, 2020). The White-striped Free-tailed Bat is particularly recognised as prone to collision mortality with wind turbines (Australasian Bat Society, 2024).

Likelihood and Consequence of Impacts

The overall risk rating for non-listed microbat species is 'High' based on a 'Likely' likelihood rating and a 'Moderate' consequence rating. Rationale for responses to each criterion are detailed below and summarised in **Appendix Table B.30**.

- **Criterion A:** Due to data deficiency on flight heights of microbats in published literature, the precautionary principle has been applied and the expected flight behaviours of microbat species assessed here is based on their associated foraging guilds. A 'Likely' rating was assigned to Criterion A for the White-striped Free-tailed Bat, Gould's Wattled Bat, and Western Free-tailed Bat. These species are known to regularly hunt above the tree canopy and may commute long distances between roosting and foraging sites where they may occur at RSA (Baker & Gynther, 2023). A 'Possible' rating has been assigned to all remaining species as they may only occasionally occur at RSA during longer distance movements or have been recorded at RSA in unpublished datasets (Umwelt, 2025).
- **Criterion B:** A 'Likely' rating has been assigned to Criterion B as all microbat species assessed were recorded within the Survey Area and are expected to regularly occur in or move through the Study Area.
- **Criterion C:** A 'Moderate' rating has been assigned to Criterion C for all microbat species assessed. Given the large scale clearing in the broader region, suitable habitat for microbats would be largely restricted to remnant vegetation and anthropogenic structures (e.g. shed or dwelling rooves). Some species of microbats in this area may roost in colonies, while some may roost in solitary.
- **Criterion D:** A 'Moderate' rating has been assigned to Criterion D for all microbat species assessed. The life-history characteristics for these species overlap with certain aspects of both the descriptions for a Low and High rating for Criterion D.

- **Criterion E:** A 'Moderate' rating has been conservatively assigned to Criterion E for all microbat species assessed. None of the species considered likely to occur within the Study Area have been assigned a conservation status. However, the total population of microbats in Western Australia are not well defined and it is noted that microbats are at increased risk of collision from wind farms (Australasian Bat Society, 2024) with at least one species (the White-striped Free-tailed Bat) being recognised by the IUCN Red List as having a declining population as a result (Pennay, 2020).
- **Criterion F:** A 'Low' rating has been assigned to Criterion E for all microbat species assessed. No species have been listed under the EPBC Act, BC Act, or as Priority species by DBCA**.**

Appendix Table B.29 Non-listed Microbats Risk Assessment

Likelihood			**Consequence**				
	Criterion A	**Criterion B**		**Criterion C**	**Criterion D**	**Criterion E**	**Criterion F**
Unlikely			**Low**				X
Possible	CWB, IBB, LLB, SFB,		**Moderate**	X	X	X	
Likely	GWBm, WeFB, WhFB,	All	**High**				
Risk Rating							
Likelihood	All: Likely		**Consequence**	All: Moderate			
Overall Rating: High							

Note. CWB=Chocolate Wattled Bat, GWB=Gould's Wattled Bat, IBB=Inland Broad-nosed Bat, LLB=Lesser Long-eared Bat, SFB=Southern Forest Bat, WeFB=Western Free-tailed Bat, WhFB=White-striped Free-tailed Bat.

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