BIRD AND BAT MANAGEMENT PLAN

Waddi Wind Farm (EPBC 2023/09639)

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DECLARATION OF ACCURACY

In making this declaration, I am aware that section 491 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) makes it an offence in certain circumstances to knowingly provide false or misleading information or documents to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the Environment Protection and Biodiversity Conservation Regulations 2000 (Cth). The offence is punishable on conviction by imprisonment or a fine, or both. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.

Signed

_____

Full name (please print)

_____

Organisation (please print)

_____

Date

_____

ACKNOWLEDGEMENTS

RPS AAP Consulting Pty Ltd acknowledges that this Bird and Bat Management Plan has been informed by the contents of a partially completed draft Avian Fauna Collision Monitoring Program for the Waddi Wind Farm prepared by Brett Lane & Associates Pty Ltd for Waddi Wind Farm Pty Ltd in 2017.

GLOSSARY

Term / acronym	Description
Barotrauma	Bodily injury caused by changes in barometric (air) pressure
BBMP	Bird and Bat Management Plan
BC Act	*Biodiversity Conservation Act 2016*
commissioning	All activities, including turning of turbines, after the components of the wind turbine are installed. The date on which commissioning commences is the first date on which the blades of the first completed wind turbine start rotating.
DAWE	Department of Agriculture, Water and the Environment
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DBCA	Department of Biodiversity, Conservation and Attractions
Disturbance Area	The Disturbance Area (138.4 ha) represents the physical footprint required to construct and operate the wind farm and transmission line infrastructure components of the Proposed Action. This area represents approximately 1.3 per cent of the Project Area and approximately 10.9 per cent of the Indicative Works Area.
DPaW	Department of Parks and Wildlife
DPIRD	Department of Primary Industries and Regional Development
DWER	Department of Water and Environmental Regulation
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
Feather spot	A clump of five feathers or more
full operation	Occurs once the commissioning of the last wind turbine has been completed
ha	Hectare
Impact trigger for DBCA priority listed and non-threatened species	A total of ten or more bird or bat carcasses, or parts thereof, of the same species in two successive searches for the turbines monitored of a DBCA-listed priority or non-threatened species.
Impact trigger for migratory, threatened or specially protected species	A single migratory, threatened or specially protected bird or bat individual (or recognisable parts thereof) listed under the Commonwealth EPBC Act or state BC Act, is found dead or injured under or close to a wind turbine during any carcass search survey or incidentally by site personnel.
Indicative Works Area	The Indicative Works Area (1,226.6 ha) is the area within which the wind farm and transmission line infrastructure components are proposed to be sited. This area represents approximately 11.7 per cent of the broader Project Area.
km	Kilometres
km/hr	Kilometres/hour
kV	Kilovolt
m	Metres
m AHD	Metres Australian Height Datum
MW	Megawatts
Proposed Action	The Proposed Action is to construct and operate the wind farm development proposed with up to 18 wind turbines and associated infrastructure, including an overhead 132 kV transmission line from an on-site substation into Western Power's existing transmission network.
Project Area	The Project Area (10,493.7 ha) follows the cadastral property boundaries for the wind farm components and the proposed land tenure of the transmission line infrastructure component. The Project Area represents the area of land for which the Proponent has agreements in place with relevant parties to undertake the Proposed Action.
Proponent	The proponent is the Waddi Wind Farm Pty Ltd as Trustee for Waddi Wind Farm Project Trust, a subsidiary of the portfolio of companies trading as Tilt Renewables.
PVA	Population viability analysis
RPS	RPS AAP Consulting Pty Ltd

Term / acronym	Description
RSA	Rotor Swept Area
Strike	An impact between bird or bat and wind turbine blade or associated infrastructure
SWIS	South West Interconnected System
Unacceptable impact on DBCA priority listed and common species	Where population numbers are known and reported by DBCA for the period concerned, an unacceptable impact is any impact that is likely to: • Lead to a greater than 50% reduction over a five-year period in the immediate population (i.e. local population, where known) that utilises the wind farm; AND • Act in an ongoing way to reduce the wider, regional population (where known) by more than 30% over a five-year period; OR • Reduce the total species' population (where known) by more than 10% over a five-year period
Unacceptable impact on migratory, threatened or specially protected species	• Where population numbers are known and reported by DCCEEW or DBCA for the period concerned, an unacceptable impact is any impact that is likely to reduce the total species' population by more than 0.1%[1]; OR • Where population numbers are not confirmed, an unacceptable impact is more than three carcasses found of one migratory, threatened or specially protected bird or bat species over a successive two-month period (i.e. three or more individuals over a successive two-month survey period).
UXO	Unexploded ordnance

[1] For species that aggregate in flocks, 1% of the population is considered internationally important, 0.1% as nationally important. The same threshold levels are used here for want of more specific ecological research (Department of the Environment 2015).

1 INTRODUCTION

1.1 Background

The Waddi Wind Farm (the Proposed Action) is located approximately 15 km north-west of Dandaragan, 30 km north of Cataby and approximately 150 km north of Perth in the mid-west region of Western Australia's wheatbelt. The site is wholly within the Dandaragan Shire (Figure 1).

Waddi Wind Farm Pty Ltd as Trustee for Waddi Wind Farm Project Trust, a subsidiary of the portfolio of companies trading as Tilt Renewables (the Proponent), was granted development approval for the Proposed Action by the Shire of Dandaragan on 26 February 2024. The Proponent is also seeking approvals under Commonwealth and state environmental legislation, including:

- A referral (EPBC 2023/09639) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This was lodged in August 2023 and the Proposed Action was determined to be a controlled action by the Department of Climate Change, Energy, the Environment and Water (DCCEEW). In April 2025, the Proponent submitted an amended Preliminary Documentation to DCCEEW, which is under assessment by DCCEEW for the Minister, or their delegate, to determine whether to approve the Proposed Action.
- A native vegetation clearing permit application (CPS 10418/1) under the state *Environmental Protection Act 1986* (EP Act). This was lodged in November 2023. The clearing permit application is under assessment by the Department of Water and Environmental Regulation (DWER).

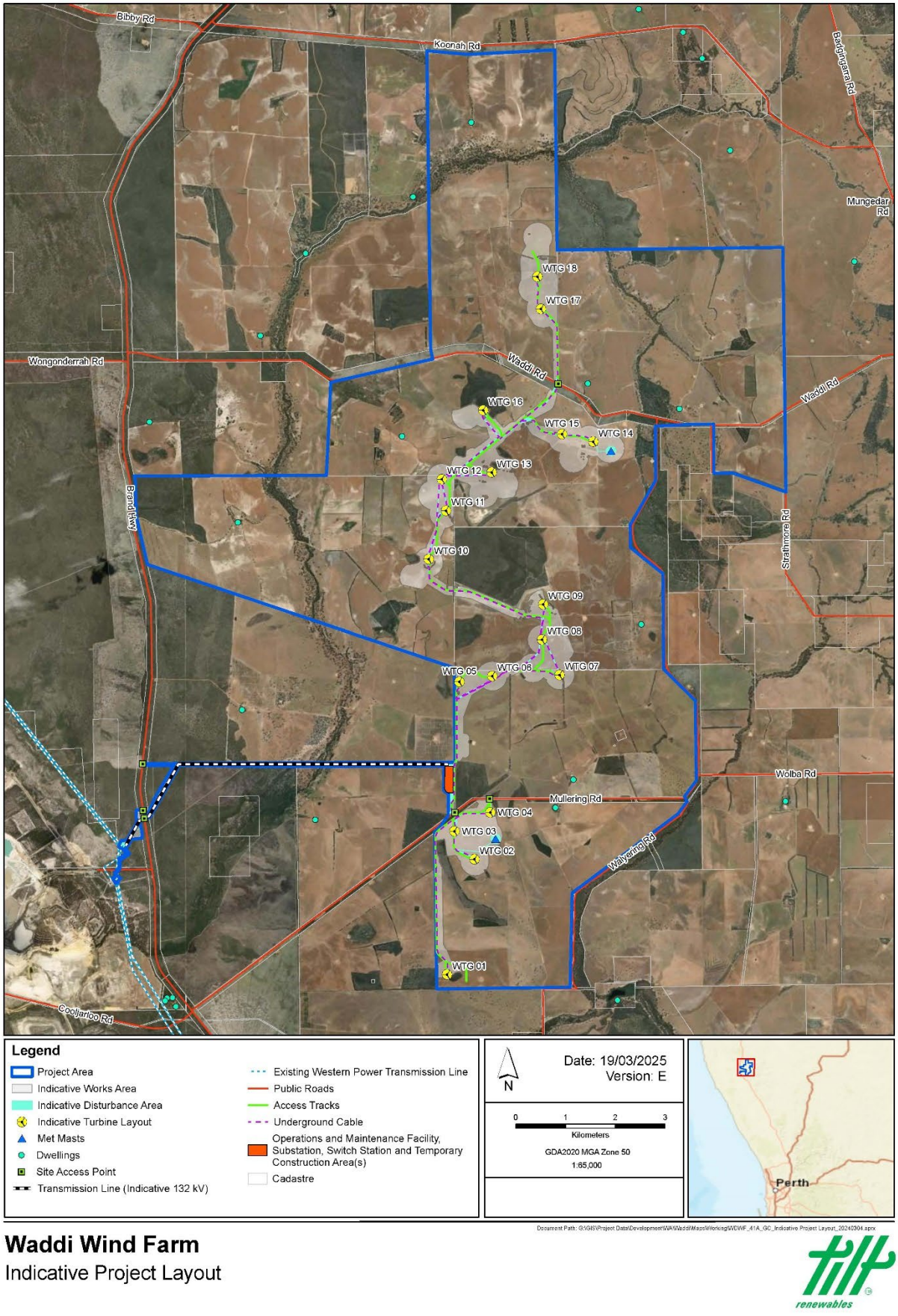


Figure 1: Indicative project layout

1.2 Purpose and scope

1.2.1 Purpose

The purpose of a BBMP is to enable a robust approach to mitigate and manage potential impacts of a Proposed Action associated with individual mortality from turbine collision and barotrauma, and potential changes to species utilisation of a Project Area on relevant bird and bat species (DCCEEW 2023a).

This Bird and Bat Management Plan (BBMP) has been prepared by the Proponent, to meet the current approval requirements relevant to bird and bat management set out in Table 1 and to address DCCEEW's request for additional information in December 2023 to provide a Bird and Bat Management Plan (BBMP) with a Preliminary Documentation (EPBC 2023/09639).

Subject to an EPBC Act approval (EPBC 2023/09639) being granted by the Commonwealth Minister for the Environment, or their delegate, and to a clearing permit (CPS 10418/1) being granted by DWER's Chief Executive Officer, conditions relevant to bird and bat management are presented in Table 1.

Table 1: Bird and bat management approval conditions

Approval	Condition no.	Condition text	Response to condition requirements	BBMP reference and page no.
Shire of Dandaragan development approval	20	The proponent shall develop and implement an Avian Fauna Collision Monitoring Program, to the satisfaction of the Western Australia Department of Biodiversity, Conservation and Attractions to monitor the impact of the wind farm on avian fauna in the Project Area, specifically in respect to the endangered Carnaby's cockatoo.	This BBMP has been prepared to address this condition. The draft BBMP will be provided to the Department of Biodiversity, Conservation and Attractions (DBCA) for comment to ensure it addresses their requirements prior to being finalised.	This BBMP

This BBMP has been prepared in accordance with the DCCEEW's Environmental Management Plan Guidelines (DCCEEW 2024x), which was a requirement from the DCCEEW's request for additional information in December 2023.

This BBMP has been prepared to demonstrate the approach to:

- Mitigate and manage potential impacts to relevant listed threatened and migratory bird species associated with individual mortality from turbine and transmission line collision and barotrauma, and potential changes to species utilisation of the Project Area. This is applicable to relevant threatened and migratory bird species listed under the Commonwealth EPBC Act and the state *Biodiversity Conservation Act 2016* (BC Act).
- Mitigate and manage potential impacts to relevant non-threatened at-risk bird and bat species associated with multiple mortalities from turbine and transmission line collision and barotrauma, and potential changes to species utilisation of the Project Area.
- Address all environmental and planning approval conditions relating to bird and bat management in connection to constructed and operational wind turbines and transmission line.
- Implement an adaptive management framework, including impact triggers and associated contingency actions.
- Inform performance and compliance reporting and provide for independent environmental auditing.

1.2.2 Scope

The scope of the BBMP includes:

- A description of the Proposed Action (Section 2).
- Details on the preliminary site characterisation and site specific assessment (Section 0).
- An assessment of potential impacts from the operation of the Proposed Action on birds and bats (Sections 4 and 5):
  - Operation (direct impact)
    - Collision with wind turbines causing death or injury
    - Barotrauma from wind turbines
    - Collision with overhead transmission lines causing death or injury
  - Operation (indirect impact)
    - Changes to utilisation of the site and its surrounds from disturbance and barrier effects
- Identification of proposed environmental outcomes (Section 5.5).
- Monitoring, management and mitigation measures to ensure that potential impacts are managed to within acceptable levels (Sections 6 and 7).
- Identification of impact triggers and decision-making framework (Section 8).
- Reporting requirements (Section 9).

This BBMP will be implemented prior to commissioning and the first two years of full operation. The two years of operation monitoring is intended to ensure that statistically useable and robust results are generated from the monitoring program that include an estimate of both bird and bat mortality rates, together with an estimate of sampling precision. After two years, a detailed report will be prepared reviewing the monitoring program and providing recommendations for the future in response to confirmed issues.

This BBMP is intended to apply to all employees, contractors, and visitors to the Proposed Action prior to commissioning and the first two years of operation.

1.2.3 Preliminary documentation – request for additional information

In November 2023, the DCCEEW determined that the Proposed Action (EPBC 2023/09639) was a controlled action to be assessed by preliminary documentation (DCCEEW 2023a). The delegate of the Minister of the Environment found that the Proposed Action to construct and operate a wind farm is likely to have a significant impact on matters protected under Division 4, Part 3 of the EPBC Act, namely:

- Listed threatened species and communities (sections 18 & 18A)
- Migratory species (section 20 and 20A).

On 22 December 2023, DCCEEW requested additional information to assess the impacts of the Waddi Wind Farm pursuant to Section 95A(2) of the EPBC Act. The threatened species, threatened community and migratory birds identified by DCCEEW that could potentially be impacted by the Waddi Wind Farm are:

- Carnaby's cockatoo (*Zanda latirostris*) listed as Endangered under the EPBC Act and BC Act
- Common sandpiper (*Actitis hypoleucos*) listed as Migratory under the EPBC Act and BC Act
- Curlew sandpiper (*Calidris ferruginea*) listed as Critically Endangered and Migratory under the EPBC Act and as Critically Endangered under the BC Act
- Fork-tailed swift (*Apus pacificus*) listed as Migratory under the EPBC Act and BC Act
- Pectoral sandpiper (*Calidris melanotos*) listed as Migratory under the EPBC Act and BC Act
- Sharp-tailed sandpiper (*Calidris acuminata*) listed as Migratory under the EPBC Act and BC Act

The purpose of the preliminary documentation is to present:

- The information contained in the original referral
- The requested additional information on the impacts of the Proposed Action and the proposed strategies to avoid, mitigate and / or offset the impacts
- Any other relevant information on the matters protected by the EPBC Act.

Potential impacts on these Matters of National Environmental Significance (MNES) due to habitat clearance, habitat fragmentation, and through turbine and transmission line collision and barotrauma were assessed for significance against relevant guidelines.

DCCEEW issued the draft Onshore wind farm guidance - best practice approaches when seeking approval under Australia's national environment law (DCCEEW 2024w) for consultation in May 2024. The draft guideline outlines advice on preparing a BBMP for the Commonwealth assessment process, which aligns with the BBMP elements in DCCEEW's December 2023 request for additional information (DCCEEW 2023a).

The Proponent prepared a Preliminary Documentation to address the additional information required by DCCEEW for assessment under the EPBC Act, which was submitted to DCCEEW in April 2024. On 28 May 2024, DCCEEW requested additional information to assess the impacts of the Waddi Wind Farm pursuant to Section 95A(2) of the EPBC Act. The Proponent undertook ecological surveys and prepared an amended Preliminary Documentation to address the additional information required by DCCEEW for assessment under the EPBC Act.

1.2.4 Guidance documents

This BBMP has been prepared to accord with EPBC Act guidance documents relevance to the preparation of bird and bat management plans, including:

- Survey guidelines for Australia's threatened birds (Department of the Environment, Water, Heritage and the Arts 2010a)
- Survey guidelines for Australia's threatened bats (Department of the Environment, Water, Heritage and the Arts 2010b)
- Environmental Management Plan Guidelines (DCCEEW 2024x).

As the draft Onshore wind farm guidance (DCCEEW 2024w) is not yet finalised or in force, this BBMP has been prepared in accordance with the above guidance documents and DCCEEW's request for additional information.

1.3 Objectives

The specific BBMP objectives are:

1. To implement a monitoring program capable of detecting changes or trends in species site utilisation and any mortality of at-risk birds and bats caused by the wind farm operations
2. To directly record impacts on birds and bats through carcass surveys
3. To document a decision-making framework that uses the results from monitoring and quantitative impact triggers to inform the need for addition management and mitigation measures where necessary to continue to keep impacts within acceptable levels
4. To outline the BMMP reporting scope and frequency.

The BBMP will be adaptive in response to outcomes of monitoring, detection of impact triggers that could have resulted from identified impacts to birds and bats from collisions, barotrauma, or site utilisation changes. This adaptive management framework will involve consultation with DBCA and / or DCCEEW for a management response following detected mortality or mortalities of at-risk birds and bats considered to meet an impact trigger (see Sections 8 and 9).

1.4 Qualification requirements

This BBMP has been informed by site-specific studies undertaken by specialist environmental consultancies and personnel, specifically:

- Project Area specific site utilisation surveys and assessments for birds and bats (Bamford Consulting Ecologists (BCE) 2025, Terrestrial Ecosystems 2022, Ecologia Environment 2016, Outback Ecology 2014, RPS 2014 and RPS 2010).
- Technical review of Carnaby's cockatoo night-roosting and flock movement behaviours in the localities of Cooljarloo, Cataby and Badgingarra using research data sourced between 2017 and 2022 (Murdoch University 2024).
- Site utilisation survey for birds at Yandin Wind Farm (Ecologia Environment 2017) and annual mortality surveys for birds and bats at Yandin Wind Farm (Alinta Energy 2022 and Alinta Energy 2024).
- Site utilisation survey and annual mortality and abundance monitoring surveys at Badgingarra Wind Farm (Ecoscape (Australia) Pty Ltd [Ecoscape] 2018, Ecoscape 2019a, Ecoscape 2019b and Ecoscape 2020).

The experience of the specialist environmental consultancies and personnel who undertook the site-specific studies is presented in Table 2. Suitably qualified environmental consultancies and personnel will be employed to implement the proposed post commissioning monitoring program in order to detect potential long-term changes to species utilisation of the Project Area and its surrounds because of the operation of the Waddi Wind Farm.

1.5 Exclusion of potential impacts addressed in the BBMP

Preliminary Documentation (RPS 2025) has been prepared for the Proponent to address other potential impacts to birds and bats relevant to the Proposed Action. The potential impacts to birds and bats, which are excluded from consideration as part of this BMMP, because they have been addressed as part of the Preliminary Documentation (RPS 2025), include:

- Construction phase
  - Permanent loss of foraging habitat
  - Habitat fragmentation
  - Disturbance, injury, or death during vegetation clearing and construction
  - Introduction and / or distribution of weeds, pests, and diseases
  - Disturbance to surrounding fauna habitat
- Operational phase
  - Introduction and / or distribution of weeds, pests, and diseases.

Potential impacts to bats from collision with overhead transmission lines causing death or injury during the operational phase has not been considered in this BBMP's long-term impact risk assessment. This is due to there being no evidence to suggest that microbats are at risk of new overhead transmission lines (RPS 2014). Echolocation abilities of many of the insectivorous bats enable them to identify and avoid objects less than a millimetre across (Grinnell and Griffen 1958).

Table 2: Qualifications for the BBMP's information sources

Requirements	Information sources	Qualifications of personnel involved
Preparation of the BBMP by a suitably qualified ecologist	This BBMP has been primarily informed by the contents of a partially completed draft Waddi Wind Farm Avian Fauna Collision Monitoring Program prepared by Brett Lane & Associates Pty Ltd for Waddi Wind Farm Pty Ltd in 2017	• Brett Lane & Associates Pty Ltd personnel prepared the draft Avian Fauna Collision Monitoring Program, including a senior ecologist, project manager and principal consultant. • Brett Lane & Associates Pty Ltd personnel have experience gained from the preparation and implementation of approved management plans to monitor and mitigate the impacts of wind farm operation on birds and bats at numerous wind farms in Western Australia, New South Wales, and Victoria.
	This BBMP has been prepared by RPS.	• RPS personnel prepared this BBMP, including a senior environmental consultant, senior marine scientist and technical directors. • RPS has undertaken a number of impact assessments for wind farms and is familiar with the specific ecological issues associated with wind farm developments.
Requirement for site utilisation surveys to be undertaken by a suitably qualified expert.	Avifauna Assessment, Proposed Waddi Wind Farm Development (RPS 2010)	• Experienced bird ecologists from RPS undertook avifauna surveys for the Waddi Wind Farm and Yandin Wind Farm (RPS 2010). • RPS has undertaken several avian surveys and impact assessments for wind farms and is familiar with the specific ecological issues associated with wind farm developments.
	Fauna Assessment, Waddi Wind Farm (RPS 2014)	• RPS ecologists undertook a bat survey for the Waddi Wind Farm (RPS 2014). Bamford Consulting Ecologists undertook a site inspection and provided specialist technical advice. • RPS ecologists are qualified to undertake bat surveys. • Bamford Consulting Ecologists' personnel are qualified to undertake fauna investigations for environmental impact assessment.
	Waddi Wind Farm Spring Flora and Vegetation Survey and Black Cockatoo Habitat Survey (Outback Ecology 2014)	• Qualified botanists from Outback Ecology undertook black cockatoo habitat assessments. • Outback Ecology's personnel are qualified to undertake flora and vegetation surveys.
	Waddi Wind Farm project – Cataby Supplementary Flora, Vegetation and Fauna Survey (Ecologia Environment 2016)	• Ecologia Environment personnel undertook a fauna survey including broad fauna habitat mapping and targeted survey for Carnaby's cockatoo foraging habitat and significant trees. • Ecologia Environment personnel are qualified to undertake flora and fauna surveys.
	Black-Cockatoo habitat assessment for the Waddi Wind Farm transmission line alignment and the nominated areas in the adjacent farmland (Terrestrial Ecosystems 2022)	• Terrestrial Ecosystems personnel undertook a black cockatoo habitat survey and assessment. • Terrestrial Ecosystems personnel are qualified to undertake fauna surveys and fauna assessments.
	Wind Prospect Pty Ltd Yandin Wind Farm–Flora, Vegetation and Avifauna Assessment (Ecologia Environment 2017)	• Ecologia Environment personnel undertook an avifauna survey and flora and fauna assessments for Yandin Wind Farm. • Ecologia Environment personnel are qualified to undertake flora and vegetation and fauna surveys.
	Carnaby's Cockatoo and other Birds Baseline Monitoring Report 2018: Badgingarra Wind Farm (Ecoscape 2018)	• Ecoscape undertook the pre-operational baseline monitoring surveys for Carnaby's cockatoos and other birds at Badgingarra Wind Farm. • Ecoscape undertook site use and bird abundance surveys for Carnaby's cockatoo and other bird species and prepared field summary reports. This included a senior zoologist and principal ecologist. • Ecoscape personnel are qualified to undertake fauna monitoring programs.
	Carnaby's cockatoo and other birds year one operational monitoring (Ecoscape 2019a)	
	Field Summary Report - Spring 2019 (Ecoscape 2019b)	
	Field Summary Report - Summer 2020 (Ecoscape 2020)	
	Carnaby's Black-Cockatoo and Fork-tailed Swift utilisation survey report (BCE 2025)	• BCE personnel undertook a site utilisation survey for Carnaby's cockatoo and fork-tailed swift for the Waddi Wind Farm Project Area. • BCE personnel are experienced bird specialists and are qualified to undertake bird surveys.
Post-commissioning requirement for a long-term site utilisation survey program for each relevant species to be prepared by a suitably qualified expert	The proposed operational phase site utilisation survey program (Section 6 of this BBMP) aligns with the draft BBMP framework provided in DCCEEW's requested additional information for assessment by preliminary documentation (DCCEEW 2023a) and the Shire of Dandaragan's development approval condition 20 requirements.	• RPS personnel prepared this BBMP, including a senior environmental consultant, senior marine scientist and technical directors. • RPS has undertaken a number of impact assessments for wind farms and is familiar with the specific ecological issues associated with wind farm developments.

1.6 Consultation with government agencies

An initial risk assessment for the draft Avian Fauna Collision Monitoring Program was provided to the Department of Environment Regulation (now Department of Water and Environmental Regulation [DWER]), the (then) Department of Parks and Wildlife (DPaW) (now DBCA) and the Shire of Dandaragan for their consideration in early May 2017. Meetings were held with these agencies on 30 and 31 May 2017 to discuss the draft Avian Fauna Collision Monitoring Program. Written feedback on the initial risk assessment was received from the DPaW. The feedback was incorporated into the partially completed version of the draft Avian Fauna Collision Monitoring Program (Brett Lane & Associates Pty Ltd 2017) provided to RPS.

This draft BBMP will be appended to the Preliminary Documentation and submitted to the DCCEEW. Simultaneously, the Proponent will submit the draft BBMP to the DBCA for comment to ensure it addresses their requirements prior to being finalised. The final BBMP will be provided to the Shire of Dandaragan in accordance with the development approval condition No. 20.

1.7 Document interface

This BBMP forms part of the Environmental Management Framework for the Proposed Action. Plans that interface with this BBMP include contractor management plans and health, safety, and environmental quality systems.

2 PROJECT DESCRIPTION

2.1 Location

The Proposed Action is located approximately 12 km north-west of Dandaragan town site, approximately 150 km north of Perth, in the Shire of Dandaragan (Figure 1). The Proposed Action is predominantly located within private rural properties and minor extents within public lots and road reserves.

The location of the Proposed Action was selected as it has demonstrated excellent wind resources, it is in predominantly cleared agricultural lands and is proposed to connect into a location on the transmission network that allows for reliable export of the renewable energy generated by the wind farm.

The Proposed Action is separated into the following sections (Figure 1):

- The Project Area (10,490.8 hectares [ha]) follows the cadastral property boundaries for the wind farm components and the proposed land tenure (easement) of the transmission line infrastructure component. The Project Area represents the area of land for which the Proponent has agreements in place with relevant parties to undertake the Proposed Action.
- The Indicative Works Area (1,226.6 ha) is the area within which the wind farm and transmission line infrastructure components are proposed to be sited. This area represents approximately 11.7 per cent of the broader Project Area.
- The Disturbance Area (134.0 ha) represents the physical footprint required to construct and operate the wind farm and transmission line components of the Proposed Action. This area represents approximately 1.3 per cent of the Project Area and approximately 10.9 per cent of the Indicative Works Area.

2.2 Wind farm regional context

The Project Area is proximate to six operating wind farms:

- Large-scale wind farms:
  - **Badgingarra Wind Farm:** APA's Badgingarra Wind Farm is situated approximately 20 to 35 km north-west of the Waddi Wind Farm and consists of 37 Siemens 3.6-MW wind turbine generators installed with a hub height of 85 m and tip height of 150 m (APA 2024a). The minimum lower tip swing is approximately 20 m above natural ground level (APA n.d.)
  - **Emu Downs Wind Farm:** APA's Emu Downs Wind Farm is situated immediately to the south of the Badgingarra Wind Farm and is approximately 15 to 20 km north-west of the Waddi Wind Farm. The Emu Downs Wind Farm consists of 48 × 1.65-MW wind turbine generators installed with a hub height of 68.5 m (APA 2024b). The minimum lower tip swing is approximately 27.5 m above natural ground level (APA 2024b). It was originally completed in 2006 and acquired by APA in 2011
  - **Yandin Wind Farm:** Alinta Energy's Yandin Wind Farm is situated approximately 10 to 25 km south-east of the Waddi Wind Farm and consists of 51 Vestas 4.2-MW wind turbine generators (Ratch and Alinta Energy 2024). The Yandin Wind Farm formed part of the Dandaragan Wind Farms proposal (EPBC 2011/6006) along with the Waddi Wind Farm. The minimum lower tip swing is approximately 30 m above natural ground level (Ratch and Alinta Energy 2024)
- Small scale wind farms:
  - **Moora Microgrid:** Advanced Energy Resources' Moora Microgrid is situated approximately 35 km east of the Waddi Wind Farm and consists of five refurbished 0.5 MW wind turbine generators. The minimum lower tip swing of these turbines is unknown
  - **West Hills Wind Farm:** BlairFox's West Hills Wind Farm is situated approximately 35 km south-west of the Waddi Wind Farm and consists of ten 0.5 MW wind turbine generators. The minimum lower tip swing of these turbines is unknown
  - **Karakin Wind Farm:** BlairFox's Karakin Wind Farm is situated approximately 50 km south-west of the Waddi Wind Farm and consists of ten 0.5 MW wind turbine generators. The minimum lower tip swing of these turbines is unknown

The Project Area is proximate to two proposed wind farm:

- **Parron Wind Farm:** Zephyr Energy Pty Ltd's Parron Wind Farm is situated approximately 16 to 30 km north-west of the Waddi Wind Farm (Zephyr Energy Pty Ltd 2024). The Parron Wind Farm formed part of the Badgingarra Wind Farm proposal (EPBC 2007/3529), which has been delivered except for the portion relevant to the Parron Wind Farm's Project Area. The Parron Wind Farm is proposed to consist of 79 x 6.2-MW wind turbine generators installed with a hub height of 149 m and tip height of 230 m. The minimum lower tip swing is approximately 69.65 m above natural ground level. An EPBC Act referral (EPBC 2024/10062) was submitted in October 2024 and the Proposed Action is awaiting a delegate decision
- **Nilgen Wind Farm:** Pacific Hydro's Nilgen Wind Farm is situated approximately 40km south-west of the Waddi Wind Farm and is proposed to consist of 38 2.5 MW wind turbine generators. The minimum lower tip swing of these turbines is 42m. An EPBC Act referral (EPBC 2009/4694) was submitted in 2009 and the Proposed Action was determined not to be a controlled action. Construction has not commenced, and it is unclear whether the project is still being actively developed.

The location of the proximate wind farms relative to the Project Area is identified in Figure 2.

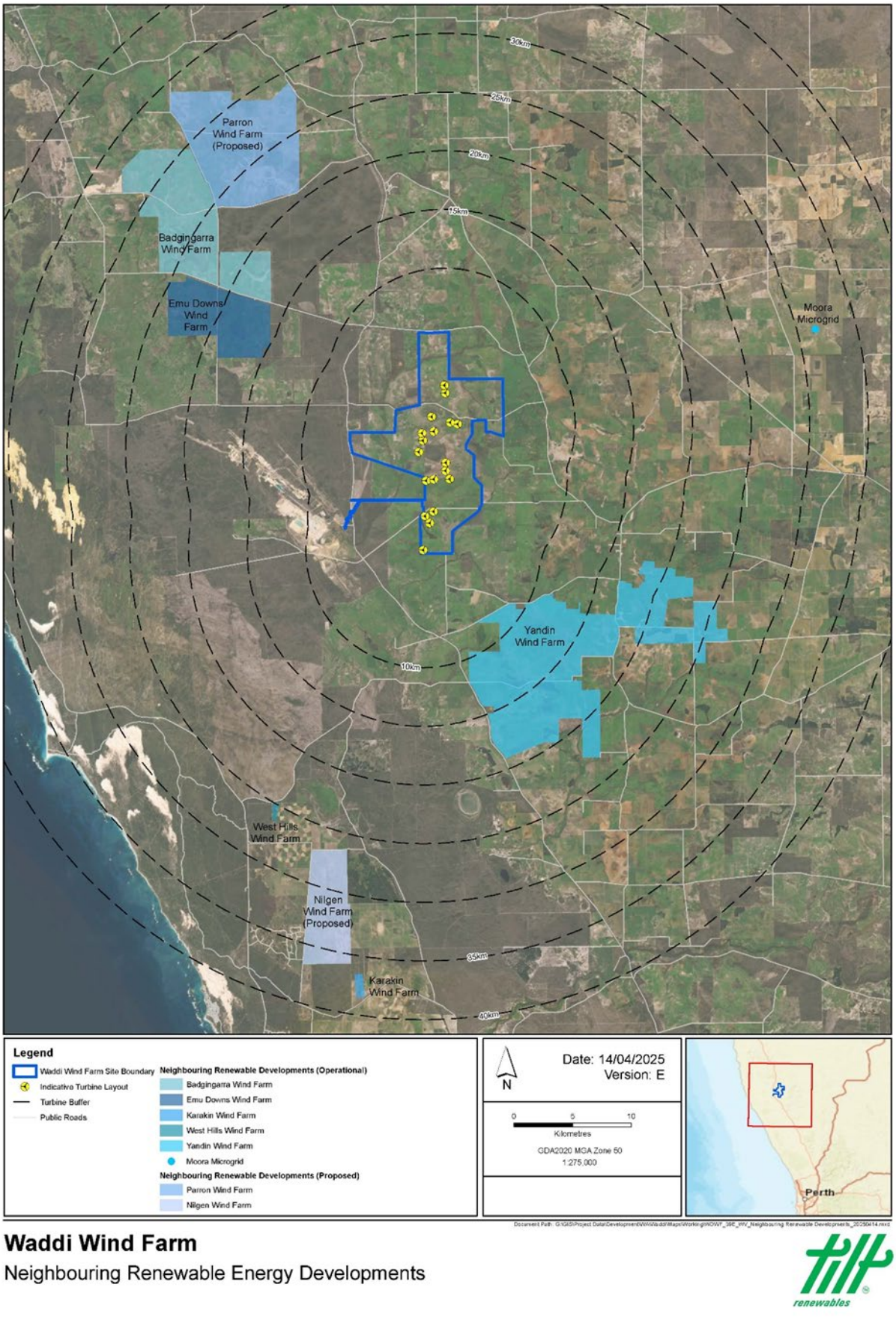


Figure 2: Neighbouring wind farm developments

2.3 Layout

The Proposed Action will consist of the following components:

- Wind farm
  - Eighteen wind turbines, with a maximum turbine blade tip height of 220 m (likely to be 206 m). The wind turbines will have a total installed indicative capacity of approximately 108 megawatts (MW)
  - Up to two permanent meteorological monitoring masts for wind speed verification, weather, and general monitoring purposes
  - Internal access tracks, hardstand areas and other associated on-site infrastructure
  - Underground electrical cabling linking the wind turbines to each other and the on-site substation
  - An on-site substation
  - Temporary construction facilities, including a concrete batching plant, construction compound, laydown areas and gravel borrow pits
  - Minor upgrades to local roads, as required for the delivery, installation and maintenance of wind turbines and the related facilities
  - An operations and maintenance facility incorporating a control room and equipment storage facilities
- Transmission line infrastructure
  - Approximately 8 km of overhead double circuit 132 kV transmission line from the on-site substation into Western Power's existing SWIS transmission network, west of Brand Highway and north of the Cataby substation (Figure 1)
    - The transmission structures will consist of approximately 30 steel poles between 11 m and 40 m in height, with an average height of approximately 30 m. Spans of the conductors between the transmission poles range from 140 m to 350 m
    - Each of the two circuits will have four conductors, three energised conductors and one optical ground wire. The optical ground wire provides lightning protection and a communications link
    - The minimum clearance for the conductors occurs in the mid-span when sag is at a maximum with the minimum ground clearance for the conductors being approximately 7.5 m
  - Cut-in/cut-out connection arrangements to the Pinjar–Eneabba/Emu Downs transmission line (PJR-ENB/EMD 81) at the point of connection to the SWIS
  - Underground fibre optic cabling of approximately 1.5 km in length from the point of connection at the SWIS to the existing Western Power-operated Cataby Substation

The layout of the wind farm and the transmission line infrastructure components are shown in Figure 1. The precise location of these components will be confirmed as part of detailed design. Western Power will be responsible for the ongoing operation and maintenance of the transmission line infrastructure.

2.3.1 Wind turbine specifications

The specifications for the Proposed Action's wind turbines are outlined in Table 3. The location of the wind turbines WTG 01 to WTG 18 is illustrated in Figure 1, and they extend approximately 15 km in a north to south orientation and approximately 5 km in an east to west orientation.

Table 3: Wind turbine specifications

Turbine specification	Anticipated dimensions	Maximum dimensions
Number of turbines	18	18
Rotor Swept Area (RSA) dimensions	44 – 206 m	58 – 220 m
Maximum RSA height (tip height)	206 m	220 m
Hub height	125 m	139 m
Minimum RSA height (above ground)	44 m	58 m
Blade length	81 m	81m
Rotor diameter	162 m	162 m
RSA per turbine	20,611.99 m^2 (or 2.1 ha)	20,611.99 m^2 (or 2.1 ha)
RSA for all turbines	371,015.82 m^2 (or 37.1 ha)	371,015.82 m^2 (or 37.1 ha)

2.3.2 Transmission line specifications

The specifications for the Proposed Action's transmission line are outlined in Table 4. The location of the transmission line is illustrated in Figure 1, and extends in a westerly and south-westerly direction towards the Cataby substation.

Table 4: Transmission line specifications

Transmission line specification	Statistic
Length of transmission line	Approximately 8 km
Voltage	132 kV
Transmission pole height	Between 11 m and 40 m
Transmission line minimum separation distance from ground	Approximately 7.5 m
Transmission line height range	Approximately 7.5 – 40 m
Number of conductors	4 (3 energised and 1 optical ground wire)
Number of transmission poles	Approximately 30

2.4 Implementation timeframes and activities

2.4.1 Timeframes

The implementation of the Proposed Action will be phased. A summary of the indicative timing and duration of the construction, operation and decommissioning phases of the Proposed Action is provided in Table 5.

Table 5: Timing and duration of Proposed Action phases

Phase	Commencement	Cessation
Balance of plant construction	March 2026	December 2026
Turbine installation	October 2026	July 2027
Commencement of operation	October 2027	September 2057
Decommissioning	October 2057	-

As identified in Section 1.2.2, this BBMP is relevant to the commissioning and operation of the Waddi Wind Farm, however for completeness and considering these activities span both the construction and operational phases, all relevant activities have been described in the following sections for reference.

2.4.1.1 Construction phase

Construction of the Waddi Wind Farm is expected to take approximately 16-24 months, commencing with site establishment, clearance of vegetation, construction of access tracks and all other site civil works, including preparation of hardstand areas. This would be followed by excavation of the foundations and

preparation of the concrete footings, which must be cured prior to installation of the wind turbines and permanent meteorological monitoring masts.

Wind turbine construction and erection can be relatively fast once the footings are prepared. The towers are erected in sections using large cranes, the nacelles lifted to the top of the towers, and finally blades lifted and bolted to the hub or preassembled on the ground and lifted as a unit. Substation, transmission line and grid connection works would be carried out in parallel.

The commissioning phase involves conducting checks on all high-voltage equipment prior to connection to the network. Once the electrical connections have been commissioned and energised, each wind turbine is then separately commissioned and placed into service.

On completion of construction, remaining disturbed areas would be remediated to the pre-disturbance land use and all waste materials removed and disposed of appropriately.

The location of the borrow pits is yet to be defined. The borrow pits will be sited within the Indicative Works Area and within areas surveyed and confirmed not to contain native vegetation or cultural heritage.

Activities required to be undertaken prior to the commencement of the Proposed Action include:

- Surveying for unexploded ordinance (UXO) and undertaking UXO remediation (if required) within the Disturbance Area. The Disturbance Area is within the mapped extents of sites categorised as Substantial Potential for UXO (Department of Defence 2025).
- Geotechnical surveys to assess the subsurface ground conditions of the site, identify potential hazards and provide data to inform detailed design and construction decisions, ensuring stability and safety of the proposed infrastructure.
- The installation of temporary meteorological masts to provide meteorological data to improve the certainty in wind resource models and energy predictions to inform detailed design.

2.4.1.2 Operational phase

Operational maintenance of the wind turbines and electrical balance of plant, excluding the transmission line, will be undertaken by the wind turbine original equipment manufacturer under contract with the Proponent. Anticipated annual maintenance activities include:

- A 1 to 2-day whole-of-site outage to complete routine maintenance and testing
- A maintenance schedule for each wind turbine (approximately 3–5 days per year)
- Scheduled one, three and six-monthly inspections for the electrical balance of plant.

Operational maintenance of the transmission line will be undertaken by Western Power, which maintains the asset in line with relevant technical specifications, ensuring the reliability of supply of electricity. Anticipated maintenance activities include:

- Annual vegetation inspections of all spans to identify vegetation encroachment in the clearance zone, regrowth with the potential to grow into the clearance zone before the next inspection cycle and potentially hazardous trees.
- Ongoing maintenance of the access tracks and hardstands to allow safe access for Western Power's heavy fleet vehicles (e.g. elevated work platforms).
- Emergency inspections and repairs (as required).

Western Power requires the following conductor clearances to be maintained under the transmission line, which may necessitate vegetation trimming (but no additional vegetation clearing) over the life of the asset:

- For spans between 100 m and 200 m – four m horizontal and two m vertical.
- For spans between 200 m and 350 m – ten m horizontal and four m vertical.

2.4.1.3 Decommissioning phase

The expected commercial life of the Waddi Wind Farm will be approximately 30 years. Decommissioning involves dismantling and removing the wind turbines and removing related infrastructure. Similar road access arrangements to construction would be required and access for large cranes and transport vehicles would be

necessary to dismantle and remove the turbines. Internal access roads may be retained where requested by landowners.

All underground foundations would remain in situ. All above ground infrastructure including protruding electrical cabling, conduit and other structures would be removed and the foundations covered.

Overhead electrical cabling and powerlines would be dismantled, removed and materials reused or sold where possible. Powerline poles would also be removed. In locations where potential environmental damage from complete removal of the powerline pole outweighs the benefits, the pole may be cut off at ground level.

3 BIRD AND BAT STUDIES SUMMARY

A recent desktop review of relevant resources was undertaken to provide contemporary information on the bird and bat values within the Project Area. The information sources referenced are outlined in Table 6.

Site specific bird site utilisation surveys, targeted Carnaby's cockatoo habitat assessments and fauna surveys have been undertaken over the past fifteen years to provide a robust ecological baseline for the Proposed Action. The outcomes of these ecological studies along with avian monitoring reports sourced from neighbouring wind farm sites are summarised in Table 7.

The survey extents for the site specific ecological surveys are presented relative to the Project Area, Indicative Works Area and Disturbance Area in Figure C.

Table 6: Desktop information sources

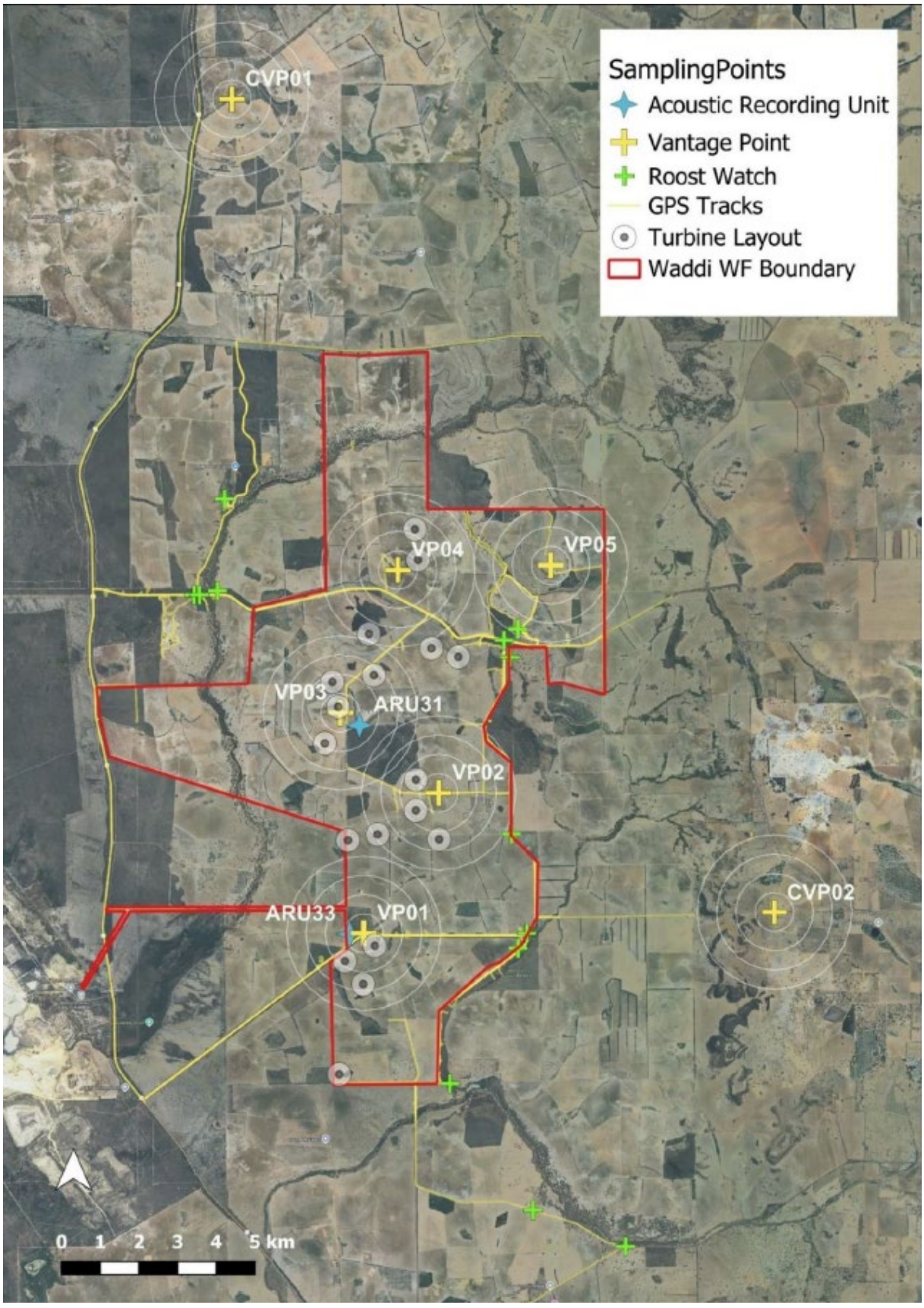
Information source	Name	Details	Date accessed	In-text citation
DCCEEW	Protected Matters Search Tool	The Protected Matters Search Tool is designed to assist in identifying the location of MNES and other matters protected by the EPBC Act. The mapped data can be relied on as a general guide. Where distributions are well known, distributions are inferred or modelled from known records, described habitat and thematic spatial data. A Protected Matters Search Tool report was generated for the Proposed Action in March 2024 as part of preparing the BBMP (Draft A) (DCCEEW 2024a). Another Protected Matters Search Tool report was generated in February 2025 as part of preparing the BBMP (Draft B) (DCCEEW 2025a). **Search area:** Project Area and a 25 km radius buffer around the Project Area.	February 2025	(DCCEEW 2025a)
DCCEEW	Species Profile and Threats Database (SPRAT)	The SPRAT database is designed to provide information about species and ecological communities listed under the EPBC Act. SPRAT profiles, and associated conservation advice and recovery plans, were consulted for detailed information on population and distribution, habitat, movements, feeding and reproduction.	March 2024	(DCCEEW 2024c – DCCEEW 2024v)
DAWE	Referral guideline for 3 WA threatened black cockatoo species. These being Carnaby's cockatoo (*Zanda latirostris*), Baudin's cockatoo (*Zanda bauhinia*) and the forest red-tailed black-cockatoo (*Calyptorhynchus banksii naso*).	This referral guideline provides information on black cockatoo foraging, breeding, and roosting habitat requirements.	March 2024	(DAWE 2022a)
DBCA	DBCA's threatened, specially protected and priority fauna database, including black cockatoo breeding and roosting datasets	The DBCA's databases include specific locality information on threatened, specially protected and priority fauna, locations of confirmed or potential breeding locations of white-tailed black cockatoos (Carnaby's cockatoo and Baudin's cockatoo) and locations of known roost sites for white-tailed black cockatoos and forest red-tailed black cockatoos. A database search request was submitted to the DBCA on 15 August 2023 as part of preparing the EPBC Act referral and clearing permit application (DBCA 2023a). Records of Carnaby's cockatoo and white-tailed black cockatoo (either Carnaby's cockatoo or Baudin's cockatoo) are illustrated in Figure D . These records would have been Carnaby's cockatoo, as Baudin's cockatoo are not distributed across the Shire of Dandaragan (DAWE 2022). Records of Carnaby's cockatoo roosting and breeding sites, and white-tailed black cockatoo breeding sites (either Carnaby's cockatoo or Baudin's cockatoo) are illustrated in Figure E. These breeding sites would have been for Carnaby's cockatoo, as Baudin's cockatoo are not distributed across the Shire of Dandaragan (DAWE 2022). **Search area:** Project Area and a 25 km radius buffer around the Project Area.	August 2023	(DBCA 2023a)
Landgate	Locate V5	The Locate V5 database provides a spatial data source based on state government datasets **Search area:** Project Area and a 25 km radius buffer around the Project Area.	February 2024	(Landgate 2024a)
Atlas of Living Australia	Species profiles	The Atlas of Living Australia website provides data source based on peer reviewed articles, state government and community records	March 2024	(Atlas of Living Australia 2024a – Atlas of Living Australia 2024e)
BirdLife Australia	Handbook of Australian, New Zealand and Antarctic Birds	A digital database of the seven-volume encyclopedia documenting the ecology, behaviour and morphology of birds recorded in the Australian, New Zealand and Antarctic region.	March 2024	(BirdLife Australia 2023a – BirdLife Australia 2023r)
BirdLife Australia	Birdata	A digital database of Australian birdlife survey data, collected by citizen scientists. Birdata is Australia's largest and longest running database for birds, with more than 22 million records	March 2025	Birdlife Australia 2025
BirdLife International	Species factsheets	The BirdLife International website provides a data source based on field handbooks and international records.	March 2024	(BirdLife International 2024a – BirdLife International 2024e)

Table 7: Summary of site specific ecological studies and avian monitoring reports from neighbouring wind farm sites

Report	Survey extent (ha)	Description of surveys and habitat assessments	Survey guidelines	Survey effort
Project Area specific surveys and habitat assessments				
Avifauna Assessment Proposed Waddi Wind Farm Development (RPS 2010)	12,962.1	• Avifauna surveys. • Targeted survey for Carnaby's cockatoo. • Wetland bird surveys around regional wetland habitat. • Avifauna habitat assessment.	• Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia. Guidance Statement No. 56 (Environmental Protection Authority [EPA] 2004). • Best Practice Guidelines for Implementation of Wind Energy Projects in Australia (Australia Wind Energy Association [Auswind] 2006). • Wind Farms and Birds: Interim Standards for Risk Assessment (Auswind 2005).	• The avifauna surveys addressed 43 census sites (1 ha plots) – 16 census sites at Waddi Wind Farm, 20 census sites at Yandin Wind Farm and seven census sites at representative habitat areas outside the immediate footprint of both wind farm sites in the wider locality. • The avifauna survey census sites were visited four times each day, and were undertaken over two periods: – 29 October to 7 November 2008 – 18 to 26 November 2008 • The targeted survey for Carnaby's cockatoo was concentrated on areas between large stands of vegetation and turbine locations and was undertaken over one period: – 15 to 16 January 2009
Fauna Assessment Waddi Wind Farm (RPS 2014)	12,962.1	• Level 1 reconnaissance fauna survey • Site inspection, to support a revision of the data from a 2008 site survey. • Bat survey.	• Terrestrial Biological Surveys as an Element of Biodiversity Protection. Position Statement No. 3 (EPA 2002) • Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia. Guidance Statement No. 56 (EPA 2004a). • Guidelines for bat surveys in relation to wind farm developments (Lumsden 2007)	• A reconnaissance fauna survey was undertaken on 12–13 November 2008. • A site inspection was undertaken on 27 November 2013. • The bat survey included 20 bat detector nights for 260 hours at locations within the Project Area and at a lowland site (Waddi Bush Resort). • The bat survey was undertaken over two periods: – October to November 2008 – May 2009
Waddi Wind Farm Spring Flora and Vegetation Survey and Black Cockatoo Habitat Survey (Outback Ecology 2014)	97.7	• Level 1 flora and vegetation survey, including targeted flora surveys. • Black cockatoo habitat assessment.	• Terrestrial Biological Surveys as an Element of Biodiversity Protection. Position Statement No. 3 (EPA 2002) • Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia. Guidance Statement No. 51 (EPA 2004b). • Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia. Guidance Statement No. 56 (EPA 2004a). • Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA and Department of Environment and Conservation 2010). • Survey Guidelines for Australia's Threatened Birds (Department of the Environment, Water, Heritage and the Arts 2010a). • EPBC Act Referral Guideline for 3 threatened black cockatoo species (Department of Sustainability, Environment, Water, Populations and Communities 2012).	A level 1 flora and vegetation survey and a significant fauna habitat assessment were undertaken from 29 October to 1 November 2013.
Waddi Wind Farm project – Cataby Supplementary Flora, Vegetation and Fauna Survey (Ecologia Environment 2016)	13.6	• Flora and vegetation survey, including targeted flora surveys. • Fauna survey, including broad fauna habitat mapping and targeted survey for foraging habitat and significant trees for Carnaby's cockatoo. • Targeted tree survey	• Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia. Guidance Statement No. 51 (EPA 2004b). • Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia. Guidance Statement No. 56 (EPA 2004). • Technical Guide – Flora and Vegetation Survey Technical Guide for Environmental Impact Assessment (EPA and DPaW 2015).	The flora and vegetation survey, fauna survey and tree survey were undertaken on 6 October 2016.
Black-Cockatoo habitat assessment for the Waddi Wind Farm transmission line alignment and the nominated areas in the adjacent farmland (Terrestrial Ecosystems 2022)	1,450.69	Black cockatoo habitat assessment	Referral guideline for 3 WA threatened black cockatoo species (DAWE 2022a)	The black cockatoo habitat assessment was undertaken over two periods: • 14 to 15 October 2021 by foot, 4WD vehicle, and utility vehicle. • 28 October 2022 by foot and 4WD vehicle

Report	Survey extent (ha)	Description of surveys and habitat assessments	Survey guidelines	Survey effort
Desktop analysis of black cockatoo tracking data to show movement and site utilisation of Carnaby's cockatoos in the Cataby Region with reference to the Waddi Wind Farm (Murdoch University 2024)	-	• Murdoch University's night-roost location data and flock movement track data in the vicinity of the Project Area Additional information to inform potential site utilisation within the Project Area		• Night-roost location data and flock movement track data collected from 14 individual Carnaby's cockatoos tagged over five separate tag deployments between 2017 and 2022: – Two tag deployments in 2017 and 2022 were undertaken at the Coomallo Creek breeding area for Carnaby's cockatoos. – Two tag deployments in 2021 and 2022 were undertaken at the Cataby breeding area for Carnaby's cockatoos. One tag deployment in 2022 was undertaken at Regan's Ford during the non-breeding season for Carnaby's cockatoos.
Carnaby's Black-Cockatoo and Fork-tailed Swift utilisation survey (BCE 2025)	10,491	Site utilisation survey for Carnaby's cockatoo and fork-tailed swift	• Onshore wind farm guidance (DCCEEW 2024) • EPBC Act referral guidelines for three threatened black cockatoo species (Department of Sustainability, Environment, Water, Population and Communities 2012) • Referral guideline for 3 WA threatened black cockatoo species (DAWE 2022) • Recommended bird survey methods to inform impact assessment of onshore wind farms (Scottish Natural Heritage 2017)	• Carnaby's cockatoo and fork-tailed swift utilisation survey was undertaken in 26–27 August, 7–9 October, 20–22 October and 6, 16-17 and 20 December 2024, and 6–7 and 10 January 2025. • The utilisation survey encompassed Vantage Point surveys (2 Vantage Points within the Project Area, 2 Vantage Points at control sites), acoustic recording (2 units within the Project Area) and Focal Follow surveys (within and up to 6 km outside the Project Area). The location of sampling points is illustrated in Figure 3.
Surrounding wind farm surveys and habitat assessments				
Wind Prospect Pty Ltd Yandin Wind Farm–Flora, Vegetation and Avifauna Assessment (Ecologia Environment 2017)	15,360	• Reconnaissance flora and vegetation survey, including targeted flora surveys • Threatened Ecological Community (TEC) assessment • Avifauna survey	• Environmental Factor Guideline – Flora and Vegetation (EPA 2016a) • Environmental Factor Guideline – Terrestrial Fauna (EPA 2016b) • Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016c) • Technical Guidance – Terrestrial Fauna Surveys (EPA 2016d)	• The reconnaissance flora and vegetation survey, Threatened Ecological Community (TEC) assessment and avifauna survey were undertaken from 18 to 20 September 2017. • The avifauna survey addressed 22 census sites.
Yandin Wind Farm Avian Fauna Monitoring Program (Alinta Energy 2022)	-	• Avian fauna collision monitoring for the first year of operational phase, including scavenger trials and detectability trials • Avian fauna observations of at-risk groups (wedge-tailed eagles, other raptors and Carnaby's cockatoo).	Onshore Wind Farms – Interim Guidance on Bird and Bat Management (DAWE 2021).	• The avian fauna collision monitoring program involved: – Monthly mortality searches at 17 turbines from December 2021 to November 2022 – Scavenger trials at 17 turbines during two seasons, the short grass season (February 2022) and the long grass season (September 2022) – Detectability trials during the long grass season (August and October 2022) • The avian fauna observations were recorded during the monthly mortality searches from December 2021 to November 2022.
Yandin Wind Farm Avian Fauna Monitoring Program (Alinta Energy 2024)	-	• Avian fauna collision monitoring for the second year of operational phase, including detectability trials • Avian fauna observations of at-risk groups (wedge-tailed eagles, other raptors and Carnaby's cockatoo).	Onshore Wind Farms – Interim Guidance on Bird and Bat Management (DAWE 2021).	• The avian fauna collision monitoring program involved: – Monthly mortality searches at 17 turbines from December 2022 to November 2023. – Detectability trials during two seasons, the short grass season (March and April 2023) and long grass season (August 2022). • The avian fauna observations were recorded during the monthly mortality searches from December 2022 to November 2023.
Carnaby's Cockatoo and other Birds Baseline Monitoring Report 2018: Badgingarra Wind Farm (Ecoscape 2018)	-	• Abundance monitoring for Carnaby's cockatoo and other birds. • Bird mortality monitoring, including carcass persistence trials and searcher efficiency trials	Monitoring methodology underpinned by expert opinion	• The abundance monitoring for Carnaby's cockatoo and other birds was undertaken during two peak flight periods for Carnaby's cockatoo: – 6 to 12 October and 2 to 8 December 2017 (adult west-east migration period for breeding (July to September)) – 9 to 16 February and 9 to 16 April 2018 (adult and fledgling east-west migration for feeding (December to April)). • Bird mortality monitoring involved: – Carcass persistence trials at eight turbines were undertaken during 9 to 16 February and 9 to 16 April 2018. – Searcher efficiency trials were undertaken during 9 to 16 February 2018.

Report	Survey extent (ha)	Description of surveys and habitat assessments	Survey guidelines	Survey effort
Carnaby's cockatoo and other birds year one operational monitoring (Ecoscape 2019a)	-	• Abundance monitoring for Carnaby's cockatoo. • Bird mortality monitoring for first year of operational phase, including carcass persistence trials and searcher efficiency trials.	Monitoring methodology from Ecoscape (2018) adapted	• The abundance monitoring for Carnaby's cockatoo was undertaken two peak flight periods for Carnaby's cockatoo: – 3 to 8 February 2019 and 18 to 24 March 2019 (adult and fledgling east-west migration for feeding (December to April)) – 30 July to 5 August 2019 and 16 to 22 September 2019 (adult west to east migration period for breeding (July to September)) • Bird mortality monitoring involved: – Carcass searches at eight turbines and eight randomly selected turbines were undertaken in February and March 2019. – Carcass searches at eight turbines were undertaken in July, August and September 2019 and 21 randomly selected turbines between July and September 2019. – Carcass persistence trials and searcher efficiency trials were undertaken in February and July 2019.
Field Summary Report - Spring 2019 (Ecoscape 2019b)	-	• Abundance monitoring for Carnaby's cockatoo. • Bird mortality monitoring for first year of operational phase, including carcass persistence trials and searcher efficiency trials.	-	• The abundance monitoring for Carnaby's cockatoo was undertaken a peak flight period for Carnaby's cockatoo: – 30 July to 5 August 2019 and 16 to 22 September 2019 (adult west to east migration period for breeding (July to September)) • Bird mortality monitoring involved: – Carcass searches at eight turbines were undertaken in July, August, and September 2019 and 21 randomly selected turbines between July and September 2019. – Carcass persistence trials and searcher efficiency trials were undertaken in February and July 2019.
Field Summary Report - Summer 2020 (Ecoscape 2020)	-	• Abundance monitoring for Carnaby's cockatoo. • Bird mortality monitoring for second year of operational phase, including carcass persistence trials and searcher efficiency trials.	-	• The abundance monitoring for Carnaby's cockatoo was undertaken a peak flight period for Carnaby's cockatoo: – 7 to 14 February and 14 to 21 April 2020 (adult and fledgling east to west migration for feeding (December to April)). • Bird mortality monitoring involved: – Carcass searches at eight turbines were undertaken in February, March, and April 2010 and 21 randomly selected turbines between February and April 2020. – Carcass persistence trials were undertaken prior to carcass searches commencing in March 2020. – Searcher efficiency trials at two turbines were undertaken prior to carcass searches commencing in March 2020.



(Source: BCE 2025)

Figure 3: Sampling points and recording unit locations for Waddi Wind Farm, with GPS tracks for the surveyors recorded throughout campaigns

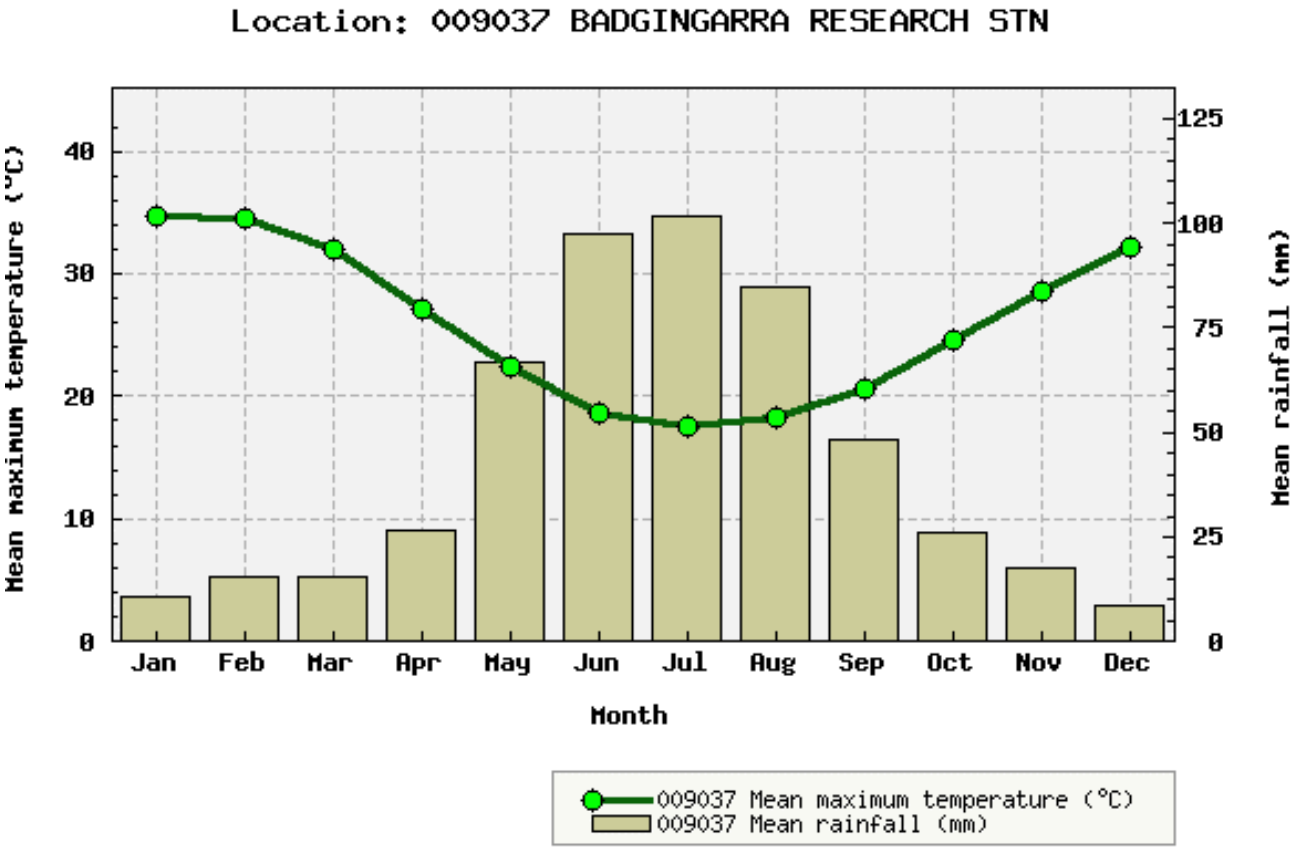
3.1 Preliminary site characterisation

3.1.1 Site characteristics

The Proposed Action is situated within large areas of agricultural land used for cropping. This land use has been ongoing for decades and much of the Project Area has been historically cleared of native vegetation

3.1.1.1 Climate

The climate of the Lesueur Sandplain and Swan Coastal Plain subregions are Mediterranean (Desmond and Chant 2001, Mitchell et al 2001). Badgingarra is the nearest Bureau of Meteorology recording station to record all climatic variables, approximately 18 km north of the Project Area (Station no. 009037) (Bureau of Meteorology 2024). The summers are generally short, hot, and dry and the winters cool, with less than 600 millimetres (mm) of rainfall received on average annually. Rainfall is predominantly received during winter months (June to August). Graph 1 below shows the mean temperatures and rainfall for Badgingarra since it opened in 1965.



(Source: Bureau of Meteorology 2024)

Graph 1: Mean maximum temperature and mean rainfall data for Badgingarra weather station (009037) 1965–2024

3.1.1.2 Topography

The topography of the Project Area ranges from approximately 120 m AHD at the south-western boundary to 240 m AHD at its northern and eastern boundary, based on the Wedge Island 1:100 000 topographical map (Geoscience Australia 2001) and Dandaragan 1:100 000 topographical map (Geoscience Australia 1976). Its elevation predominantly runs in a north–south direction with undulating hills and shallow flat-bottomed valleys characterised by remnant vegetation and ephemeral watercourses (Figure A).

The wind turbines will be located within agricultural paddocks at points of high elevations within the Project Area, ranging from approximately 220 m AHD (WTG 10) to approximately 290 m AHD (WTG 15) (DPIRD 2024a) (Figure A).

3.1.1.3 Soil

The Department of Primary Industries and Regional Development (DPIRD) soil landscape mapping shows four soil systems across the Proposed Action's Disturbance Area, including (Figure B) (Landgate 2024a):

- Yerramullah system. Subdued dissected lateritic plateau, undulating low hills and rises on laterised weathered sandstone. Pale deep sand, sandy gravels and yellow deep sand. This system is associated with the wind turbines and most of the transmission line alignment
- Nylagarda system. Alluvial plains and terraces of the Hill River and major creeks of the north coastal plain. Brown deep sands and brown sandy earths predominate, with minor pale deep sand and saline wet soil. This system is associated with Mullering Brook
- Bassendean system. Sand dunes and sandplains with pale deep sand, semi-wet and wet soil. This system is associated with the westernmost extent of the transmission line alignment
- Boothendarra system. Narrow band of sandy and gravelly duplexes, often found on subdued stripped lateritic plateaus. This system is associated with the far east of the Project Area within which no wind farm or transmission line infrastructure is proposed.

3.1.1.4 Vegetation

3.1.1.4.1 Regional vegetation

The Project Area almost entirely lies within the Lesueur Sandplain subregion of the Geraldton Sandplains bioregion of the Interim Biogeographical Regionalisation of Australia (IBRA) (Department of Agriculture, Water and the Environment (DAWE) 2023). A minor south-western portion of the Project Area is situated within the Perth subregion of the Swan Coastal Plain bioregion. T

The landscape of the Lesueur Sandplain subregion is composed mainly of extensive, undulating, lateritic sandplain mantling Permian to Cretaceous strata (Desmond and Chant 2001). The Perth subregion is composed of colluvial and aeolian sands, alluvial river flats, and coastal limestone (Mitchell et al 2001).

Agricultural activities occupy over 69% of the Lesueur Sandplain subregion (Desmond and Chant 2001), while major components of the Perth subregion's landscape are covered by mines, mining tenements, exploration leases and to a lesser extent grazing (Mitchell et al 2001).

The broad vegetation associations mapped within the proposed action's Disturbance Area (Shepherd et al. 2002 and Beard et al. 2013) are described as follows:

- Vegetation Association 1031 – Mosaic: Shrublands; hakea scrub-heath / Shrublands; dryandra heath
  - Vegetation Type 108 – Scrub-heath / heath
- Vegetation Association 1030 – Low woodland; *Banksia attenuate* and *Banksia menziesii*
  - Vegetation Type 9 – Low woodland or open low woodland: Other wattle (*Acacia* spp.), banksia (Banksia spp.), peppermint (*Agonis flexuosa*), cypress pine (*Callitris* spp.), casuarina (*Allocasuarina* spp.), York gum (*Eucalyptus loxophleba*)
- Vegetation Association 7 – Medium woodland; York gum (*Eucalyptus loxophleba*) and wandoo
  - Vegetation Type 4 – Woodland: Wheatbelt—York gum (*Eucalyptus loxophleba*), salmon gum (*E. salmonophloia*), etc. Goldfields—gimlet (*E. salubris*), redwood (*E. transcontinentalis*), etc. Riverine— rivergum (*E. camaldulensis*). Tropical—Darwin stringybark (*E. tetrodonta*) and woolybutt (*E. miniata*)

The Vegetation Associations 7 and 1031 have 33.6% and 72.5% of their pre-European extent remaining within the Geraldton Sandplains IBRA bioregion and the Vegetation Association 1030 has 63.8% of its per-European extent remaining within the Swan Coastal Plain IBRA bioregion (Government of Western Australia 2019). The Commonwealth's National Targets and Objectives for Biodiversity Conservation (Environment Australia 2001) recognises that the retention of 30%, or more, of the preclearing extent of each ecological community is necessary if Australia's biological diversity is to be protected.

3.1.1.4.2 Vegetation types

The vegetation types within the Project Area identified by the flora and vegetation surveys (RPS 2023, Ecologia Environment 2016, Outback Ecology 2014 and Outback Ecology 2010) within the Project Area are broadly described as:

- Banksia Low Open Woodland
- *Corymbia calophylla* Woodland
- *Eucalyptus todtiana* Woodland
- *Melaleuca* Low Open Woodland
- Proteaceous Heath

The vegetation types mapped within the Project Area is illustrated in Figure F.

Vegetation condition ranged from Excellent to Completely Degraded (RPS 2023, Ecologia Environment 2016, Outback Ecology 2014 and Outback Ecology 2010).

3.1.1.5 Fauna habitats

The key habitat types within the Project Area identified by the fauna surveys (Terrestrial Ecosystems 2022, Ecologia Environment 2016, RPS 2014, Outback Ecology 2014 and RPS 2010) within the Project Area are broadly described as:

- Open pasture / cultivation area, often with scattered trees
- Remnant heathland vegetation
- Woodland remnants / elements
- Areas where various combinations of heathland and / or woodland are associated with areas dominated by open pasture / cultivation habitats
- Aerial habitats above land for avifauna.

Carnaby's cockatoo site utilisation survey and targeted black cockatoo habitat surveys have been undertaken for the Project Area, which identified potential foraging, roosting and breeding habitat for Carnaby's cockatoo. These areas are discussed in Section 3.2 (BCE 2025, Terrestrial Ecosystems 2022, Ecologia Environment 2016 and Outback Ecology 2014).

3.1.1.6 Surface water features

The Project Area is characterised by undulating hills with ephemeral to semi-permanent drainage lines in gullies and valleys (RPS 2014). Mullering Brook is a significant stream, which intersects the Disturbance Area and another significant stream, Minyulo Brook, flows to the south of the Disturbance Area (Landgate 2024a). The river condition of Mullering Brook was assessed twice as part of the Healthy Rivers Program in October 2008 and October 2021 at locations approximately 750 m south of the Disturbance Area. The two samples had an average pH of 7.06 and an average salinity of 7,802 uS/cm electrical conductivity, which is indicative of neutral and brackish water (DWER 2025). The nutrient readings of the water sample included total phosphorus of 0.046 mg/L and total nitrogen of 1.6 mg/L.

The Disturbance Area is also surrounded by numerous farm dams and wetlands (Landgate 2024a). A portion of the Mullering Brook has been mapped as flood plain wetland in the Geomorphic Wetlands Cervantes South dataset. There are a few regional wetland habitats in the wider locality, including (RPS 2010):

- Small to moderate sized water bodies near Dandaragan, including the Aggie's Cottage and Farm Dams and Yandin Road Dam, approximately 10 km east of the Project Area.
- A few relatively large water bodies including Lake Guraga and nearby lakes, approximately 20 km south of the Project Area.
- Several water bodies in the Upper Moore River Catchment near Moora, approximately 37 km east of the Project Area.

- Several water bodies including Thetis Lake and Clay Plan Lake, approximately 35 km west of the Project Area.
- A few large water bodies near Wongan Hills including Lake Hinds and Lake Ninan, approximately 95 km east-south-east of the Project Area.

The surface water features are mapped in relation to the Project Area in Figure G.

3.1.2 Species characteristics

During the desktop review of the Protected Matters Search Tool results (DCCEEW 2025a) and database search results (DBCA 2023a), the following 30 listed threatened and migratory bird and bat species, specially protected bird species, and DBCA listed priority bird species were identified as having the potential to occur:

- Seven threatened bird species, four threatened and migratory species and 15 migratory bird species
- One threatened bat species
- One specially protected bird species
- Two priority bird species.

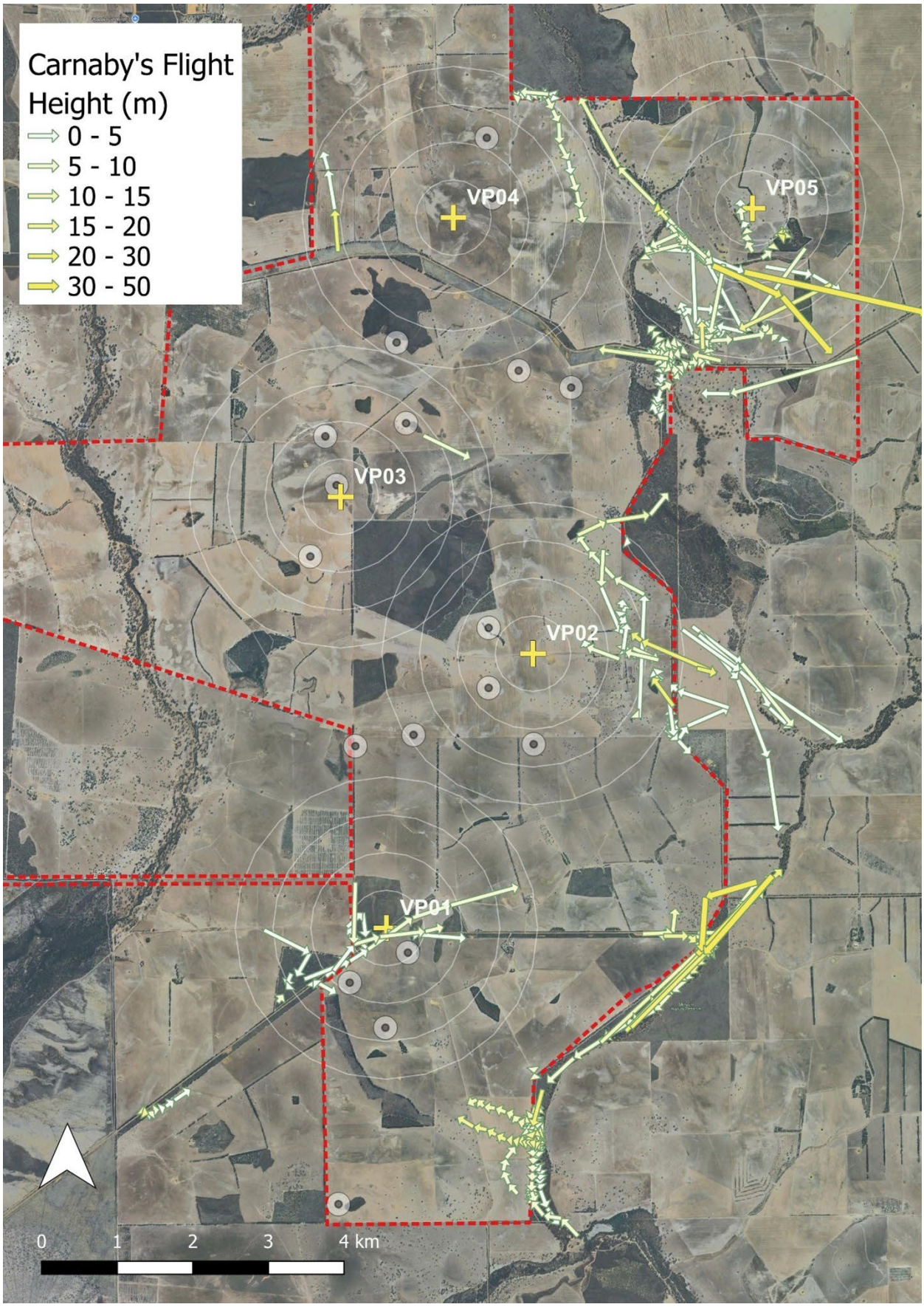
The species characteristics of the conservation significant bird and bat species identified by the database searches are summarised in Appendix A. Carnaby's cockatoo is a known seasonal visitor to the Project Area, however the other identified conservation significant bird and bat species are considered either unlikely or highly unlikely to occur in the Project Area or in the case of the western ground parrot locally extinct.

For ease of reference, the species behaviour and habitat, flight or demographic factors (i.e. species presence ongoing or transitory/ migratory, site use (i.e. transit, roosting, breeding, and/or foraging), flight paths (including migratory flight paths), flight heights, soaring, flocking and population numbers for Carnaby's cockatoo has been provided in Table 8.

Table 8: Species characteristics of Carnaby's cockatoo

Species	Conservation status	Behaviour and habitat	Flight or demographic factors	Site use	Flight paths	Flight heights	Soaring, flocking and population numbers
Zanda latirostris (Carnaby's cockatoo)	Endangered (EPBC Act, BC Act)	• Breeding habitat for Carnaby's cockatoo comprises woodland or forest and partially cleared woodland or forest including isolated trees. They nest in hollows of live or dead trees, and many *Eucalyptus* species may provide suitable hollows. Carnaby's cockatoos roost in or near riparian environments or natural or artificial water sources. Any tall trees may provide roosting habitat, particularly flat-topped yate (*Eucalyptus occidentalis*), salmon gum, wandoo, marri, karri, blackbutt, tuart, and introduced eucalypts and pines. They forage in native shrubland, heathland and woodland on seeds, nectar and flowers of native proteaceous plant species and on a range of introduced plant species including pine (DAWE 2022a). • Behaviour observed during the 2019 bird surveys for Badgingarra Wind Farm included over-flying, foraging and hovering over remnant vegetation (Ecoscape 2019a). • Behaviour observed during the 2022 bird surveys for Yandin Wind Farm included over-flying, foraging and perching in canopy of trees, and foraging in pine plantation, marri trees and banksia (Alinta Energy 2022 and Alinta Energy 2024). • There are three known breeding areas surrounding the Project Area, the Badgingarra breeding area (within 6 km to the north-east), the Cataby breeding area (approximately 6 km to the south), and the Moora breeding area (over 30 km to the east). There are other breeding areas at Coomallo Creek and Hill River (Murdoch University 2024). • Carnaby's cockatoos spent most of the time roosting and foraging, either on the ground or on vegetation (BCE 2025). This was true for individual birds and large flocks. When foraging and roosting in native vegetation or paddocks, groups of Carnaby's cockatoo would slowly move through the vegetation by leap frogging over birds that were perched or on the ground. Carnaby's cockatoo flights were often meandering however direct flights was observed occasionally in birds transiting larger distances, which defined most flights above 30 m (BCE 2025). A high number of Carnaby's cockatoo sightings were located in the lower landscape along the Project Area's eastern boundary, with	• Movements recorded during October–November 2008 avifauna surveys for the Project Area were seasonally nomadic (RPS 2010). • Flight behaviours recorded were considered representative of Carnaby's cockatoo during the late winter, spring and early summer, and included the entire breeding season. Carnaby's cockatoo regularly used airspace to the south-west of the Project Area along Mullering Road, the Minyulo Nature Reserve and around the three roosting locations along the Project Area's eastern boundary (BCE 2025). • Small flocks of Carnaby's cockatoo were observed to respond to disturbance by spiralling upwards or "vortexing". This was observed in response to a wedge-tailed eagle, a group of western corellas and a crop-dusting aircraft flying overhead, and the birds reached heights of up to 30 m. This behavioural response potentially places larger groups of Carnaby's cockatoos at risk of collision with turbine blades. However, none of the vortexing events observed to date has resulted in birds entering the proposed RSA (44 – 206 m) (BCE 2025).	• Habitat recorded during October–November 2008 avifauna surveys for the Project Area over which the species was observed was forest / woodland / heath (RPS 2010). • Habitat recorded during 2022 surveys for Yandin Wind Farm which the species was observed using was airspace while transitioning, flying around pine plantation and foraging in pine plantation, marri trees and banksia (Alinta Energy 2022 and Alinta Energy 2024). • Flocks of Carnaby's cockatoo deployed at the Cataby breeding area were observed foraging on a combination of remnant native proteaceous vegetation in patches within the agricultural matrix and on road verges. They also foraged on introduced species, such as canola and wild radish (Murdoch University 2024). • The 2024–2025 utilisation survey found Carnaby's cockatoo foraging and feeding on *Hakea*, *Banksia*, marri and pines, with *Banksia* heath and marri woodland frequently targeted by the species. A substantial amount of foraging was observed in cropped paddocks of canola and lupins and on wild radish as weed species (Figure H). • Night roost evidence was recorded at six separate locations within or near the Project Area (Figure E), and a roost location to the north of the Waddi Bush Resort is suspected. Nesting was observed in one tree on Minyulo Brook with one pair successfully raising a chick (Figure E). There were several wandoo and marri trees with chewed hollows consistent with nesting cockatoos along Minyulo Brook and in woodland north of Waddi Road.	• This species was found to primarily frequent low-land areas and movements of these species tended to follow valleys with woodland vegetation (RPS 2010). • This species breeds in the winter within the Wheatbelt region and moves to the coastal plain for the summer (RPS 2010). • This species observed flight path during the 2022 surveys for Yandin Wind Farm was sedentary, north-east, north-west, east, west and south-west (Alinta Energy 2022 and Alinta Energy 2024). • General flock movements of the Cataby breeding area during the post-fledging period shows that Carnaby's cockatoo continue to use main roosts around the breeding area for several months (December to March), and their numbers increased to about 200 as birds arrived from other breeding grounds with newly fledged young (Murdoch University 2024). • Within the Project Area, Carnaby's cockatoo did not appear to have the luxury of transiting routinely from a specific roost to a specific foraging ground to define a flight pathway (BCE 2025).	• Flight heights recorded during October–November 2008 avifauna surveys for the Project Area and wider locality from 101 records (RPS 2010): – Twenty-four records (24%) below surveyed RSA (i.e. <40 m) from Waddi Wind Farm. – Sixty-five records (64%) below surveyed RSA (i.e. <40 m) from the reference sites and Yandin Wind Farm. – Twelve records (12%) within surveyed RSA (i.e. 40–152 m) from Waddi Wind Farm. • Flight heights recorded during September 2017 avifauna surveys for Yandin Wind Farm (Ecologia Environment 2017): – Thirty-eight records flying between 0–40 m (commonly recorded at this height range) and between 40–152 m (occasionally recorded at this height range) • Flight heights recorded during 2017-2018 bird surveys for Badgingarra Wind Farm (Ecoscape 2018): – 3,751 records, of which 278 (9%) were estimated to be flying at the Badgingarra Wind Farm RSA height (20–150 m). – The majority of this species seen during surveys and opportunistically were observed to be flying below RSA height (~<20 m). • Flight heights recorded during 2019 bird surveys for Badgingarra Wind Farm (Ecoscape 2019a): – 923 records, or 25 flocks were observed. Five flocks were recorded flying at the Badgingarra Wind Farm RSA height (20–150 m). – Carnaby's cockatoo observed opportunistically were flying below the Badgingarra Wind Farm RSA height (0–20 m). • Flight heights recorded during 2022 bird surveys for Yandin Wind Farm (Alinta Energy 2022 and Alinta Energy 2024): – Eighty-four birds below 10 m, three birds above 10 m and three birds below 20 m. – Six birds at pine plantation canopy height	• Flight speeds recorded during October–November 2008 avifauna surveys for the Project Area were slow flocks (RPS 2010). • Individuals to flocks up to 400+ birds were recorded during 2017–2018 bird surveys for Badgingarra Wind Farm (Ecoscape 2018). • Four flocks with 2–22 birds in each flock (29 birds in total) were recorded during 2019 surveys for Badgingarra Wind Farm (Ecoscape 2019b). • 35 flocks with 1–166 birds in each flock were recorded (1,200+ birds in total) during 2020 surveys for Badgingarra Wind Farm (Ecoscape 2020). • The recorded average group size of Carnaby's cockatoo was 6 birds, with a maximum of 52 birds (BCE 2025). Carnaby's cockatoo occurred in larger flocks of 20-50 birds during winter and early spring, and flock sizes diminished into summer when it is thought the Carnaby's cockatoos moved to over-wintering areas. The maximum flock size of 52 birds was relatively small compared to other areas in the region for the same period, including up to 300 birds near Cooljarloo, up to 300 birds near Badgingarra, and 400 birds near Ledge Point. • The total population of this species is estimated to be between 11,000–60,000 (DCCEEW 2024v)

Species	Conservation status	Behaviour and habitat	Flight or demographic factors	Site use	Flight paths	Flight heights	Soaring, flocking and population numbers
		occasional forays of smaller groups across higher ground in the south and centre (BCE 2025).				– Six birds at 20 m – Thirty-three birds above 20 m. • Flight heights of Carnaby's cockatoos were recorded, as shown in Figure 4 relative to the wind turbine locations. The turbines are positioned on higher ground and have an anticipated ground clearance of approximately 44 m. Carnaby's cockatoo flights above 44 m comprised 0.13% of all bird time records. Furthermore, these four flights were recorded of single birds flying at 40 m or above and were in the lower areas of the landscape (BCE 2025). • Flight heights of Carnaby's cockatoos flying between 6 m – 40 m were 41.7% of the recorded bird time (35% at 6-10 m, 5.1% at 11-18 m, 1.5% at 19-30 m and 0.1% at 31-40 m; BCE 2025). None of the recorded flight lines of Carnaby's cockatoo overflew the proposed transmission line (Figure 4), however Carnaby's cockatoos have been observed flying over paddocks elsewhere in the Project Area and a foraging sign was been recorded proximate to the proposed transmission line (Figure H), therefore Carnaby's cockatoo may overfly the proposed transmission line (approximately 7.5 – 40 m).	



(Source: BCE 2025)

Figure 4: Flight lines for Carnaby's cockatoo groups showing flight heights and general distribution

3.1.3 Likelihood of occurrence assessment

Information from the site characteristics, species characteristics and site utilisation surveys and habitat assessments were used to inform a likelihood of occurrence assessment for the identified conservation significant bird and bat species within the Project Area (Appendix B).

A summary of the likelihood of occurrence assessment are presented in Table 9.

Table 9: Summary of likelihood of occurrence assessment for conservation significant bird and bat species

Likelihood of occurrence within Project Area	No. of species	Species
Locally extinct	1	• Western ground parrot
Highly unlikely	20	• Southern whiteface • Australasian bittern • Forest red-tailed black cockatoo • Greater sand plover • Bar-tailed godwit • Malleefowl • Grey wagtail • Eastern curlew • Blue-billed duck • Osprey • Western rosella (inland) • Glossy ibis • Pacific golden plover • Grey plover • Australian painted snipe • Australian fairy tern • Crested tern • Wood sandpiper • Ghost bat • Fork-tailed swift
Unlikely	8	• Common sandpiper • Ruddy turnstone • Sharp-tailed sandpiper • Red knot • Curlew sandpiper • Pectoral sandpiper • Red-necked stint • Common greenshank
Possible	1	• Peregrine falcon
Known	1	• Carnaby's cockatoo

3.2 Site specific assessment

3.2.1 Bird site utilisation surveys and key results

The fauna values of the Project Area have been subject to extensive investigation by Project Area specific fauna surveys and assessments conducted between 2009 and 2025:

- Avifauna Assessment Proposed Wind Farm Development Dandaragan Shire (RPS 2010)
- Fauna Assessment, Waddi Wind Farm (RPS 2014)
- Waddi Wind Farm Spring Flora and Vegetation Survey and Black Cockatoo Habitat Survey (Outback Ecology 2014)

- Waddi Wind Farm Proposed Action – Cataby Supplementary Flora, Vegetation and Fauna Survey (Ecologia Environment 2016)
- Black-Cockatoo habitat assessment for the Waddi Wind Farm transmission line alignment and the nominated areas in the adjacent farmland (Terrestrial Ecosystems 2022)
- Desktop analysis of black cockatoo tracking data to show movement and site utilisation of Carnaby's cockatoos in the Cataby region with reference to the Waddi Wind Farm (Murdoch University 2024)
- Carnaby's Black-Cockatoo and Fork-tailed Swift utilisation survey (BCE 2025)

The key findings from these Project Area specific fauna surveys and assessments have informed the risk assessment in Section 4, which in turn has identified species of concern addressed by this BBMP. The outcomes of the recent targeted Carnaby's cockatoo survey and assessments are provided in Table 10.

Table 10: Project Area specific recent targeted Carnaby's cockatoo survey and assessments

Fauna survey	Fauna investigation methods	Key results
Black-Cockatoo habitat assessment for the Waddi Wind Farm transmission line alignment and the nominated areas in the adjacent farmland (Terrestrial Ecosystems 2022)	• Targeted black cockatoo habitat survey was undertaken between 14 to 15 October 2021 for a 1,408-ha extent and on 28 October 2022 for an additional 42 ha extent • Assessed all vegetation (excluding planted crops, and paddocks cleared or left as fallow) using the foraging habitat categories as described in the Referral guideline for three WA threatened black cockatoo species (DAWE 2022a) • All potential black cockatoo breeding trees (i.e. eucalypts with a DBH of ≥500 mm) had their DBH measured and any eucalypt trees with hollows of suitable dimensions for a black cockatoo nesting site were noted and the hollow(s) dimensions recorded	• Trees were classified as in-situ native and non-planted, with the native trees typically being found either in the conservation reserve, in the proposed transmission line route or roadside vegetation • Many of the larger trees, particularly those in paddocks had been planted, and the majority are non-endemic eucalypts or pine trees. Groves of planted trees contained species that do not typically form hollows nor provide a foraging resource for black cockatoos, and trunks have often grown at oblique angles • 967 trees were assessed within the survey area, with 64 marri (*Corymbia calophylla*) trees proximate to Mullering Brook were identified as potential black cockatoo nesting trees • No evidence of black cockatoos foraging in the survey area was detected, nor were any black cockatoos seen. Chewing of banksia infructescences and pinecones by black cockatoos is obvious and was not observed • No evidence to indicate that Carnaby's cockatoo was breeding in or near the survey area was identified
Desktop analysis of black cockatoo tracking data to show movement and site utilisation of Carnaby's cockatoos in the Cataby region with reference to the Waddi Wind Farm (Murdoch University 2024)	• Murdoch University's night roost location data and flock movement track data in the vicinity of the Project Area • Tag deployments attached to 14 individual Carnaby's cockatoo between 2017 and 2022 • Additional information to inform potential site utilisation within the Project Area	• Figure 5 detailing known Cataby night roost locations within approximate mean daily foraging distance (6 km) and approximate maximum daily foraging distance (12 km). Eight night-roost locations were recorded with 6 km of the Project Area. A further seven night-roost locations were recorded with 12 km of the Project Area • Figure 6 detailing Cataby flock movement tracks including those within approximate mean daily foraging distance (6 km) and approximate maximum daily foraging distance (12 km). Flocks showed north to south movement patterns with traverses to the west of the Project Area (i.e. Cataby Breeding area, Cooljarloo, Emu Downs, Koonah Road and Badgingarra) associated with consolidated extents of foraging habitat within the Conservation Park (Crown Reserve 41986) and Badgingarra National Park
Carnaby's Black-Cockatoo and Fork-tailed Swift utilisation survey (BCE 2025)	• Carnaby's cockatoo and fork-tailed swift utilisation survey was undertaken in 26–27 August, 7–9 October, 20–22 October and 6, 16-17 and 20 December 2024, and 6–7 and 10 January 2025. Survey boundaries are presented in Figure I • The utilisation survey encompassed Vantage Point surveys (2 Vantage Points within the Project Area, 2 Vantage Points at control sites), acoustic recording (2 units within the Project Area) and Focal Follow surveys (within and up to 6 km outside the Project Area). The location of sampling points is illustrated in Figure 3.	• Carnaby's cockatoos were recorded throughout each survey campaign on and around the Waddi Wind Farm, during which time 145 separate flights were recorded, and were defined by 619 separate point records. The recorded average group size of Carnaby's cockatoo was 6 birds, with a maximum of 52 birds. A high number of Carnaby's cockatoo sightings were located in the lower landscape along the Project Area's eastern boundary, with occasional forays of smaller groups across higher ground in the south and centre (Figure D) (BCE 2025). • Carnaby's cockatoo was recorded feeding on Hakea, Banksia, Marri and pines, with Banksia heath and Marri woodland frequently targeted by the species, and in cropped paddocks of Canola and Lupins and on Wild Radish as weed species. Foraging signs were recorded proximate to the Disturbance Area, and within and beyond the Project Area (Figure H) (BCE 2025) • Night roost evidence was recorded at six separate locations within or near the Project Area (Figure 5; Figure E), and a roost location to the north of the Waddi Bush Resort is suspected (BCE 2025) • Nesting was observed in one tree on Minyulo Brook with one pair successfully raising a chick (Figure E). There were several Wandoo and Marri trees with chewed hollows consistent with nesting Carnaby's cockatoos (potential nesting trees) along Minyulo Brook and in woodland north of Waddi Road. The known and potential nesting trees are located along the Project Area's eastern boundary (BCE 2025). • Flight behaviours recorded were considered representative of Carnaby's cockatoo during the late winter, spring and early summer, and included the entire breeding season. Carnaby's cockatoo regularly used airspace south-west along Mullering Road, along the Minyulo Nature Reserve and between and around the three roosting locations along the Project Area's eastern boundary (BCE 2025). The likely RSA assessed by BCE (2025) ranged from 44 m to 206 m (the maximum RSA is 58 m to 220 m; Table 3). Carnaby's cockatoo flights above 44 m comprised 0.13% of all bird time records. Furthermore, these four flights were recorded of single birds flying at 40 m or above and were in the lower areas of the landscape (BCE 2025). • Fork-tailed swifts were not observed or heard during the utilisation survey's Vantage Point or Focal Follow campaigns and have not been detected in decades of biannual surveys at the nearby Cooljarloo Mineral Sands Mine (BCE 2025). Fork-tailed swifts are likely to occur very infrequently over the Waddi Wind Farm.

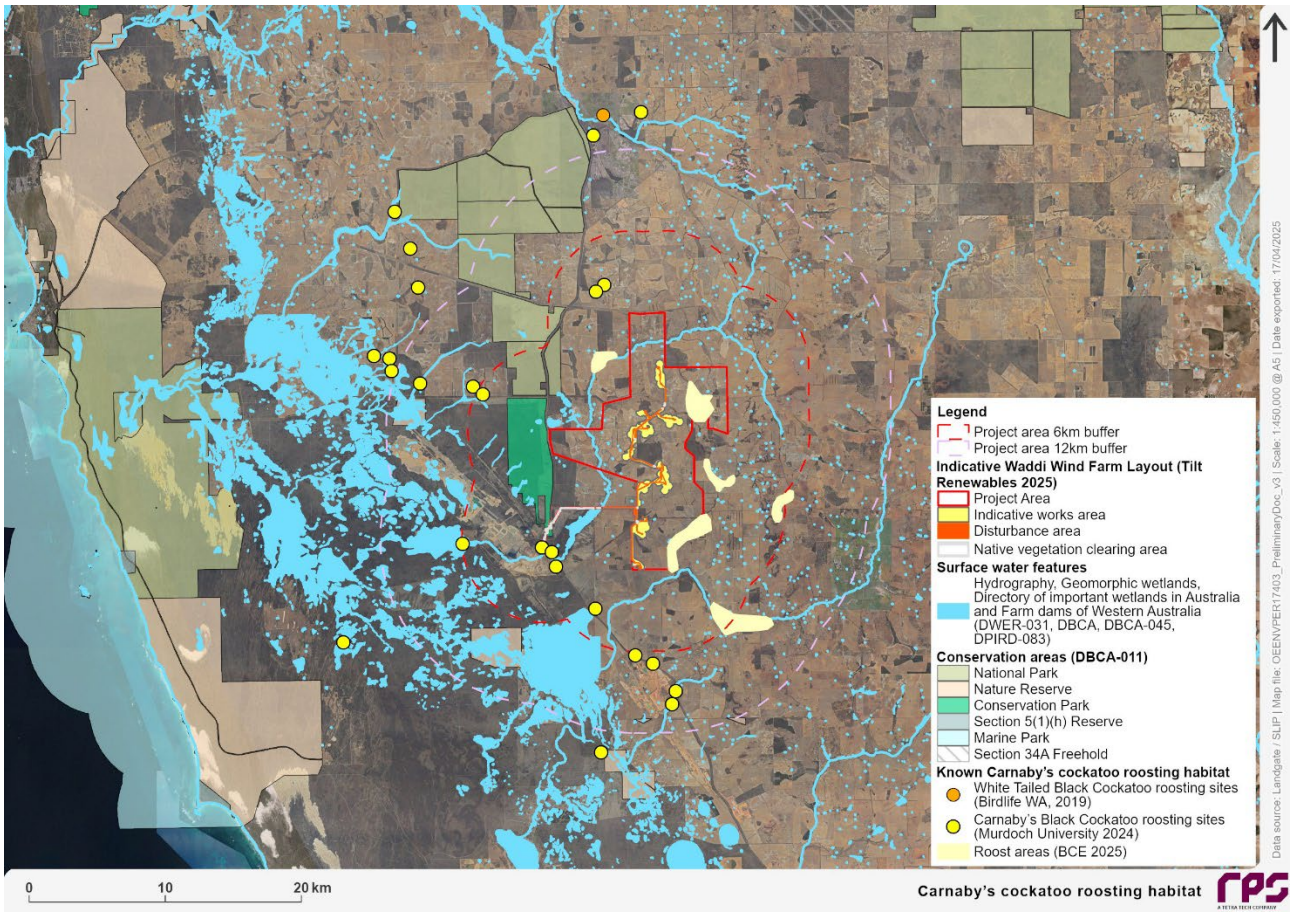
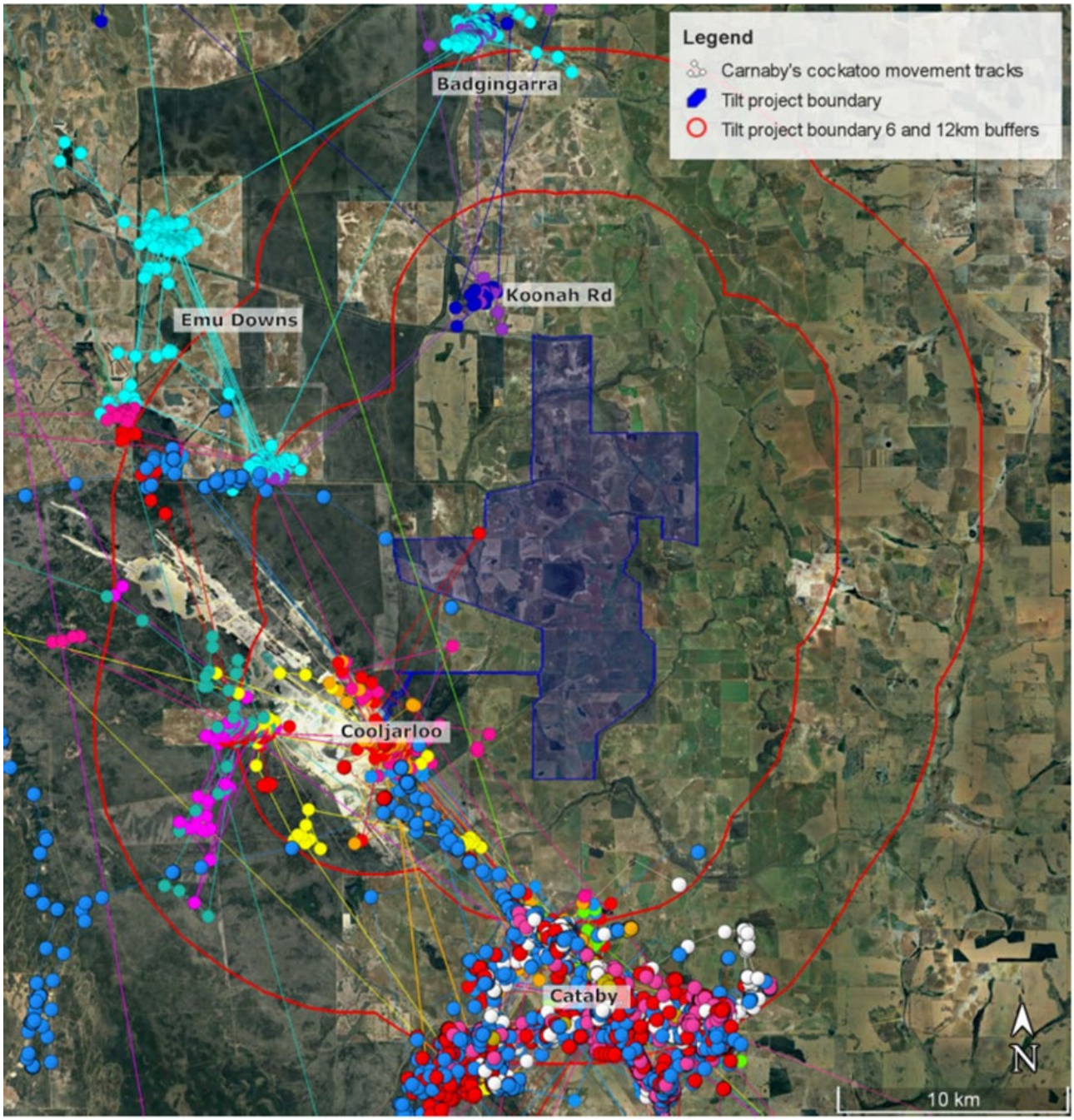


Figure 5: Carnaby's cockatoo known roosting habitat within 12 km of the Project Area



(Source: Murdoch University 2024)

Figure 6: Carnaby's cockatoo flock movement tracks for which Murdoch University has data

3.2.1.1 Listed threatened and migratory species and specially protected species site utilisation

Within the Project Area, one listed threatened species (Carnaby's cockatoo) was recorded, and within the regional extent of the Project Area, one listed threatened, five migratory and one specially protected bird species were recorded (BCE 2025, Murdoch University 2024, Terrestrial Ecosystems 2022, Ecologia Environment 2016, Outback Ecology 2014, RPS 2014 and RPS 2010). These species included:

- Listed threatened species:
  - Carnaby's cockatoo
- Listed migratory species:

- Sharp-tailed sandpiper
- Pectoral sandpiper
- Red-necked stint
- Pacific golden plover
- Common greenshank

- Specially protected species
  - Peregrine falcon.

The species characteristics of these species are summarised in Appendix A.

These findings have informed the risk assessment in Section 4, which in turn has identified species of concern addressed by this BBMP.

3.2.1.2 Priority bird species site utilisation

Within the regional extent of the Project Area, one DBCA listed priority species was recorded (RPS 2010), the blue-billed duck. This finding has informed the risk assessment in Section 4, which in turn has identified species of concern addressed by this BBMP.

3.2.1.3 At-risk common bird species site utilisation

Within the Project Area and its regional extent, 88 bird species were recorded. The flight height ranges of the 86 common bird species encompassed (RPS 2010):

- Below the surveyed RSA of RPS (2010) (i.e. <40 m), 85 bird species were commonly recorded (25–95%), and one bird species was occasionally recorded (5–25%).
- Within the surveyed RSA of RPS (2010) (i.e. 40–152 m), five bird species were commonly recorded (25–95%), eight bird species were occasionally recorded (5–25%) and six bird species were rarely recorded at this height (0–5%).
- Above the surveyed RSA of RPS (2010) (i.e. >152 m), one bird species was commonly recorded (25–95%), and five species were rarely recorded at this height (0–5%).

Most bird species were recorded flying below the surveyed RSA (RPS 2010), however there were at least three species groups that are known to sometimes fly at considerable heights which may also place them intermittently within the RSA, such as:

- Birds of prey (raptors)
  - Australian hobby
  - Collared sparrowhawk
- Honeyeaters
  - Black honeyeater
  - Singing honeyeater
  - Tawny-crowned honeyeater
- Waterfowl (ducks, geese and waders).

Locally abundant waterfowl were observed within specific habitat types not associated with the locations of wind turbines. As such, the waterfowl species recorded below the surveyed RSA (i.e. <40 m) are not considered in the risk assessment in Section 4.

There were 19 bird species recorded within and above the surveyed RSA (i.e. 40–152 m and >152 m) and as such have a potential risk of collision with the anticipated RSA (approximately 44 – 206 m) (and maximum RSA of 58–220 m) of the Project Area's wind turbines:

- Birds of prey (raptors)
  - Black-shouldered kite

  - Brown falcon
  - Nankeen kestrel
  - Wedge-tailed eagle
- Songbirds
  - Australian magpie
  - Australian magpie-lark
  - Black-faced cuckoo-shrike
  - Brown songlark
- Ducks
  - Australian shelduck
  - Australian wood duck
- Cockatoos
  - Galah
  - Western corella (northern)
- Swallows and Martins
  - Fairy martin
  - White-backed swallow
- Australasian pipit
- Australian raven
- Australian ringneck
- Black-faced woodswallow
- Straw-necked ibis.

Out of these 19 bird species, 14 bird species returned more than 30 individual records across all surveys, a number indicating statistical robustness (RPS 2014). Five bird species returned a low number of records, including the Australian wood duck (13), brown falcon (4), white-backed swallow (4), black-shouldered kite (2) and fairy martin (1), suggesting that these species are species are unlikely to be at significant risk of impact due to very low densities within the locality.

The species characteristics of the 19 bird species recorded within and above the surveyed RSA and the five bird species recorded below the RSA with the potential to fly at considerable heights are summarised in Appendix C. This includes species behaviour and habitat, flight or demographic factors (i.e. species presence ongoing or transitory/migratory, site use (i.e. transit, roosting, breeding, and/or foraging), flight paths (including migratory flight paths), flight heights, soaring, flocking and population numbers.

These findings have informed the risk assessment in Section 4, which in turn has identified species of concern addressed by this BBMP.

3.2.1.4 Sufficient baseline data for listed threatened and migratory bird species

Fauna values have been investigated extensively by Project Area specific fauna surveys and assessments conducted between 2009 and 2025.The key habitat types identified by the fauna surveys are validated by the vegetation types and open pasture surveyed most recently by the RPS (2023) flora and vegetation survey. The generalised Carnaby's cockatoo flock movements identified by Murdoch University (2024) accord with the observations of Carnaby's cockatoo movement patterns identified by RPS (2010) (i.e. movement of Carnaby's cockatoo occur along lowland woodland corridors within valleys) and BCE (2025) (i.e., majority of sightings located in the lower landscape along the eastern boundary). The areas to the west contain large, consolidated extents of *Banksia* woodland and proteaceous heath communities that meet foraging requirements of Carnaby's cockatoo. The Murdoch University (2024) tracking data indicate a strong habitat preference for the consolidated vegetated extents containing foraging, roosting, and breeding habitat

that occur proximate to Brand Highway, when compared to the open agricultural paddocks proximate to the turbine locations, which also include small, isolated patches of habitat.

A contemporary site utilisation surveys for Carnaby's cockatoo and fork-tailed swift were undertaken to provide an improved understanding of the risk of impacts to key EPBC Act listed species. The site utilisation survey occurred from August 2024 to January 2025, spanning six months, and collected flight behaviours considered representative of Carnaby's cockatoo during the late winter, spring and early summer, and included the entire breeding season. Fork-tailed swifts were not encountered during any of the field campaigns and have not been detected in three decades of bi-annual surveys at the nearby Cooljarloo Mineral Sands Mine (BCE 2025).

3.2.2 Bat site utilisation survey methods

A bat survey was undertaken for the Project Area over two periods, October to November 2008 and May 2009. The bat survey was designed to be consistent with the guidelines provided by Lumsden (2007) and works previously undertaken on similar developments in the area. Bat species generally do not take advantage of open pasturelands over native vegetation, likely due to exposure to the elements and greatly reduced insect richness and abundance over pasture compared with woodland habitats. Bats are also known to prefer sheltered habitats over exposed high ground, however strong flying bats may use higher areas more regularly than smaller bats. The wind turbines will be positioned on high ground within pasture. While bats are more likely to use woodland and sheltered valleys than the pasture on high ground, a bat survey was conducted within the Project Area to establish what species occur in the area and their utilisation of the habitats.

AnaBat II bat detectors and AnaBat ZCAIM recording units were placed at six locations within the Project Area to detect and record passing bats as they echolocated and found prey. The location of the detectors was selected to represent typical conditions where turbines were proposed and either near or between features known to be used by bats such as linear features (e.g. tree line wind breaks), native vegetation, woodland stands, or water bodies. Further sampling was undertaken at a lowland wooded site at Waddi Bush Resort, approximately 2.5 km west of the Project Area, to determine the bat species present in optimum conditions. The passive bat call acquisition included 20 bat detector nights for 260 hours at locations within the Project Area and at a lowland wooded reference site (Waddi Bush Resort) during October to November 2008 and May 2009. In addition to the passive bat detection, several ad-hoc surveys were conducted over two nights to try and establish bat behaviour where conditions allowed (RPS 2014).

3.2.3 Bat site utilisation survey results

During the October 2008 bat survey within the Project Area, 28 call recordings were obtained from the Anabat recorders over three detector nights (RPS 2014). Six of these recordings were not clear bat calls and several more were too unclear to identify to species level , however the recordings were used to identify at least five bat species to genus level.

During the November 2008 bat survey at the lowland wooded reference site (Waddi Bush Resort), 29 call recordings were obtained over two days (26–27 November 2008) (RPS 2014). These recordings confirmed five bat species, as listed in Table 11. The greater number of species and calls for the lowland site confirmed expectations that bats use the closed lowland habitats more readily than the open pasture on higher ground.

During the May 2009 bat survey within the Project Area, 406 bat sonograms were obtained from the Anabat detector at each of the six locations for two to four days (RPS 2014). These recordings confirmed five bat species, as listed in Table 11. The highest activity was recorded at sampling locations W2 and W1, which are located near adjacent scrub habitat and a line of trees with a pond, respectively. The bat activity at the other four sampling locations (W3, W4, W5 and W6) within open pasture was low and found a small number of detections. Of note were the findings at sampling location W4, which was positioned within 50 m from scattered scrub and low-lying heath, yet only four records were collected. These results possibly reflect the poor association bats have with open pasture and the close association bats have with taller vegetation and the shelter and foraging opportunities it provides.

No bat species listed under the EPBC Act or BC Act or DBCA listed priority species were identified during the bat surveys (RPS 2014). All five bat species detected were common and have been detected in other bat surveys for wind farm developments in the region.

The common bat species at risk from collision with wind turbines comprises species known to fly at RSA height, namely:

- White-striped freetail bat *Austronomus australis*
- Southern freetail bat *Ozimops planiceps*
- Gould's wattled bat *Chalinolobus gouldii*.

These findings have informed the risk assessment in Section 4, which in turn has identified species of concern addressed by this BBMP.

3.2.3.1 Sufficient baseline data for listed threatened bat species

Significant survey effort has been undertaken to characterise the local and regional bat assemblages, distribution and abundance, habitat values and flight paths. No conservation significant bats were identified during the bat surveys, nor are they know to occur in the Wheatbelt region. It is considered that the local bat assemblages have been studied with sufficient rigour to adequately predict their likelihood of occurrence, flight patterns and risk profile presented by the operation of the Proposed Action (Table 11).

Table 11: Bat species detected, and species characteristics observed within Project Area and reference site

Species	Behaviour and habitat	Flight or demographic factors	Site use	Flight paths and heights	Records and population numbers
Chalinolobus gouldii (Gould's wattled bat)	• Woodlands within the Project Area are mostly long narrow bands of vegetation following watercourses and roads. Here bats are likely to fly low and close to the vegetation most of the time (RPS 2014). • The Gould's wattled bat can use a variety of habitat types, including open forest, mallee, dense forest, tall shrubland and urban areas (Chruszcz and Barclay 2002).	• The Gould's wattled bat is a microbat, as it belongs to the suborder Microchiroptera. Microbats navigate and forage using echolocation, achieved by generating rapid sequences of high-frequency calls that bounce off objects and the returning echoes provide details of their surroundings (O'Leary 2011). • The Gould's wattled bat can forage within a woodland-farmland mosaic and bats can fly across open paddocks to foraging in woodland patches and clumps of trees in paddocks (Chruszcz and Barclay 2002).	• Low numbers of the Gould's wattled bat were recorded across the Project Area, indicating a low but ubiquitous presence (RPS 2014). • Records within the Project Area were near adjacent scrub habitat in open pasture (RPS 2014).	• The Gould's wattled bat is known to forage above and below the forest canopy and in the open area just below the forest canopy. Flight is direct and rapid, and manoeuvrability is limited (Chruszcz and Barclay 2002). • This species tends to stay below 20 m and may descend to a height of 1 m above the ground (Chruszcz and Barclay 2002).	• Records collected during the 2008-2009 bat surveys (RPS 2014): – Project Area – 2 – Reference site – 2 • Colonies often contain around 30 individuals but can reach numbers of up to 200 (Chruszcz and Barclay 2002).
Mormopterus spp. (4) (or *Ozimops planiceps*) (southern freetail bat)	• Woodlands within the Project Area are mostly long narrow bands of vegetation following watercourses and roads. Here bats are likely to fly low and close to the vegetation most of the time (RPS 2014). • This species is known to roost in buildings and in tree hollows and feed primarily on agricultural pests in the eastern states (Atlas of Living Australia 2024c and RPS 2014). • The species is found across a number of vegetation types including mallee, shrubland, open forest and woodland, with a preference for wetter environments (Atlas of Living Australia 2024c).	• The southern freetail bat is a microbat, as it belongs to the suborder Microchiroptera. Microbats navigate and forage using echolocation, achieved by generating rapid sequences of high-frequency calls that bounce off objects and the returning echoes provide details of their surroundings (O'Leary 2011). • The species is a medium sized bat (RPS 2014). • The southern freetail bat forages in or above open canopy and can utilise gaps in trees such as edges and roads. They are agile enough to feed on the ground however may not be able to take off from the ground, requiring them to climb upwards 1–2 m before taking flight (Atlas of Living Australia 2024c).	The southern freetail bat was the most commonly detected species and was regularly recorded at all sampling locations but in relatively low numbers (RPS 2014).	The flight habits of the species may occasionally put it at risk of collision with the surveyed RSA (i.e. 40–152 m) (RPS 2014).	• Records collected during the 2008-2009 bat surveys (RPS 2014): – Project Area – 48 – Reference site – 17 • Populations can contain up to 100 bats with an average of 30–40 females in a roost and fewer numbers in male groups (Atlas of Living Australia 2024c).
Nyctophilus major (western long-eared bat)	• Woodlands within the Project Area are mostly long narrow bands of vegetation following watercourses and roads. Here bats are likely to fly low and close to the vegetation most of the time (RPS 2014). • The western long-eared bat has only been recorded in southwestern Australia and generally regarded as preferring woodlands and shrublands (RPS 2014). • The western long-eared bat generally occupies *Banksia* woodland, *Casuarina* and *Melaleuca* forests and tall eucalypt forests with high annual rainfall, preferring habitats with well-developed shrub understory. They roost in tree hollows (Wilson and Mittermeier 2019).	• The western long-eared bat is a microbat, as it belongs to the suborder Microchiroptera. Microbats navigate and forage using echolocation, achieved by generating rapid sequences of high-frequency calls that bounce off objects and the returning echoes provide details of their surroundings (O'Leary 2011). • The western long-eared bat forages on insects by perch-hunting and are known to glean insects off the ground or forage on the ground (Wilson and Mittermeier 2019).	• This species was recorded regularly at most sampling locations with a large number at W2. The large numbers of records at this location at dusk indicates that a roost may be close by for the southern forest bat and / or the western long-eared bat (RPS 2014). • There was an absence of records for southern forest bat and the western long-eared bat at dawn, indicating that they may have moved to another roost or return to roost in the late evening at this time of year (RPS 2014).	• The species are slow fliers (6–9 km/hr while foraging) however they likely can fly at greater speeds (Wilson and Mittermeier 2019). • This species does not regularly fly at the surveyed RSA (i.e. 40–152 m), therefore it is not expected to be at risk of collision.	• Records collected during the 2008–2009 bat surveys (RPS 2014): – Project Area – 106 – Reference site – 1
Tadarida australis (or *Austronomus australis*) (white-striped freetail bat)	• Woodlands within the Project Area are mostly long narrow bands of vegetation following watercourses and roads. Here bats are likely to fly low and close to the vegetation most of the time (RPS 2014). • The white-tailed freetail bat roosts mostly in tree hollows, however individuals can roost in caves and lofts of houses (RPS 2014). • The -tailed freetail bat roosts can be found in most habitats from closed forest, open flood plain and within urban areas (Atlas of Living Australia 2024d).	• The white-striped freetail bat is a microbat, as it belongs to the suborder Microchiroptera. Microbats navigate and forage using echolocation, achieved by generating rapid sequences of high-frequency calls that bounce off objects and the returning echoes provide details of their surroundings (O'Leary 2011). • The echolocation calls of the white-striped freetail bat are audible to humans (Atlas of Living Australia 2024d). • This species is known to forage regularly at height as well as at low level, even gleaning from the ground (RPS 2014). • The white-striped freetail bat tends to forage in open areas well above canopy height (Churchill 1998).	Low numbers of the white-striped freetail bat were recorded across the Project Area, indicating a low but ubiquitous presence (RPS 2014).	• The white-striped freetail bat is a specialized high-altitude, fast-fluing interceptor insectivore (Atlas of Living Australia 2024d). • The white-striped freetail bat is common in winter and commonly flies at height and possibly within the surveyed RSA (i.e. 40–152 m) (RPS 2014). • Its aerial foraging activity may put it at risk of collision with turbine blades (RPS 2014).	• Records collected during the 2008–2009 bat surveys (RPS 2014): – Project Area – 8 – Reference site – 3
Vespadelus regulus (southern forest bat)	• Woodlands within the Project Area are mostly long narrow bands of vegetation following watercourses and roads. Here bats are likely to fly low and close to the vegetation most of the time (RPS 2014). • The southern forest bat uses tree hollows and houses to roost (RPS 2014). • The southern forest bat occupies a variety of mallee and other semi-arid woodland and wet sclerophyll forest in areas of higher rainfall (Atlas of Living Australia 2024e).	• The southern forest bat is a microbat, as it belongs to the suborder Microchiroptera. Microbats navigate and forage using echolocation, achieved by generating rapid sequences of high-frequency calls that bounce off objects and the returning echoes provide details of their surroundings (O'Leary 2011). • The species is a small sized bat (RPS 2014). • The southern forest bat forages amongst all levels of their habitat, including at the ground and above the forest canopy (Atlas of Living Australia 2024e).	• This species was recorded regularly at most sampling locations with a large number at W2. The large numbers of records at this location at dusk indicates that a roost may be close by for the southern forest bat and / or the western long-eared bat (RPS 2014). • There was an absence of records for southern forest bat and the western long-eared bat at dawn, indicating that they may have moved to another roost or return to roost in the late evening at this time of year (RPS 2014).	• They are highly energetic and can hunt their prey, insects, with great manoeuvrability. Their flight is characterised by spiralling and gliding in long arcs (Atlas of Living Australia 2024e). • Considering that this species is sensitive to fragmentation and avoids small habitat remnants, corridors, and open areas, it would have flown over such areas to have been recorded at most sampling locations during the 2008-2009 bat surveys (RPS 2014). • As the bat prefers to fly within vegetation, it is unlikely to fly within the surveyed RSA (i.e. 40–152 m) (RPS 2014).	• Records collected during the 2008–2009 bat surveys (RPS 2014): – Project Area – 104 – Reference site – 6 • The southern forest bat occurs in colonies of up to 100 bats (Atlas of Living Australia 2024e).

4 POTENTIAL IMPACTS TO BIRDS AND BATS

A summary of the potential impacts to the identified listed threatened and migratory birds, specially protected birds, DBCA-listed priority birds and common birds and bats during operation of the Proposed Action is provided in Table 12. The potential impacts are predicted to be permanent and in the case of collision with turbines and / or transmission lines and barotrauma are likely to cause death or injury.

There are unlikely to be significant risks to birds and bats from project decommissioning (i.e. removal of the wind turbines), as such this is not considered in this BBMP.

Table 12: Potential key impacts on birds and bats from the operation of the wind farm

Phase	Impact class	Works/operations	Potential impacts
Operational	Direct	Operation of wind turbine and transmission line	• Collision with wind turbines causing death or injury • Barotrauma from wind turbines • Collision with overhead transmission lines causing death or injury
	Indirect		• Changes to utilisation of the site and its surrounds from disturbance and barrier effects

5 LONG-TERM IMPACT RISK ASSESSMENT

5.1 Long-term impact risk assessment methods

This section demonstrates how the potential impacts to each relevant bird and bat species has been analysed as part of the long-term impact risk assessment. The species of concern addressed in the long-term impact risk assessment were informed by the likelihood of occurrence assessment outlined in Section 0, including the results of project specific site utilisation surveys and other relevant information sources.

The long-term impact risk assessment was based on the Risk Evaluation Matrix Model, which complies with the AS/NZS ISO31000 Risk Assessment Standard 2009. The risk assessment involved the following:

- An assessment of three potential impact pathways based on the preliminary site characterisation (Section 3.1) and the site-specific assessment (Section 3.2), including:
  - Death or injury from collision with wind turbines and barotrauma
  - Death or injury from collision with overhead transmission line
  - Changes to utilisation of the site and its surrounds from disturbance and barrier effects
- Impact likelihood criteria were developed and applied to each impact pathway for each species of concern (Table 13)
- Impact consequence criteria were developed and applied to each impact pathway for each species of concern (Table 14)
- Through calculating the likelihood and the consequence, an overall risk rating was determined consistent with a risk matrix (Table 15). This Risk Evaluation Matrix Model is currently used across a wide range of industry sectors, in particular for assessing environmental risk.

Table 13: Likelihood of event criteria

Likelihood	Description
Certain	It is very probable that the risk event could occur in any year (>95%)
Almost Certain	It is more probable than not that the risk event could occur in any year (>50%)
Likely	It is equally probable that the risk event could or could not occur in any year (50%)
Unlikely	It is less probable than not that the risk event could occur in any year (<50%)
Rare	It is improbable that the risk event could occur in any year (<5%)

Table 14: Consequences of event criteria

Negligible	Low	Moderate	High	Severe
Occasional individuals lost but no reduction in local or regional population viability.	Repeated loss of small numbers of individuals but no reduction in local or regional population viability.	Moderate loss in numbers of individuals, leading to minor reduction in localised or regional population viability for between one and five years.	Major loss in numbers of individuals, leading to reduction in regional or state population viability for between five and ten years.	Extreme loss in numbers of individuals, leading to reduction in regional or state population viability for a period of at least ten years

Table 15: Risk matrix defining risk level based on likelihood and consequence

		Consequence				
		Negligible	Low	Moderate	High	Severe
Likelihood	Certain	Negligible	Low	High	Severe	Severe
	Almost Certain	Negligible	Low	Moderate	High	Severe
	Likely	Negligible	Low	Moderate	High	High
	Unlikely	Negligible	Negligible	Low	Moderate	High
	Rare	Negligible	Negligible	Negligible	Low	Low

The long-term impact risk assessment tables are structured to include the following information as part of the risk assessment process (Table 16).

Table 16: Information addressed within the long-term impact risk assessments

Aspect	Description	Ratings
Species	Each species is identified by its recognised scientific and common name.	-
Conservation status	Conservation status of each species under the EPBC Act, the BC Act and DBCA-listing.	-
Chance of occurrence within Project Area	• Likelihood that different species might occur within the Project Area varies with habitat requirements. The Project Area's site characterisation is provided in Section 3.1 and the species characteristics are provided in Appendix A and C. • For the identified listed threatened and migratory birds, specially protected birds, and DBCA-listed priority birds, the likelihood of occurrence assessment found the species to be locally extinct, highly unlikely, unlikely, possible and known (Appendix B). A qualitative (Low for locally extinct and highly unlikely species, Moderate for unlikely and possible species or High for known species measure of the likelihood of occurrence within the Project Area was applied. • For the common birds and bats potentially at risk from collision with wind turbines, a qualitative (Low, Moderate, High) measure of the likelihood of occurrence within the Project Area was applied based on known records, ad hoc species observations and field study results (Alinta Energy 2024, Alinta Energy 2022, Ecoscape 2020, Ecoscape 2019a, Ecoscape 2019b, Ecoscape 2018, Ecologia Environment 2017, RPS 2014 and RPS 2010).	Low, Moderate, High
Abundance within Project Area vicinity	A qualitative (Low, Moderate, High) measure based on the observed species densities within the Project Area and its vicinity is given.	Low, Moderate, High
Chance of occurrence within likely RSA (44 – 206 m) (maximum RSA of 58 – 220 m)	• Local movements of bird and bat species are given a qualitative (Low, Moderate or High) measure of their likelihood to occur within the anticipated RSA (approximately 44 – 206 m) (maximum RSA of 58 – 220 m) in reference to their identified movement patterns in the local Cooljarloo and regional Dandaragan settings (BCE 2025, Murdoch University 2024, Alinta Energy 2024, Alinta Energy 2022, Ecoscape 2019a, Ecoscape 2019b, Ecoscape 2018, Ecologia Environment 2017 and RPS 2010). • For local movements of bird and bat species that have not been recorded within the local Cooljarloo and regional Dandaragan settings, qualitative measures have been applied based on their species characteristics, such as flight heights, habitat preferences and site use.	Low, Moderate, High

Aspect	Description	Ratings
Chance of occurrence within proposed transmission line height range (7.5–40 m)	• Local movements of bird species are given a qualitative (Low, Moderate or High) measure of their likelihood to occur within the proposed transmission line heights (7.5–40 m) in reference to their identified movement patterns in the local Cooljarloo and regional Dandaragan settings (BCE 2025, Murdoch University 2024, Alinta Energy 2024, Alinta Energy 2022, Ecoscape 2019a, Ecoscape 2019b, Ecoscape 2018, Ecologia Environment 2017 and RPS 2010). • For local movements of bird and bat species that have not been recorded within the local Cooljarloo and regional Dandaragan settings, qualitative measures have been applied based on their species characteristics, such as flight heights, habitat preferences and site use.	Low, Moderate, High
Potential impact pathway	Three potential impact pathways are considered: 1. Death or injury from collision with wind turbines and barotrauma 2. Death or injury from collision with overhead transmission line 3. Changes to utilisation of the site and its surrounds from disturbance and barrier effects.	-
Likelihood of event	Based on the above, a qualitative (Rare, Unlikely, Likely, Almost Certain, Certain) measure of the likelihood for each species to be considered at risk of impact is given.	Rare, Unlikely, Likely, Almost Certain, Certain
Consequence of event	A qualitative (Negligible, Low, Moderate, High, Severe) measure of the consequences for each species to be considered at risk of impact is given.	Negligible, Low, Moderate, High, Severe
Risk rating	The resultant measure (Negligible, Low, Moderate, High, Severe) of the likely level of risk for each bird and bat species based on consideration of consequence and likelihood of impacts is provided.	Negligible, Low, Moderate, High, Severe
Comments	Details the specific assessment outcomes on the likelihood of event and consequence of event to determine the risk rating.	-

5.2 Long-term impact risk assessment results

The results of the long-term impact risk assessment are summarised in Table 18 for the identified conservation significant birds and bats, and in Table 19 for the identified common birds and bats. A full detailed risk assessment with comments on the assessment outcomes can be found in Appendix D.

The Project Area specific site utilisation surveys (BCE 2025, Terrestrial Ecosystems 2022, Ecologia Environment 2016, Outback Ecology 2014, RPS 2014 and RPS 2010) and a technical review of Carnaby's cockatoo night-roosting and flock movement behaviours in the localities of Cooljarloo, Cataby and Badgingarra using research data sourced between 2017 and 2022 (Murdoch University 2024), combined with the knowledge generated at operating wind farms elsewhere in Australia (Brett Land & Associates unpublished data), indicate that collision rates are typically very low, and this long-term impact risk assessment indicates that no significant population-wide impacts are anticipated for species of concern.

Of the 30 listed threatened and migratory birds, specially protected birds and DBCA-listed priority birds assessed:

- All thirty species were at a negligible risk of being impacted by the Proposed Action
- Carnaby's cockatoo was assessed at a negligible risk of being impacted by the Proposed Action. However, this species will be addressed in this BBMP to meet the Shire of Dandaragan's development approval condition 20, "… to monitor the impact of the wind farm on avian fauna in the Project Area, specifically in respect to the endangered Carnaby's cockatoo" (Table 17).

Of the 27 common birds and bats assessed:

- Nineteen bird species and three bat species were at a negligible risk of being impacted by the Proposed Action
- Eight bird species were at a low risk of being impacted by the Proposed Action (Table 17).

Due to the findings of this risk assessment, the bird and bat monitoring program and adaptive management framework in this BBMP will have a particular emphasis on effectively monitoring and managing the risk of

collisions with wind turbines and barotrauma, collisions with overhead transmission line and changes to site utilisation for these species.

Table 17: Bird species identified in long-term impact risk assessment as at a low risk and by Shire of Dandaragan to be addressed in the BBMP

Conservation category	Species
Threatened and migratory bird species	• Carnaby's cockatoo
Common bird species	• Australian magpie • Australian magpie-lark • Australian raven • Black-shouldered kite • Brown falcon • Collared sparrowhawk • Nankeen kestrel • Wedge-tailed eagle

Table 18: Summary of long-term impact risk assessment for identified conservation significant birds and bats

Species	Conservation status	Potential impact pathway	Likelihood of event	Consequence of event	Risk rating
Birds					
Actitis hypoleucos (common sandpiper)	Migratory (EPBC Act, BC Act)	Death or injury from collision with wind turbines and barotrauma	Unlikely	Negligible	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Negligible	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Aphelocephala leucopsis (southern whiteface)	Vulnerable (EPBC Act)	Death or injury from collision with wind turbines and barotrauma	Unlikely	Negligible	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Negligible	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Apus pacificus (fork-tailed swift)	Migratory (EPBC Act, BC Act)	Death or injury from collision with wind turbines and barotrauma	Unlikely	Negligible	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Negligible	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Arenaria interpres (ruddy turnstone)	Migratory (EPBC Act, BC Act)	Death or injury from collision with wind turbines and barotrauma	Unlikely	Negligible	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Negligible	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Botaurus poiciloptilus (Australasian bittern)	Endangered (EPBC Act, BC Act)	Death or injury from collision with wind turbines and barotrauma	Unlikely	Low	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Low	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Calidris acuminata (sharp-tailed sandpiper)	Migratory (EPBC Act, BC Act)	Death or injury from collision with wind turbines and barotrauma	Unlikely	Negligible	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Negligible	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Calidris canutus (red knot)	Endangered (EPBC Act, BC Act) Migratory (EPBC Act)	Death or injury from collision with wind turbines and barotrauma	Unlikely	Negligible	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Negligible	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Calidris ferruginea (curlew sandpiper)	Critically Endangered (EPBC Act, BC Act) Migratory (EPBC Act)	Death or injury from collision with wind turbines and barotrauma	Unlikely	Low	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Low	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Calidris melanotos (pectoral sandpiper)	Migratory (EPBC Act, BC Act)	Death or injury from collision with wind turbines and barotrauma	Unlikely	Negligible	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Negligible	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Calidris ruficollis (red-necked stint)	Migratory (EPBC Act, BC Act)	Death or injury from collision with wind turbines and barotrauma	Unlikely	Negligible	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Negligible	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Calyptorhynchus banskii naso (forest red-tailed black cockatoo)	Vulnerable (EPBC Act, BC Act)	Death or injury from collision with wind turbines and barotrauma	Rare	Negligible	Negligible
		Death or injury from collision with overhead transmission line	Rare	Negligible	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Rare	Negligible	Negligible
Charadrius leschenaultii (greater sand plover)	Migratory (EPBC Act) Vulnerable (BC Act)	Death or injury from collision with wind turbines and barotrauma	Rare	Negligible	Negligible
		Death or injury from collision with overhead transmission line	Rare	Negligible	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Rare	Negligible	Negligible
Falco peregrinus (peregrine falcon)	Other Specially Protected (BC Act)	Death or injury from collision with wind turbines and barotrauma	Unlikely	Negligible	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Negligible	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Limosa lapponica (bar-tailed godwit)	Migratory (EPBC Act, BC Act)	Death or injury from collision with wind turbines and barotrauma	Rare	Negligible	Negligible
		Death or injury from collision with overhead transmission line	Rare	Negligible	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Rare	Negligible	Negligible
Leipoa ocellata (malleefowl)	Vulnerable (EPBC Act, BC Act)	Death or injury from collision with wind turbines and barotrauma	Rare	Low	Negligible
		Death or injury from collision with overhead transmission line	Rare	Low	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Motacilla cinerea (grey wagtail)	Migratory (EPBC Act, BC Act)	Death or injury from collision with wind turbines and barotrauma	Rare	Negligible	Negligible
		Death or injury from collision with overhead transmission line	Rare	Negligible	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Numenius madagascariensis (eastern curlew)	Critically Endangered (EPBC Act, BC Act) Migratory (EPBC Act)	Death or injury from collision with wind turbines and barotrauma	Rare	Moderate	Negligible
		Death or injury from collision with overhead transmission line	Rare	Moderate	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Oxyura australis (blue-billed duck)	Priority 4	Death or injury from collision with wind turbines and barotrauma	Unlikely	Negligible	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Negligible	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Pandion haliaetus (osprey)	Migratory (EPBC Act, BC Act)	Death or injury from collision with wind turbines and barotrauma	Unlikely	Negligible	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Negligible	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Pezoporus flaviventris or *Pezoporus wallicus flaviventris* (western ground parrot)	Critically Endangered (EPBC Act, BC Act)	Death or injury from collision with wind turbines and barotrauma	Rare	Moderate	Negligible
		Death or injury from collision with overhead transmission line	Rare	Negligible	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Rare	Negligible	Negligible
Platycercus icterotis xanthogenys (western rosella (inland))	Priority 4	Death or injury from collision with wind turbines and barotrauma	Unlikely	Negligible	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Negligible	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Plegadis falcinellus (glossy ibis)	Migratory (EPBC Act, BC Act)	Death or injury from collision with wind turbines and barotrauma	Unlikely	Negligible	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Negligible	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible

Species	Conservation status	Potential impact pathway	Likelihood of event	Consequence of event	Risk rating
Pluvialis fulva (Pacific golden plover)	Migratory (EPBC Act, BC Act)	Death or injury from collision with wind turbines and barotrauma	Unlikely	Negligible	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Negligible	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Pluvialis squatarola (grey plover)	Migratory (EPBC Act, BC Act)	Death or injury from collision with wind turbines and barotrauma	Unlikely	Negligible	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Negligible	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Rostratula australis (Australian painted snipe)	Endangered (EPBC Act, BC Act)	Death or injury from collision with wind turbines and barotrauma	Unlikely	Low	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Low	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Sternula nereis nereis (Australian fairy tern)	Vulnerable (EPBC Act, BC Act)	Death or injury from collision with wind turbines and barotrauma	Rare	Low	Negligible
		Death or injury from collision with overhead transmission line	Rare	Low	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Rare	Negligible	Negligible
Thalasseus bergii (crested tern)	Migratory (EPBC Act, BC Act)	Death or injury from collision with wind turbines and barotrauma	Rare	Negligible	Negligible
		Death or injury from collision with overhead transmission line	Rare	Negligible	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Rare	Negligible	Negligible
Tringa glareola (wood sandpiper)	Migratory (EPBC Act, BC Act)	Death or injury from collision with wind turbines and barotrauma	Unlikely	Negligible	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Negligible	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Tringa nebularia (common greenshank)	Migratory (EPBC Act, BC Act)	Death or injury from collision with wind turbines and barotrauma	Unlikely	Negligible	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Negligible	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Zanda latirostris (Carnaby's cockatoo)	Endangered (EPBC Act, BC Act)	Death or injury from collision with wind turbines and barotrauma	Unlikely	Negligble	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Low	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Bat					
Macroderma gigas (ghost bat)	Vulnerable (EPBC Act, BC Act)	Death or injury from collision with wind turbines and barotrauma	Rare	Negligible	Negligible
		Death or injury from collision with overhead transmission line	Rare	Negligible	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Rare	Negligible	Negligible

Table 19: Summary of long-term impact risk assessment for identified common birds and bats

Species	Conservation status	Potential impact pathway	Likelihood of event	Consequence of event	Risk rating
Birds					
Accipiter cirrhocephalus (collared sparrowhawk)	-	Death or injury from collision with wind turbines and barotrauma	Almost certain	Low	Low
		Death or injury from collision with overhead transmission line	Almost certain	Low	Low
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Anthus novaeseelandiae (Australasian pipit)	-	Death or injury from collision with wind turbines and barotrauma	Unlikely	Low	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Low	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Low	Negligible
Aquila audax (wedge-tailed eagle)	-	Death or injury from collision with wind turbines and barotrauma	Almost certain	Low	Low
		Death or injury from collision with overhead transmission line	Almost certain	Low	Low
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Artamus cinereus (black-faced woodswallow)	-	Death or injury from collision with wind turbines and barotrauma	Unlikely	Low	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Low	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Low	Negligible
Banardius zonarius (Australian ringneck)	-	Death or injury from collision with wind turbines and barotrauma	Unlikely	Low	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Low	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Low	Negligible
Cacatua pastinator derbyi (western corella (northern))	-	Death or injury from collision with wind turbines and barotrauma	Unlikely	Low	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Low	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Low	Negligible
Cacatua roseicapilla (galah)	-	Death or injury from collision with wind turbines and barotrauma	Unlikely	Low	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Low	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Low	Negligible
Certhionyx niger (black honeyeater)	-	Death or injury from collision with wind turbines and barotrauma	Unlikely	Low	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Low	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Low	Negligible
Chenonetta jubata (Australian wood duck)	-	Death or injury from collision with wind turbines and barotrauma	Unlikely	Low	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Low	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Cheramoeca leucosterna (white-backed swallow)	-	Death or injury from collision with wind turbines and barotrauma	Unlikely	Low	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Low	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Low	Negligible
Cincloramphus cruralis (brown songlark)	-	Death or injury from collision with wind turbines and barotrauma	Unlikely	Low	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Low	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Low	Negligible
	-	Death or injury from collision with wind turbines and barotrauma	Unlikely	Low	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Low	Negligible

Species	Conservation status	Potential impact pathway	Likelihood of event	Consequence of event	Risk rating
Coracina novaehollandiae (black-faced cuckoo-shrike)		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Low	Negligible
Corvus coronoides (Australian raven)	-	Death or injury from collision with wind turbines and barotrauma	Likely	Low	Low
		Death or injury from collision with overhead transmission line	Likely	Low	Low
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Gymnorhina tibicen (Australian magpie)	-	Death or injury from collision with wind turbines and barotrauma	Likely	Low	Low
		Death or injury from collision with overhead transmission line	Likely	Low	Low
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Elanus axillaris (black-shouldered kite)	-	Death or injury from collision with wind turbines and barotrauma	Almost certain	Low	Low
		Death or injury from collision with overhead transmission line	Almost certain	Low	Low
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Falco berigora (brown falcon)	-	Death or injury from collision with wind turbines and barotrauma	Almost certain	Low	Low
		Death or injury from collision with overhead transmission line	Almost certain	Low	Low
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Falco cenchroides (nankeen kestrel)	-	Death or injury from collision with wind turbines and barotrauma	Almost certain	Low	Low
		Death or injury from collision with overhead transmission line	Almost certain	Low	Low
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Falco longipennis (Australian hobby)	-	Death or injury from collision with wind turbines and barotrauma	Almost certain	Low	Low
		Death or injury from collision with overhead transmission line	Almost certain	Low	Low
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Grallina cyanoleuca (Australian magpie-lark)	-	Death or injury from collision with wind turbines and barotrauma	Likely	Low	Low
		Death or injury from collision with overhead transmission line	Likely	Low	Low
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Petrochelidon ariel (fairy martin)	-	Death or injury from collision with wind turbines and barotrauma	Unlikely	Low	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Low	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Low	Negligible
Gavicalis virescens (singing honeyeater)	-	Death or injury from collision with wind turbines and barotrauma	Unlikely	Low	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Low	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Low	Negligible
Gliciphila melanops (tawny-crowned honeyeater)	-	Death or injury from collision with wind turbines and barotrauma	Unlikely	Low	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Low	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Low	Negligible
Tadorna tadornoides (Australian shelduck)	-	Death or injury from collision with wind turbines and barotrauma	Unlikely	Low	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Low	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Threskiornis spinicollis (straw-necked ibis)	-	Death or injury from collision with wind turbines and barotrauma	Unlikely	Low	Negligible
		Death or injury from collision with overhead transmission line	Unlikely	Low	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Bats					
Chalinolobus gouldii (Gould's wattled bat)	-	Death or injury from collision with wind turbines and barotrauma	Likely	Negligible	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Mormopterus spp. (4) (or *Ozimops planiceps*) (southern freetail bat)	-	Death or injury from collision with wind turbines and barotrauma	Likely	Negligible	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible
Tadarida australis (*or Austronomus australis*) (white-striped freetail bat)	-	Death or injury from collision with wind turbines and barotrauma	Likely	Negligible	Negligible
		Changes to utilisation of the site and its surrounds from disturbance	Unlikely	Negligible	Negligible

5.3 Population viability analysis for Carnaby's cockatoo

The purpose of population viability analysis (PVA) is to assess the risks from a given predicted impact on a population or sub-population of a species of interest, while considering all other key threats (Chaudhary and Oli 2019). Through the PVA process, the critical thresholds of losses can be estimated to examine what the losses from the wind farm would mean for the wider population.

Data acquired throughout the survey programmes supporting the Waddi Wind Farm and other surveys being conducted by BCE that focus on Carnaby's cockatoos have produced little to no evidence that Carnaby's cockatoo fly high enough to risk being struck by the rotor blades. This has been especially so with the 2024-2025 site utilisation survey program (BCE 2025), which acquired a large data set that focused on the flight behaviours of Carnaby's cockatoo. Furthermore, operational risk from collision with turbine blades on Carnaby's cockatoo has also been shown to be negligible through the ongoing monitoring of operational wind farms in the region (Ecoscape 2018).

A partial assessment of PVA was undertaken by BCE (2025) for Carnaby's cockatoo, focusing on losses from collision risk and displacement of Carnaby's cockatoo from roosting, breeding and foraging habitat. The DCCEEW does not prescribe a procedure for PVA but the following model for undertaking PVA has been used in submissions to DCCEEW (e.g. Grant et al 2023):

1. Conceptualise key life-history for species of interest
2. Parameterise demographic model
3. Define the population and spatial structure
4. Define PVA parameters
5. Develop PVA scenario including estimates of mortality resulting from the Proposed Action

The results of the PVA are presented in BCE (2025) where the population of Carnaby's cockatoos using the Project Area were estimated by considering five of the six roost areas (Figure E) used by birds that visit the Project Area, according to observed flight activities collected from August 2024 to January 2025, and assuming that all five roost areas were used simultaneously and were occupied by different birds. BCE found that the late winter and spring population would be approximately 86 Carnaby's cockatoos, and as large as 100 – 120 individual birds when allowing for some underestimation of the number of birds at dusk or dawn. Full demographics of a population were present during the survey period (August 2024 to January 2025) over a 10,491-ha survey area, including adults of both sexes, sub-adults and a fledgling.

5.3.1 Estimates of mortality for Carnaby's cockatoo

There is over 18,000 ha of potential Carnaby's cockatoo foraging habitat within conservation estates identified within 12 km of the Project Area, including Badgingarra National Park (13,108 ha), Badgingarra Conservation Park (Crown reserve 41986) (2,369 ha), Crown reserve 27216 (1,074 ha), Unnamed Nature Reserve (1,012 ha), Wonderrah Nature Reserve (439 ha) and Minyulo Nature Reserve (86 ha). Additionally, there are substantial areas of Carnaby's cockatoo habitat outside of the conservation estates and Crown reserves that are also utilised for foraging, roosting and nesting (Figure E, Figure H). It is unlikely that the potential foraging, roosting and breeding habitat proposed to be permanently lost within the Project Area will affect the extent of potential foraging, roosting and breeding opportunities for Carnaby's cockatoo (BCE 2025).

Apart from natural causes, mortalities of Carnaby's cockatoo within the Project Area are likely to be from feral predators and vehicle collisions (BCE 2025). Foxes (*Vulpes vulpes*) and feral cats (*Felis catus*) have been recorded within the Project Area (RPS 2010 and RPS 2014), and there is evidence of these species feeding on carcasses during the carcass persistence trials conducted at Badgingarra Wind Farm and Yandin Wind Farm (Ecoscape 2018, Ecoscape 2019a, Ecoscape 2019b, Ecoscape 2020, Alinta Energy 2022 and Alinta Energy 2024). Vehicles utilising the Project Area include light vehicles associated with farms, and road trains, the latter which have been observed daily and travelling at speed (BCE 2025). Mortality of individual birds particularly from vehicle strike is a major contributor to declines in population (DAWE 2022). The Proponent has committed to a proposed management action relevant to mitigating the risk of vehicle strike to Carnaby's cockatoos. That is, during construction and operation, all vehicle speeds traversing the Project Area will be low (<40 km/hr) to reduce the risk of fauna collision and any incidents of fauna injury will be recorded.

All turbines proposed as part of the Waddi Wind Farm are being positioned on higher ground in cleared agricultural land. The turbines have an anticipated ground clearance of approximately 44 metres, and only a few Carnaby's cockatoos were observed flying over higher ground (up to 25 m on one occasion) and none within the RSA. Only four flights were recorded by BCE (2025) of single Carnaby's cockatoos flying at 44 m or above comprising 0.13% of the total bird/time, and these were in the lower areas of the landscape (i.e. not proximate to the turbines). Flights below 44 m comprised 99.87% of the total bird/time observations reported by BCE (2025).

Furthermore, no Carnaby's cockatoo bird strikes have been reported by proximate Dandaragan wind farms (Ecoscape 2019b; Ecoscape 2022; Alinta Energy 2022; Alinta Energy 2024), which have significant seasonal populations. This may be due to Carnaby's cockatoo's visual detection of the turbine blades (Smales 2006) and avoidance of moderate to high wind velocities (RPS 2010a) or operating turbines (Mike Bamford pers. obs.). Therefore, BCE (2025) concluded that the annual mortality resulting from the Proposed Action on the suggested population of 120 Carnaby's cockatoos is zero.

5.3.2 Population viability analysis conclusion

The viability of the population of Carnaby's cockatoos recorded within and proximate to the Project Area is concluded to be sustainable (BCE 2025). There are external factors which are more influential on the viability of this population of Carnaby's cockatoos than the Proposed Action as outlined in BCE (2025).

5.4 Mathematical collision risk modelling consideration

DCCEEW's request for additional information for assessment by Preliminary Documentation (DCCEEW 2023a) requests that mathematical collision risk modelling (CRM) be undertaken for relevant listed threatened and migratory bird species. It is routine during wind farm impact assessment to utilise CRM to estimate the number of birds of a given species that may collide with the turbine blades (normally restricted to conservation significant species only) (BCE 2025).

Mathematical CRM for listed threatened and migratory bird species was not undertaken for this BBMP. CRM requires data on the site utilisation rates for each species being modelled, to help characterise the activities of these species that may be at risk of collision with turbines (Smales 2006). Input parameters to a CRM may include bird size and average flight speed, flight activity data from the site and turbine specifications (Smales et al. 2013). Where data is not available as a species was not recorded on site, or records were too few to reliably extrapolate from, a well-informed scenario can be used (Smales 2006).

Specifically, CRM was not applied to the Proposed Action for the following reasons:

- One of the objectives of the Vantage Point sampling during the site utilisation survey by BCE (2025) was to generate bird density estimates over space and time (otherwise known as flux) that drive CRM. In addition, the Focal Follow sampling would help inform CRM through a more robust flight height profile. Generation of robust estimates of annual mortality through collision, requires a reasonable number of flights of target bird species within the turbine array and within the RSA. The extensive sampling across the Waddi Wind Farm recorded no flights of Carnaby's cockatoo that meet these criteria (i.e. flights within turbine array at RSA height) and therefore CRM could not be conducted (BCE 2025). As a result, the risk to Carnaby's from colliding with the turbine blades has been identified qualitatively and is low to negligible.
- Another factor that informs CRM is the ability of a species to avoid colliding with turbine blades. Monitoring activities on Yandin and Badgingarra Wind Farms in the same region reported a mixed response of Carnaby's over time, between impact and control sites, and between years. However, Carnaby's were still present within the wind farm arrays. While Carnaby's were still using the airspace within the turbine array, no mortalities were recorded from these facilities. Yandin has a lower clearance to ground level of approximately 27 m while Badgingarra is at 18 m and would pose a higher level of risk than the Proposed Action. Observations of Carnaby's during wind farm monitoring have witnessed Carnaby's adjusting their flight heights as they approach turbines (Mike Bamford pers. obs.).
- Only one EPBC Act listed threatened species was recorded flying within the Project Area, Carnaby's cockatoo. Flight heights of Carnaby's cockatoos were recorded by BCE (2025), as shown in Figure 4, and compared to the Proposed Action's likely dimensions of the wind turbines RSA, where the turbines are positioned on higher ground and the turbines have a likely ground clearance (air gap) of 44 m. For over 145 separate flights, Carnaby's cockatoos were observed flying below 44 m for 99.87% of the recorded bird time. On one occasion Carnaby's cockatoos were observed flying as high as 25 m over

higher ground, near VP04, and there was a cluster of flights near VP01 which were at a maximum of 10 m over higher ground. The highest Carnaby's cockatoo flights were recorded at 50 m on four separate occasions, which involved single birds over lower ground and were outside of the proposed turbine array. RPS (2010) found no records of Carnaby's cockatoo occurring within the surveyed RSA in ridge top contexts nor of this species flying above 152 m. This is likely due to avoidance of moderate to high wind velocities that characterise the wind farm site on a daily basis and the somewhat laboured flight action of Carnaby's cockatoos. As such, it is considered unlikely that local populations of this species would be at significant risk of collision because of the operational Waddi Wind Farm.

- For the EPBC Act listed threatened and migratory bird species not recorded within the Project Area with potential to fly within the anticipated RSA (approximately 44 – 206 m) (maximum RSA of 58 – 220 m), a well-informed scenario could not be reasonably applied, considering their likelihood of occurrence within the Project Area and as there have been no recorded mortalities of threatened and migratory bird species at the nearby wind farms (Ecoscape 2019a, Ecoscape 2019b and Ecoscape 2020, Alinta Energy 2022 and Alinta Energy 2024).

5.5 Environmental outcomes for Bird and Bat Management Plan

The Environmental Management Plan Guidelines (DCCEEW 2024x) require the environmental outcomes for a proposal to be defined and tailored to the key environmental issues. The BBMP's environmental outcomes have been informed by the long-term risk assessment results (Section 5.2), and are listed below:

1. EO 1. No unacceptable impacts to migratory, threatened or specially protected bird species listed under the Commonwealth EPBC Act or state BC Act within the Project Area attributable to the Proposed Action's wind turbines
2. EO 2. No unacceptable impacts to migratory, threatened or specially protected bird species listed under the Commonwealth EPBC Act or state BC Act within the Project Area attributable to the Proposed Action's transmission lines
3. EO 3. No significant impact to Carnaby's cockatoo utilisation of the Project Area and its surrounds attributable to disturbance and barrier effects from the Proposed Action.
4. EO4. No unacceptable impacts to DBCA-listed priority or common bird species within the Project Area attributable to the Proposed Action's wind turbines
5. EO 5. No unacceptable impacts to DBCA-listed priority or common bird and bat species within the Project Area attributable to the Proposed Action's transmission lines

The Proposed Action will achieve these environmental outcomes by implementing a range of design features, mitigation and management measures to avoid or reduce environmental impacts to at or below acceptable levels. These are outlined in Section 3.2 (Impact avoidance) and Section 7 (Proposed avoidance and mitigation measures) of the Preliminary Documentation (RPS 2025), where Section 7.3 requires implementation of the BBMP. A bird and bat monitoring program is outlined in Section 6, bird and bat mitigation measures outlined in Section 7, and the adaptive management framework is outlined in Section 9.2.

6 BIRD AND BAT MONITORING PROGRAM

The strategy adopted in this BBMP to achieve the proposed environmental outcomes (Section 5.5) will involve:

- Statistically robust carcass–monitoring program (random sampling design) to detect birds (and bats) that collide fatally with wind turbines as a basis for an estimate of overall bird and bat mortality rates at the Proposed Action
- Specific investigations and, if possible, mitigation measures initiated due to a specific impact trigger (Section 8)
- Mitigation measures to reduce the possible interactions between birds and operating wind turbines.

6.1 Roles and responsibilities

Meeting the environmental outcomes of this BBMP is ultimately the responsibility of the Proponent. The Proponent will ensure that it engages suitably qualified and trained people to supervise and implement the monitoring program. The roles and responsibilities of key personnel in relation to this BBMP are summarised in Table 20.

Table 20: Roles and responsibilities

Role	Responsibility
Environmental compliance lead (the Proponent)	• Responsible for the environmental compliance of the Proponent in relation to the regulatory approvals and environmental management framework for the Proposed Action, including this BBMP. • Engagement of suitably experienced personnel to satisfy the obligations of the BBMP. • Reporting and review of the BBMP (Section 9) and determining / implementing appropriate and feasible mitigation measures in accordance with the decision-making framework (Section 8).
Operations and maintenance contractor environment representative	• Ensuring that site personnel are familiar with the requirements of the BBMP and responsibilities are clearly communicated to all relevant parties. • Ensuring that site personnel and visitors undertake a site induction that identifies key operational risks and obligations of the BBMP. • Assist with the monitoring and reporting of incidental finds required by this BBMP, including the notification of incidental finds to the ecologist and the environmental compliance lead. • Maintaining reporting, storage, and appropriate disposal of carcasses in consultation with the ecologist.
Transmission line operator environment representative	• Ensuring that site personnel are familiar with the requirements of the BBMP and responsibilities are clearly communicated to all relevant parties. • Ensuring that site personnel and visitors undertake a site induction that identifies key operational risks and obligations of the BBMP. • Assist with the monitoring and reporting of incidental finds required by this BBMP.
Ecologist	• Lead the site implementation of the carcass searches, species identification, carcass persistence trials and detectability trials. • Provide adequate training and support to personnel undertaking activities under the BBMP. • Maintaining records of monitoring and impacts to species in accordance with the requirements of the BBMP (Section 9.1). • Undertake data analysis and reporting of the implementation of the actions required by the BBMP (Section 9.1). • Notifying the environmental compliance lead of any reportable notifications or impact trigger events (Sections 8.1.2 and 8.2.2)
Carcass controller	Facilitate the implementation of the detectability trials (Section 6.3.1.6).
Carrion removal coordinator	• Undertaking regular inspections for any stock, introduced or native mammal and bird carcasses (Section 7.1). • Arranging for the collection and disposal of any carcasses and / or remains identified.

Role	Responsibility
Employees and subcontractors	• Completing a site induction prior to commencing works. • Notifying the relevant environment representative of any incidental finds.

6.2 Bird monitoring program

Experience from other wind farms indicates that ongoing bird utilisation surveys provide varying levels of information. The information baseline was generated based on the Project Area specific site utilisation surveys (BCE 2025, Terrestrial Ecosystems 2022, Ecologia Environment 2016, Outback Ecology 2014, RPS 2014 and RPS 2010) and a technical review of Carnaby's cockatoo night-roosting and flock movement behaviours in the localities of Cooljarloo, Cataby and Badgingarra using research data sourced between 2017 and 2022 (Murdoch University 2024), and informed by data from surrounding wind farm surveys and habitat assessments (Ecologia Environment 2017, Ecoscape 2018, Ecoscape 2019a, Ecoscape 2019b, Ecoscape 2020, Alinta Energy 2022 and Alinta Energy 2024). This is considered to provide a sufficient pre-construction baseline for listed threatened and migratory bird species and common bird species to compare future changes.

Bird monitoring during the operational phase will specifically target the birds identified in the long-term impact risk assessment as at low risk from the Proposed Action (Table 17), as this would provide more useful information within an adaptive management framework for addressing the bird and bat impacts of the wind farm:

- **Carnaby's cockatoo:** This species was assessed at a negligible risk of being impacted by death or injury from collisions and barotrauma (Table 18 and Appendix D). BCE (2025) identified that the risk to Carnaby's from colliding with the turbine blades is low to negligible based on the behaviours and flight activities of Carnaby's cockatoo recorded from August 2024 to January 2025. Observations of Carnaby's during wind farm monitoring have witnessed Carnaby's adjusting their flight heights as they approach turbines (Mike Bamford pers. obs.). Other cockatoo species have been recorded as casualties at wind farms in the eastern states of Australia so to be conservative monitoring will focus on Carnaby's cockatoo.
- **Wedge-tailed eagle:** This species was assessed at a low risk of being impacted by death or injury from collisions and barotrauma (Table 19 and Appendix D). However, this species is a known casualty at wind farms elsewhere in Australia. In a regional context, three carcasses of wedge-tailed eagles have been identified during the construction phase of Yandin Wind Farm in 2020 (Alinta Energy 2022), however no strike mortalities of wedge-tailed eagles have been recorded during Yandin Wind Farm's first two years of operations (December 2021 to November 2023) and Badgingarra Wind Farm's first two years of operations (July to September 2019 and February to April 2020) (Ecoscape 2019b and Ecoscape 2020, Alinta Energy 2022 and Alinta Energy 2024). It is important that mitigation measures are implemented, where practicable, to reduce wedge-tailed eagles being attracted close to turbines. Through the bird and bat monitoring program, further information will be compiled on the wedge-tailed eagle population within the Project Area and the flight behaviours that could place the wedge-tailed eagle at risk.
- **Other raptors and common bird species:** These species were recorded at a low risk of being impacted by death or injury from collisions and barotrauma (Table 19 and Appendix D). On-site occurrence of these species will be recorded during the targeted surveys described below.

6.2.1 Long-term site utilisation surveys

Long-term site utilisation surveys will be undertaken to detect potential changes to Carnaby's cockatoo, wedge-tailed eagle and other raptors and common bird species utilisation of the Project Area and its surrounds because of the operational wind farm. The site utilisation surveys, in combination with the carcass searches, are intended to determine impacts (collisions) occurring from the commencement of commissioning of the wind turbines and during the first two years of operation[2].

[2] Operation of the proposed action for the purposes of this BBMP is defined as the successful completion of hold point testing of the wind turbines constructed as part of the proposed action, as defined and approved by the Australian Energy Market Operator.

They will also inform specific responses to impact triggers assigned to bird and bat species, such as increased monitoring surveys and carcass searches, investigation of risk behaviours and subsequent risk mitigation. This adaptive management framework is outlined in Section 9.2.

The monitoring methods used in the bird survey will be consistent with techniques used during previous field avifauna surveys. The surveys will involve recording observations of bird species from five impact sites and two reference sites. The information recorded will include as a minimum:

- Date, location and duration of observation period
- Time and duration of flight
- Number and age of birds
- Flight heights above ground (minimum and maximum)
- Flight paths, to be plotted on large-scale aerial photographs of the Project Area
- Habitat over which the flight was observed
- Flight behaviour (i.e. foraging, roosting, over-flying, soaring, directional flight (flapping), kiting, circling, gliding, diving)
- Other occasional behaviours (i.e. feeding, territorial displays, fighting, perching).

The long-term site utilisation surveys are proposed to schedule in multiple field campaigns over a two-year period to capture details in flight patterns and site utilisation of Carnaby's cockatoo during each of their four major life stages (BCE 2025):

- Autumn / winter roosting (March to August)
- Dispersion from roost sites to nesting sites (September)
- Nesting (September to December)
- Dispersion from nest sites to autumn roosts – March.

The methodology of the long-term site utilisation surveys will be aligned with the methodology employed for the vantage point (i.e. the same vantage point locations; similar monitoring durations) and focal follow surveys implemented by BCE (2025). It is noted that the breeding migration of Carnaby's cockatoo is influenced by local resource availability driven by the onset of rainfall, therefore the biannual migration flight periods may vary subject to available resources.

This method of multiple field campaigns over a two-year period to capture Carnaby's cockatoo major life stages allows for the site utilisation survey of other bird species to occur concurrently, such as the wedge tailed eagle, other raptors and common bird species, if present. The following species could potentially occur during some or all of these field campaigns as:

- The wedge-tailed eagle and other raptors and common bird species are common and widespread throughout Australia and may occur locally throughout the year.
- The surveys will be timed appropriately to ensure adequate survey of Carnaby's cockatoo and soaring birds of prey.

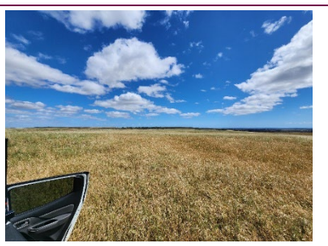
The site selection for surveys will include impact and reference sites. Impact sites are associated with the wind turbines and based on statistical advice from DBCA provided to Badgingarra Wind Farm (Ecoscape 2018) and have been proposed to be at least 2 km apart. Reference sites are proposed to be at least 1 km from a turbine site, at least 2 km from other reference sites and linked to an impact site with similar characteristics (i.e. vegetation type, disturbance level). The proposed five impact sites and two reference sites will use locations from the site utilisation survey's four Vantage Points (VP01 to VP05) and two control Vantage Points (CVP01 and CVP02), as shown in Figure 3. The reasoning behind choosing the Vantage Point locations was as follows (BCE 2025):

- Five Vantage Points were located on higher ground within sight of turbine locations that also provide the least obstructed vision
- Two control Vantage Points were located outside of what was considered to be the zone of influence from the wind farm (or other wind farms).

The proposed impact and reference site options are listed in Table 21.

In addition to the long-term site utilisation surveys, any observations of bird species will be recorded during the carcass search program (Section 6.3.1.4). Consistent monitoring across all seasons will enable the identification of possible seasonal changes.

Table 21: Proposed impact and reference sites and location details

Survey sites	No. of sites	Proposed site options	Coordinates		Elevation (m)	Description	Site suitability details	Photos
			Eastings	Northings				
Impact sites	Five	VP01	359542	6609688	226	• In road reserve adjacent Mullering Road. • Kwongan heath with Banksia, Hakea food plants of Carnaby's cockatoo	• Within the Project Area, as such will be accessible for surveys. • More than 2 km from other proposed impact sites. The closest proposed impact site is VP02.	  Left photo looks west and right photo looks east
		VP02	361479	6613317	281	• On hill adjacent water tanks and farm track. • Overlooking arable paddocks and square stand of ornamental eucalypts in valley. • Some coastal blackbutt (*Eucalyptus todtiana*) in paddock.	• Within the Project Area, as such will be accessible for surveys. • The closest proposed impact site is VP03.	-
		VP03	358936	6615390	252	• On a regolith outcrop on small hill overlooking canola crops to north, west and south. • Grazed paddock to east and stand of Kwongan heath to south-east where ARU31 is deployed.	• Within the Project Area, as such will be accessible for surveys. • The closest proposed impact site is VP02.	  Left photo looks west and right photo looks east
		VP04	360427	6619083	287	• In a grassed paddock to north of Waddi Road. • No livestock were present throughout. • Some lupins present.	• Within the Project Area, as such will be accessible for surveys. • The closest proposed impact site is VP05.	  Left photo looks north and right photo looks south
		VP05	364383	6619205	250	• On hillside surrounded by arable crops of oats and barley. • Hillside overlooking field dam and wooded creek line in valley below. • Stand of ornamental eucalypts surrounds dam and there is a tree line running away to north.	• Within the Project Area, as such will be accessible for surveys. • The closest proposed impact site is VP04.	-
Reference sites	Two	CVP01	356129	6631267	212	Roadside verge	• Outside the Project Area, but in a publicly accessible location. • More than 1 km from a turbine site. The closest turbine is WTG 18. • More than 2 km from the other proposed reference site, CVP01.	-
		CVP02	370170	6610236	310	• Located 6.1 km east of the Project Area on Wolba Road. • Harvested wheat paddock to the north and grazed paddocks to south with scattered clusters of large eucalypts. • Stand of heavily grazed Wandoo woodland lies 700 m north.	• Outside the Project Area, but in a publicly accessible location. • More than 1 km from a turbine site. The closest turbine is WTG 07. • More than 2 km from the other proposed reference site, CVP02.	  Left photo looks north and right photo looks south

6.3 Carcass searches

Carcass searches will be performed at the wind turbines as a basis for an estimate of overall bird and bat mortality rates at the Proposed Action. The results of the carcass search monitoring will be used to estimate the annual number of birds and bats that collide fatally with the wind turbines and to detect any impacts that trigger a management response or requirement to update mitigation measures or adaptive management practices.

Mortality is defined as any dead bird or bat detected under a wind turbine and within a distance from the wind turbines in which carcasses could potentially fall if struck. Detection can be either during the formal carcass search surveys, designed to generate an estimate in accordance with a statistically rigorous sampling design, or at other times by incidental observation, often by site personnel. A protocol is triggered whenever a carcass is found, either within the formal carcass search surveys or incidentally to collect consistent and useful data on the fatality event.

Collision by birds and bats with wind turbines will be monitored through a statistically rigorous carcass-search program for a minimum period of two years. This is intended to ensure that statistically useable and robust results are generated from the carcass monitoring program that include an estimate of both bird and bat mortality rates, together with an estimate of sampling precision.

It will be assumed that any intact dead bird or bat, or feather spot, detected beneath a turbine has died because of collision or interaction with a turbine, unless there are obvious signs of another cause of death (e.g. being shot)[3].

Where there are under five feathers within a square metre, it cannot be safely interpreted as a collision, as they could have been lost by a bird during preening, moulting, or fighting (Barrientos et al. 2012). Feather spots will be assumed to be remains of a bird carcass after scavenging and the scavenger correction factor will not be applied to them.

To derive accurate mortality rates, it is essential that the program is scientifically and statistically robust. A few factors, such as carcass scavenging and carcass detectability, can affect mortality rate estimates and must be measured and included in any estimate of overall mortality rates.

A scavenged carcass may reduce a mortality rate estimate so carcass persistence will be estimated from Project Area specific experimental trials (Section 6.3.1.5). Human detectability of carcasses is also a potential source of error as some carcasses can be missed by a detection dog and handler or ecologist searcher. Protocols have been developed to control for this factor in the final mortality estimates (Section 6.3.1.6).

The practical considerations that have informed the design of the carcass search program and associated trials are listed below.

- Very few carcasses are found under wind turbines in Australia compared with northern hemisphere wind farms.
- Carcasses of a suitable range of sizes for scavenger and detectability trials are difficult to source and usually involve a combination of carcasses found under turbines and those found along roads and other legal sources. It is illegal to source un-cleaned carcasses from poultry producers.
- For statistical reasons, it is likely to be very difficult to determine more than the grossest of differences in scavenging rate or detectability across the year and there is no evidence in the literature for significant differences between seasons in scavenger activity. Therefore, annual scavenger and detectability correction factors will be generated and applied.
- It is known that detectability will be easier in short grass at the dry time of the year compared with in longer grass at the wet time of the year, and detectability trials have been scheduled for both seasons.

Similar methods have been recommended in several other approved bird and bat monitoring programs in Australia. Implementation of bird and bat monitoring programs in Western Australia is still developing, and

[3] Four of the common bird species recorded within the Project Area and its locality are listed as managed fauna under Schedule 4 of the Biodiversity Conservation Regulations 2018. As such, these species can be taken (i.e. be shot) or disturbed if found to be causing, or reasonably expected to be causing, economic damage without a licence. These bird species include the Australian raven, Australian ringneck, western corella (northern), and galah.

the techniques described here are based on the number of programs already implemented, knowledge of experimental design and statistical analysis, and recent feedback from the regulatory authorities.

Carcass search surveys are proposed to be carried out for the duration of commissioning (until full operation of the Proposed Action) and mortality detection is proposed to be carried out for the first two years of operation. After two years, a detailed report will be prepared reviewing the mortality detection program and providing recommendations for the future in response to confirmed issues.

The following sections outline:

- Stratification and turbine selection (Section 6.3.1.1): how the wind turbines will be selected for a search
- Search area and survey frequency (Section 6.3.1.2): the size of area beneath turbines to be searched and how often this area will be systematically searched
- Search method (Section 6.3.1.3): how the search area will be systematically searched
- Data collection and carcass detection protocol (Section 6.3.1.4): how the data is collected, and results recorded
- Carcass persistence trials (Section 6.3.1.5): definition of carcass persistence and scavenging and how experimental trials will be conducted
- Detectability trials (Section 6.3.1.6): definition of detectability and the experimental trial methodology
- Incidental bird and bat carcass find protocol (Section 6.3.2): outlining the procedure to be adopted in the event of an incidental carcass or feather spot find by site personnel outside the formal carcass search surveys
- Injured bird and bat find protocol (Section 6.3.3): outlining the procedure to be adopted in the event of an incidental injured bird or bat find by site personnel
- Analysis of results and mortality estimation (Section 6.3.4): outlining how the data will be analysed to gain estimates of bird and bat mortality.

6.3.1 Turbine carcass search methods

6.3.1.1 Stratification and turbine selection

The Proposed Action comprises 18 wind turbines developed across one stage. The turbines and their surrounding area (at a 120 m radius) have been categorised as occurring within three distinct vegetation types (Figure F) (RPS 2023 and Outback Ecology 2010). Based on this, the turbines have been allocated to the following two strata:

- Cleared area – nine of 18 turbines (WTG 02, WTG 03, WTG 06, WTG 08, WTG 12, WTG 14, WTG 15, WTG 17 and WTG 18)
- Cleared area with minor areas of surrounding vegetation (heath or plantation) within search zone – eight of 18 turbines (WTG 01, WTG 04, WTG 07, WTG 09, WTG 10, WTG 11, WTG 13 and WTG 16).

One turbine (WTG 5) has been excluded as part of the selection process, as there would be limited access to a portion of its carcass search survey area that sits outside the Project Area (Landgate 2024b).

The Proposed Action is proposed over contiguous open agricultural land. As identified above, there is a limited range of habitat in which the wind turbines are located and the Proposed Action has a smaller geographic footprint compared to some other contemporary wind farm developments. It is further anticipated, similar to other nearby wind farms [insert APA & Alinta reference] that there will be high searcher efficiency due to the agricultural setting and limited vegetation within the search zones.

Due to this, a smaller number of wind turbines are required to be searched to give confidence in the estimates of the avian fatalities that may occur through the operation of the Proposed Action. It is proposed that eight wind turbines be searched monthly (~45% of the total wind turbines), which provides a valid dataset for statistical analysis of potential mortality rates. Wind turbine locations have been selected through an online random number generator, as listed in Table 22. The selection process was based on the rules below, which are based on a ‘stratified random’ sampling design:

- Each turbine within a stratum has an equal chance of being selected for the searches (randomly selected by number generation table)
- No stratum can have less than three turbines
- Once the turbines have been selected, the selection will not change.

Table 22: Proposed list of turbines for carcass search surveys

Stratum	Turbine IDs
Cleared area	WTG 03, WTG 06, WTG 15 and WTG 18
Cleared area with minor areas of surrounding vegetation	WTG 01, WTG 04, WTG 10 and WTG 13

The results from each stratum will be analysed separately to establish if there are differences in estimated mortality between them. They will then be combined for a whole-of-wind-farm mortality estimate using appropriate statistical methods for stratified estimates with constant selection probabilities within strata.

Information specific to each turbine that is searched for carcasses will be recorded in the carcass search data sheet (Appendix E). All wind turbine locations are presented in Figure 1.

6.3.1.2 Search area and survey frequency

The size of the search area and method in which the carcass searches will be undertaken has been determined to best detect medium to large bird carcasses. The search areas were determined as using the findings of Hull and Muir (2010), Huso and Dalthorp (2014) and Prakash and Markfort (2020), as applied to turbine specifications (maximum blade tip height and rotor diameter) from two wind farms in Western Australia and New South Wales that were equivalent to the Proposed Action's turbine specifications. The Yandin Wind Farm has a maximum blade tip height of 180 m and a rotor diameter of 150 m (Ratch and Alinta Energy 2024) and the Rye Park Wind Farm has a maximum blade tip height of 200 m and a rotor diameter of 162 m (Umwelt 2023), and the carcass search areas were both determined to be an area with a radius of 120 m comprising an inner and outer search area with radii 60 m and 120 m, respectively (Alinta Energy 2022, Umwelt 2023 and Alinta Energy 2024).

The following search areas designed to detect bird carcasses for the Proposed Action, with its likely blade tip height of 206 m and rotor diameter of 162 m, are as follows:

- Bats and small to medium and large sized birds: 60 m circular radius around the turbine (inner zone). Transects will be spaced every 6 m across this circle
- Medium to larger sized birds: 60–120 m circular radius around the turbine (outer zone). Transects will be spaced every 12 m from the inner (60 m) to outer (120 m) sections of the search area.

The inner and outer carcass search zones are illustrated in Figure 7.

(Source: Umwelt 2023)

Figure 7: Inner and outer carcass search zones underneath turbines

Given that the defined transect spacing and total search area are based on experience and evidence from previous studies (e.g. Arnett et al. 2005, Hull and Muir 2010), they are considered to be sufficient to detect the bird species of concern arising out of the risk assessment.

The survey frequency of the carcass searches at each turbine will be monthly, following the commencement of commissioning[4] of the wind turbines and subsequently for the first two years of full operation of the Proposed Action. The frequency of carcass search surveys may be altered, in consultation with DBCA, if the findings of the first year of carcass persistence trials indicate that it would be necessary or appropriate.

It is anticipated that all areas within the inner and outer search zones will be accessible and searchable.

6.3.1.3 Search method

The monthly carcass search surveys will be undertaken by suitable scent-detection dogs and trained handlers as the default if they are available and if the climatic conditions of the Project Area are suitable for detection dogs to work safely and effectively. Detection dogs have been used to improve bird and bat strike mortality estimates at wind farms and have been shown to be more accurate than humans in detecting bird and bat carcasses (Homan et al. 2001, Arnett 2006, Paula et al. 2011, Matthews et al. 2013, Smallwood et al. 2020, and Domínguez del Valle et al. 2020).

The detection dog and handler will cover the carcass search zones along paths spaced at approximately 20–30 m from each other depending on wind speed. The spacing arrangement would be subject to advice from the handler during each carcass search survey. The detection dog will be fitted with a GPS to track their movements and coverage for each survey. The handler will be experienced in identification of bird and bat species carcasses that may be found within the Project Area and understand the data collection and carcass detection protocol outlined in Section 6.3.1.4. The detectability of detection dogs will be assessed as detailed in Section 6.3.1.6.

[4] Commissioning of the proposed action for the purposes of this BBMP is defined as the commencement of hold point testing of the wind turbines constructed as part of the proposed action, as defined and approved by the Australian Energy Market Operator. This aligns with the spinning and generation from the first wind turbines constructed as part of the proposed action.

If detection dogs and handlers are not available, the monthly carcass search surveys will be undertaken by qualified ecologists. The ecologist will cover the carcass search zones along transects spaced at 6 m within the inner zone and at 12 m within the outer zone. The ecologist will use a handheld GPS device to track their movements and coverage for each survey. The ecologist will be experienced in identification of bird and bat species carcasses that may be found within the Project Area and understand the data collection and carcass detection protocol outlined in Section 6.3.1.4. The detectability of suitably qualified personnel will be assessed as detailed in Section 6.3.1.6.

6.3.1.4 Data collection and carcass detection protocol

Data will be collected and recorded by the ecologist during the monthly carcass search surveys and carcass persistence trials using the data sheets, the carcass search survey data sheet (Appendix E), the dead or injured bird or bat data sheet (Appendix F) and the carcass persistence trial data sheet (Appendix G).

The carcass search survey data sheet (Appendix E) will be completed by the ecologist for each of the carcass search surveys. This will include weather information and basic survey information and particularly identify the extent of any variable ground substrates and any unsearchable areas, as this will have implications on accurate carcass discovery.

The dead or injured bird or bat data sheet (Appendix F) will be completed by the ecologist if a bird or bat carcass or feather spot is found during the carcass search surveys. The carcass or feather spot must be collected, photographed, and stored if a carcass and its location recorded using a GPS. The carcass will be handled according to a standard procedure:

- The carcass will be removed from the site to avoid re-counting.
- The carcass will be handled by personnel wearing rubber gloves, packed into a plastic bag, wrapped in newspaper and put into a second plastic bag.
- The carcass will be clearly labelled to include a copy of the carcass search survey data sheet (Appendix E) to ensure that its origin can be traced later, if required.
- The carcass will be collected and disposed of as soon as possible.

The dog handlers or ecologists will hold any DBCA licences required to undertake the carcass search surveys.

In cases where the carcass or feather spot cannot be identified by the ecologist, the following process will be undertaken:

- Photos of the carcass or feather spot will be analysed by the lead ecologist to definitively identify the find.
- Feathers collection of the will also be undertaken to assist with subsequent species identification.
- Methods to further identify the carcass or feather spot will involve sending the photos, feathers or carcass to a species specialist or museum. Sending the carcass or feathers for DNA testing may be undertaken if there is a strong indication that the find could potentially result in an impact trigger for migratory, threatened or specially protected species, on advice from the ecologist.

The reporting requirements for the carcass search surveys are detailed in Section 9.1.

6.3.1.5 Carcass persistence trials

It is important to ascertain the rate at which carcasses persist in the environment before being removed by scavengers. This can be used to develop a ‘correction factor’ that informs the estimate of wind farm impacts on birds and bats. Scavengers can include ground-based animals, such as foxes and rats (more likely to detect carcasses by scent), as well as aerial scavengers such as birds of prey and ravens (more likely to detect them visually). The carcass persistence trial is designed to ascertain the scavenging rate, usually expressed as average carcass duration.

An intact carcass will be defined as a carcass that does not appear to have been scavenged by a vertebrate scavenger. A partially eaten carcass will be any skeletal or flesh remains found. Feather and fur spots will be defined by their presence and the absence of any other remains. Intact or partial carcasses and feather/fur spots will all be recorded as a 'find'. However, the carcass persistence correction factor will not be applied to fur and feather spots as these are most likely to represent the remains of carcasses after they have been scavenged.

Carcass persistence trials will be undertaken by the ecologist twice for the first year of operational phase monitoring. The objective of having two trials is to account for different vegetation conditions, so one will be held when the grass is long and one when the grass is short. The two periods for carcass persistence trials are shown in Table 23.

Table 23: Timing for carcass persistence trials for turbines

Vegetation condition	Likely time period	Weather	Stocking
Short grass	Winter (June)	Cool weather	Heavy stock levels
Long grass	Late spring (November)	Following rain and higher temperatures	Light stock levels

After the carcass persistence trials are completed, the requirement for additional carcass persistence and/or detectability trials and their frequency will be reviewed by the ecologist. Should this review identify that it would be necessary or appropriate to undertake additional carcass persistence trials, the Proponent will consult with DBCA and DCCEEW to confirm the timing and frequency of additional trials.

Carcass persistence trials will be undertaken by the ecologist to determine the probability of scavenging loss, and the nature of scavenger removal (e.g. an early peak in scavenging or scavenging that peaks after carcasses have been in place for a period of time). The search area for carcass persistence trials will be the same as in the carcass search survey protocol and will be located under operating turbines, selected based on the methodology outlined in Section 6.3.1.1 and 6.3.1.2.

To determine potentially different scavenging rates on birds, four size categories of carcass will be used. Different scavengers are active at different times of day, and this will be accounted for by placing carcasses out during the early morning and late afternoon. This will reduce the potential for bias in the search intervals. Based on current mortality estimation software requirements, every endeavour will be made to find ten carcasses of each size category (Table 24). Improvements on this method would require an impractical and unlikely availability of required carcass numbers, and do not lead to a commensurate improvement in the statistical power of estimates.

Table 24: Number of replicates for each carcass persistence trial for turbines

Time	Small birds	Medium sized birds	Large birds (large raptor size)	Total
Early morning	5	5	5	**15**
Late afternoon	5	5	5	**15**

The trials will be conducted at the same randomly selected turbine sites used for carcass search surveys (Section 6.3.1.1). The first five carcasses of each category (15 carcasses in total) will be randomly placed under different turbines in the morning (i.e. one carcass per turbine). In the afternoon, the 15 carcasses will be checked, then each of the carcasses will be checked twice daily for the first three days, then daily for two days, then every 48 hours for the following four days and then every three days until they disappear or at the end of 30 days (Table 25).

Table 25: Carcass persistence trial search timetable for turbines

Time	Day 1	Day 2	Day 3	Day 4	Day 5	Day 7	Day 9	Day 12	Day 15	Day 18	Day 21	Day 24	Day 27	Day 30
Early morning														
Late afternoon														
Anytime														

The timing of searches is based on experience and regulatory approval at several other wind farms where carcass persistence trials have been undertaken that show almost all carcasses have been scavenged within five to ten days. Trials at the Yandin Wind Farm have observed carcasses persist on average 2.6–6 days for bats, 1.8–2.5 days for small birds and 2.1–2.7 days for medium birds (Alinta Energy 2022). More frequent monitoring than that proposed will not significantly affect consideration of scavenging and its impact on mortality estimates.

Additional procedures for carcass persistence trials are:

- A mix of small and medium to very large bird carcasses (if available) will be obtained for use in the carcass persistence trial. Where carcasses of the species of concern cannot be found, a similar-sized and coloured substitute will be used to reduce bias by visual predators.
- Latex gloves will be always worn while handling carcasses to minimise contact with human scent, which may alter predator responses around carrion and to minimise disease risk to the handler.
- At each trial site, one carcass will be placed randomly within the 120 m search area, depending on the search protocol for that turbine. Carcasses will be thrown in the air and allowed to land on the ground to simulate at least some of the fall and allow for ruffling of fur or feathers.
- Carcasses used in the trial will have their coordinates recorded to ensure that they are not confused with an actual fatality found under a turbine during the trial searches.
- Notes will be taken on evidence remaining at sites where carcasses have been scavenged (e.g. scavenger scats, bones, feathers, animal parts and type of scavenging, if visible, such as tearing, pecking, complete removal of carcass, partial removal of carcass, bird or mammal predator evidence).
- Notes will be taken by the ecologist on the state of remaining carcasses in each search.

Undertaking two carcass persistence trials at seasonally different times is designed to account for occasional winter/spring increase in carrion use by some scavenger species. Previous studies have found that red foxes are reliant on rabbits and carrion in agricultural and forested areas (Brunner et al. 1975, Catling 1988, Molsher et al. 2000). Feral cats show little but uniform use of carrion throughout the year, whereas fox prey type is dependent on availability (Catling 1988). Catling (1988) found that foxes ate more carrion in winter/ spring compared with summer/autumn, when they fed on adult rabbits. However, Molsher et al. (2000) found that there was no overall significant difference between seasons for carrion use. Seasonal differences only occurred in other prey types (not carrion), such as lambs, invertebrates, and reptiles, as these are only available at certain times of the year.

Foxes (*Vulpes vulpes*), feral cats (*Felis catus*), and raptors have been recorded within the Project Area (RPS 2010 and RPS 2014), and there is evidence of these species feeding on carcasses during the carcass persistence trials conducted at Badgingarra Wind Farm and Yandin Wind Farm (Ecoscape 2018, Ecoscape 2019a, Ecoscape 2019b, Ecoscape 2020, Alinta Energy 2022 and Alinta Energy 2024).

Carcass persistence trials for large raptors will only be conducted once per year due to lack of availability of suitable carcasses for a technically sound trial. Experience from other wind farms indicates a low level of scavenging of these carcases and a high level of detectability that is consistent across the year.

The number of carcasses per animal and size category is based on obtaining a reasonable level of statistical confidence in the estimate of average carcass duration, as reflected in software requirements for current mortality estimation processes, whilst seeking to minimise the number of carcasses used, as they can be difficult to source. Large numbers of carcasses (e.g. on-site, roadkill) are difficult to obtain, and it may be very complicated to find alternative sources (e.g. farmed and culled animals). It is also possible that large numbers of carcasses, more size categories and more replicates may attract more scavengers to the area. Previous studies (Molsher et al. 2000) have shown that fox prey use is related to availability and therefore more foxes may be attracted to the area if more carcasses are used, thereby biasing the resulting correction factor. In addition, raptors are potentially more susceptible to collision when preying on carrion beneath turbines. However, it is necessary to conduct these trials under turbines as some scavengers may alter their behaviour in response to the turbines.

The final carcass persistence trial design is therefore a necessary compromise between high numbers of trials and practicality whilst ensuring a statistically valid trial design without altering either the behaviour of scavengers or birds that may collide with turbines.

The reporting requirements for the carcass persistence trials are detailed in Section 9.1.

6.3.1.5.1 Alternative approach

An alternative approach to the method used above is to use motion sensor cameras that monitor for scavenger activity. This approach has advantages as opposed to using human observers, including lower survey effort and the ability to determine the exact time of carcass removal. A camera would be attached to a star picket, approximately 1 m high and placed in the ground approximately 4 m away from the carcass. The camera would record any activity by scavengers over the 30-day period. This alternative approach collects precise time and method of scavenging, thereby reducing uncertainties with the carcass persistence trials results analysis. The camera locations under operating turbines will be selected based on the methodology outlined in Section 6.3.1.1 and 6.3.1.2.

6.3.1.6 Detectability trials

Detectability and carcass persistence trials will be undertaken by the ecologist concurrently, as this approach is more time efficient and cost effective.

Detectability trials will be undertaken to assess the probability that a detection dog and handler or ecologist will detect an existing carcass, given the carcass detection protocol for monthly carcass search surveys in Section 6.3.1.4 (i.e. searching along the 6 m and 12 m transects). As humans are reliant on visual cues to determine carcass location, the two visibility categories of low and high grass cover will be compared. The detection dog and handler team would rely on scent and visual cues, as such both visibility categories will be suitable.

To account for variability in detecting carcasses, only the personnel (i.e. detection dog and handler or ecologist) who have carried out monthly searches at the Project Area be involved in the detectability trials. Detection efficiency (per centage of carcasses detected) will then be incorporated into later analyses that derive mortality estimates. The number of carcasses to be employed in each trial is detailed in Table 26.

The carcass controller (a person not involved in monthly carcass searches who can act consistent with this method) will throw each carcass into the air and allow it to land on the ground to simulate at least some of the fall and the potential ruffling of fur and feathers. The carcass controller will note the placement of carcasses (via GPS) and is free to decide how many are deployed under each turbine, however all bats should be located within the inner carcass search zone (60 m).

Table 26: Number of replicates per season for detectability trials, given two factors of size and visibility for turbines

Time	Small birds	Medium sized birds	Large birds (large raptor size)
Short grass	Five	Five	Five
Long grass / vegetated	Five	Five	Five

Analysis indicates that there is a large confidence interval on the estimate of searcher efficiency, even for a high number of trials (plus or minus ten per cent even with 50 replicates). This means that only relatively large seasonal changes in detection (~20–30% or more) will be resolvable from normal background variation. Sampling will be undertaken during the two periods that represent the greatest change in vegetation cover (therefore visibility), using a number of carcasses that is logistically manageable and aligned with the number and timing of scavenger trials. Statistical confidence analysis indicates that this will result in a reasonably precise detectability estimate after one year, and optimal precision after two.

If sufficient carcasses cannot be obtained, then stuffed, realistic-looking artificial substitutes may be used. If detection dogs and handlers are not utilised, it is noted that humans are entirely visual searchers so it would not be essential to use real carcasses as long as the substitutes appear similar once on the ground. Additionally, the artificial substitutes will not attract scavengers and should not increase the likelihood of raptor collisions and the number of introduced predators on site. As these trials can be undertaken separately from scavenger trials, artificial substitutes may be ideal (i.e. mice substitute for bats).

The reporting requirements for the detectability trials are detailed in Section 9.1.

6.3.2 Incidental bird and bat carcass find protocol

Site personnel may find carcasses within the Project Area during normal operational and maintenance activities. An incidental bird and bat carcass find protocol will be implemented across the Proposed Action, including both the wind farm and transmission line components. Should an avian or bat carcass be identified, the carcass will be handled according to the carcass detection protocol outlined in Section 6.3.1.4. Any incidental find will be reported by either the operations and maintenance contractor environment representative or transmission line operator environment representative to the ecologist and environmental compliance lead to allow for any relevant notification and reporting timeframes (Section 9.1).

All site personnel will be made aware of the carcass detection protocol and injured bird and bat protocol as part of their Health, Safety and Environment training and site induction, with records kept of personnel completing the site induction. A dead or injured bird or bat data sheet (Appendix F) will be completed for each incidental carcass found by the operations and maintenance contractor environment representative or transmission line operator environment representative.

6.3.3 Injured bird and bat find protocol

Site personnel may find injured birds or bats within the Project Area during normal operational and maintenance activities, and as such will be advised of the correct procedure for assisting injured wildlife (i.e. birds). Site personnel who find injured wildlife will be required to report the find to the operations and maintenance contractor environment representative or transmission line operator environment representative.

The operations and maintenance contractor environment representative or transmission line operator environment representative will arrange as soon as possible (within 72 hours after taking possession of the animal) for the animal to be returned to the place it was originally take if it is capable of fending for itself, or to place the animal immediately into a dark place (e.g. box or cloth bag, if safe to do so) for transfer to the nearest DBCA wildlife officer, veterinary surgeon or a person who is authorised under a licence to rehabilitate fauna (i.e. holder of a Fauna possessing (other purposes) licence) (DBCA 2019).

Contact details of local veterinary staff and wildlife carers are provided below to ensure that if injured wildlife is found and cannot readily be released back to the wild, they are treated accordingly and in a timely manner:

- Moora Veterinary Service (08) 9651 1420 (https://www.acountrypracticevet.com.au/contact-us/moora-veterinary-service/)
- Wildcare Helpline (08) 9474 9055 (https://www.dbca.wa.gov.au/wildlife-and-ecosystems/animals/wildcare-helpline)
- FAWNA 0438 526 660 (https://www.fawna.com.au/emergency/).

Site personnel are prohibited from touching or handling any live bats (injured or otherwise). A qualified and appropriately vaccinated ecologist or wildlife carer must be called to handle any bats. Only persons vaccinated against Australian bat lyssavirus may handle live bats.

Within 24 hours of taking possession of a species listed as migratory, threatened or specially protected under the BC Act, written notice must be given to the CEO of DBCA by completing the Injured or Abandoned Fauna Notification form at https://www.dbca.wa.gov.au/licences-and-permits/fauna and emailing it to wildlife.protection@dbca.wa.gov.au (DBCA 2019).

This injured bird and bat protocol is valid for the operational life of the Waddi Wind Farm.

6.3.4 Analysis of results and mortality estimation

The results of the carcass search surveys will be analysed to provide information on:

- The species, number, age, and sex (if possible) of birds and bats being struck by the turbines.
- Any variation in the number of bird and bat strikes.

The results will be detailed in the annual report and will provide a basis for identifying if further detailed investigations or mitigation measures are required (Section 9.1).

Statistically robust projections of bird and bat mortality for the entire Project Area will be presented, based on the data collected from carcass search surveys. It is acknowledged that this is a current and dynamic aspect of research and that the outcomes from such programs may be equally dynamic. The current program is designed to provide an acceptably accurate and precise estimate of wind farm related bird and bat mortality within two years, so a full analysis and estimate will be provided in the second annual report, together with recommendations on the scope of future monitoring, if required.

All data will be analysed to provide the average estimated mortality of birds and bats, their standard error (variability) and ranges for the Project Area. The mortality rate of each species (if estimates of individual species are possible) and size class detected will be calculated after two years of data have been collected. If possible, the standard error and range of these estimates will be reported. Note that it may not be possible practically to provide this due to the likely small number of carcasses detected. Where this is an issue, it will be reported. Mortality estimates will also take into consideration the actual operational time of the turbines (obtained from the Proposed Action operator).

The estimated mortality rate will be generated by modelling the scavenger losses and results of the human detectability trials and using sampling inference to account for the selection and stratification of turbines. The data from the scavenger and detectability trials will be analysed using relevant techniques based on Generalised Linear Modelling (GLM) and (censored) Survival Analysis. Censored measurements are only partially known, such as the exact time of mortality or the exact time to scavenger loss (see, for example, Kaplan and Meier 1958). In addition to providing mortality estimates, this analysis will determine if any of the factors (i.e. size class or habitat stratification of turbines) are significant, where possible.

6.4 Survey schedule

An overview of the survey schedule for the different survey components of the bird and bat monitoring program is provided in Table 27.

Table 27: Survey schedule[5]

Phase	Survey	Timing	Duration
Commissioning	Carcass search surveys	Monthly.	For the duration of commissioning (until full operation of the Proposed Action). Approximately nine months.
Post-commencement of operation	Bird surveys	Multiple field campaigns over a two-year period to capture Carnaby's cockatoo major life stages, such as (BCE 2025): • Autumn / winter roosting (March to August) • Dispersion from roost sites to nesting sites (September) • Nesting (September to December) • Dispersion from nest sites to autumn roosts – March	Two years
	Carcass search surveys	Monthly. The frequency of carcass search surveys may be altered, in consultation with DBCA, if the findings of the first year of carcass persistence trials indicate that it would be necessary or appropriate.	Two years
	Carcass persistence trials	During winter (likely June) and late spring (likely November). After the carcass persistence trials are completed, the requirement for additional carcass persistence and/or detectability trials and their frequency will be reviewed by the ecologist. Should this review identify that it would be necessary or appropriate to undertake additional carcass persistence trials, the Proponent will consult with DBCA and DCCEEW to confirm the timing and frequency of additional trials.	One year
	Detectability trials	During winter (likely June) and late spring (likely November). After the carcass persistence trials are completed, the requirement for additional carcass persistence and/or detectability trials and their frequency will be reviewed by the ecologist. Should this review identify that it would be necessary or appropriate to undertake additional carcass persistence trials, the Proponent will consult with DBCA and DCCEEW to confirm the timing and frequency of additional trials.	One year
	Incidental bird and bat finds	Conducted opportunistically through the operational life of the Proposed Action.	Operational life of the Proposed Action.

[5] Note: Where timing is presented as indicative based on seasonal fluctuations, it is the responsibility of the ecologist to determine the ideal weather conditions to allow for optimal timing to undertake the relevant trials.

7 BIRD AND BAT MITIGATION MEASURES

Mitigation involves the prevention, avoidance and/or reduction of the risk of an impact trigger occurring or continuing to occur. An impact trigger is defined in Section 8 as a threshold of impact on birds or bats that triggers an investigation and/or management response. Measures to be undertaken during operation of the Proposed Action to prevent or reduce the potential for an impact to occur are addressed below.

The overall objective of mitigation measures is to ensure that the operation of the Proposed Action does not lead to significant impacts on migratory, threatened, specially protected, priority or non-threatened birds and bats further to what has been considered as part of the environmental assessment and approval of the Proposed Action.

Any future novel or new mitigation measures that are identified to be of potential benefit for birds and bats at the Proposed Action may be considered by the Proponent as part of the adaptive management framework established in this BBMP, in consultation with the DBCA and DCCEEW.

7.1 Carrion removal program

Land-use and stock management below and around turbines can influence the presence and behaviour of native birds on site. Examples include:

- Grain feeding can be an “attractant” for parrots and cockatoos
- Carrion and rabbits can be an “attractant” to raptors in the area.

A low risk to wedge-tailed eagles from death or injury from collision with wind turbines and barotrauma and death or injury from collision with wind turbines and barotrauma has been identified in the long term impact risk assessment (Table 19 and Appendix D). The wedge-tailed eagle and other raptors forage for carrion (dead and decaying flesh of an animal) and on small mammals, rabbits, and more.

To reduce the risk of raptors colliding with turbines, a regular carrion removal program will be implemented during operation of the Proposed Action, to reduce the attractiveness of the site to raptors and therefore reduce the potential for fatal collisions by this group of birds. This program will focus on areas of the Proposed Action where the Proponent has operational control and land access for the purposes of the Proposed Action activities. The procedures below will be adopted:

- A designated suitable person will be appointed (such as a wind farm employee/environmental representative) to perform the function of carrion removal coordinator who will undertake the activities described below:
  - Monthly inspections of the Project Area as part of the regular environmental inspections of the Proposed Action to search for any stock, introduced or native mammal and bird carcasses[6] that may attract raptors (e.g. kangaroos, pigs, goats, foxes, rabbits, dead stock). This search will be undertaken via vehicle and visual checks.
  - Additional, opportunistic observations by operators during normal inspections and work routines and by landowners as they travel around their properties provides further opportunity to identify and report carcasses of stock or feral animals so that timely collection can be undertaken to remove them. This can be addressed by operator and landowner protocols.
  - Any carcasses and/or remains found will be collected and disposed of as soon as possible, in a manner that will avoid attracting raptors close to turbines.
  - Waddi Wind Farm maintenance staff will be required to notify the carrion removal coordinator immediately following identification of carrion on site in between monthly searches.
  - Carcass occurrence and removal will be recorded in a site management log maintained by the operations and maintenance contractor environment representative.
- The Proponent will engage with associated landowners hosting wind turbines as part of the Proposed Action and provide education to them regarding the carrion removal program. This process will encourage landowners to notify the operations and maintenance contractor environment representative

[6] Avian carcasses to be noted as incidental finds in accordance with Section 6.3.2.

of any carcasses that may attract raptors and reducing attractiveness of the areas of their property around wind turbines to raptors, including limiting practices of grain feeding and location of lambing as appropriate). It is noted that the Proponent is unable to direct landowners to alter their property management practices in accordance with the agreements in place for the Proposed Action.

The need for continuation of any carcass removal program and the effort required will be assessed following two years of operation. In general, the criteria for continuation will be based on the frequency of carcass finds. For example, if carcass frequency is particularly low (e.g. one or two per quarter) outside of turbine search zones (i.e. not beneath turbines), the intense program may be discontinued or reduced considerably, with notification to DBCA and DCCEEW. Alternatively, if peaks occur at specific times or locations where there are turbines with intervening periods of low numbers, the effort may be focussed on the peak periods and/or locations.

7.2 Lighting on buildings

It has long been known that sources of artificial light attract birds, as evidenced by night-migrating birds in North America and Europe. Lighting is probably the most important factor under human control that affects mortality rates of birds and bats colliding with all structures (Longcore et al. 2008). Most bird mortality at communication towers for example, occurs in poor weather with low cloud in autumn and spring, i.e. during migration periods (Longcore et al. 2008).

It is postulated that bright lights may temporarily blind birds, particularly those accustomed to flying at night or in low light conditions causing them to fly toward the light source and collide with the structure (Gauthreaux and Belser 2006). They would appear prone to saturation of their retinas, causing temporary blindness when subjected to bright light (Beier 2006) and mortality of both birds and bats can result from collisions with lit structures. Birds can also become disoriented or ‘trapped’ in the field of light (Longcore et al. 2008). Bats are also attracted to the increased numbers of insects that may congregate near bright light sources.

Measures to reduce the impact of lighting include using low pressure sodium or mercury lamps with UV filters to reduce brightness. The colour of lighting may also be important. Some studies have found that red lights resulted in a lower mortality than white lights (Longcore et al. 2008), but more recent research on oil rigs at sea suggests that blue or green lights may result in lower mortality than red or white lights (Sheppard 2022).

Aviation safety lighting is not currently proposed as part of the Proposed Action. However, the turbines do have external stair lighting which would be used as needed during operations (including at night if required).

Construction and operational activities by site personnel are expected to occur during daylight hours therefore the Proposed Action is not anticipated to require night-time lighting on its buildings. However, there may be lighting on the Operation and Maintenance facility which could attract birds or bats to the artificial light. The location of this facility is shown in Figure 1.

Any safety lighting required will be planned and installed in accordance with the Best Practice Lighting Design as outlined in National Light Pollution Guidelines for Wildlife (DCCEEW 2023c):

1. Start with natural darkness and only add light for specific purposes
2. Use adaptive light controls to manage light timing, intensity and colour
3. Light only the object or area intended – keep lights close to the ground, directed and shielded to avoid light spill
4. Use the lowest intensity lighting appropriate for the task
5. Use non-reflective, dark-coloured surfaces
6. Use lights with reduced or filtered blue, violet and ultra-violet wavelengths.

8 IMPACT TRIGGERS AND DECISION-MAKING FRAMEWORK

This section identifies the circumstances that will result in notification, further investigation and additional mitigation for both threatened and non-threatened birds and bats ('impact triggers'). If an impact trigger is met, there must be an investigation into the cause of the impact, and whether the event was likely to be a one-off occurrence or occur regularly. The impact trigger may be an unacceptable impact in itself or may lead to an unacceptable impact.

Ultimately, the Proponent's environmental compliance lead will be responsible for implementation of this BBMP and the decision-making that goes with it, with technical support provided by the approved expert.

8.1 Migratory, threatened or specially protected species

8.1.1 Definition of impact trigger and unacceptable impact

Generally, an impact trigger is where there is evidence of death or injury to birds and/or bats by collision or other interaction with turbines. Under this BBMP, the circumstances that define an impact trigger and unacceptable impact for migratory, threatened or specially protected birds and bats are detailed below.

Impact triggers for and unacceptable impacts on migratory, threatened or specially protected species are defined as follows:

- Impact trigger
  - A single migratory, threatened or specially protected bird or bat individual (or recognisable parts thereof) listed under the Commonwealth EPBC Act or state BC Act, is found dead or injured under or close to a wind turbine during any carcass search survey or incidentally by site personnel.
- Unacceptable impact
  - Where migratory, threatened or specially protected bird or bat species population numbers are confirmed and reported by DCCEEW or DBCA for the period concerned, an unacceptable impact is any impact that is likely to reduce the total species' population by more than 0.1%; OR
  - Where population numbers are not confirmed, an unacceptable impact is more than three carcasses found of one migratory, threatened or specially protected bird or bat species over a successive two-month period (i.e. three or more individuals over a successive two-month survey period).

8.1.2 Adaptive management framework and reporting

If an impact trigger for migratory, threatened or specially protected species occurs, further investigation will immediately be triggered, and the decision-making framework outlined below will be followed (Figure 8).

Immediate reporting of the occurrence of an impact trigger by the ecologist to the environmental compliance lead, who will report it to the DBCA and/or DCCEEW within two business days of it being recorded. The Shire of Dandaragan will be kept informed of the correspondence between the Proponent and DBCA and / or DCCEEW. The relevant government department will depend on the species' conservation status under state and/or Commonwealth legislation:

- DBCA will be contacted regarding any species listed under the BC Act, via the regional office responsible for the Proposed Action, the Turquoise Coast office in Jurien Bay (jurien@dbca.wa.gov.au).
- DCCEEW will be contacted regarding any species listed under the EPBC Act, via the DCCEEW monitoring and audit area mailbox (epbcmonitoring@dcceew.gov.au).
- Immediate investigation (to be completed within 15 business days) by the ecologist to determine the cause of death or injury. If the cause of death is due to turbine collision, an investigation will be undertaken to identify any particular risk behaviours that could have led to the collision and an evaluation of the likelihood of further occurrences. The impact trigger may be one-off or cluster events.

- The rapid investigation over 15 business days will assess, if possible, the most effective mitigation and will ensure that the mitigation is implemented correctly and quickly. The investigation will aim to provide a clear understanding of the cause of the impact, where required, informed by on-site investigations of the occurrence of the species on the wind farm site.
- If the cause of the impact trigger is not clear, further on-site investigation of risk behaviours and evaluation of likely re-occurrence will be required. This follow-up investigation will be complete within six weeks of agreeing with DBCA/DCCEEW that the investigation is required, or another timeframe as agreed to with DBCA/DCCEEW. If these investigations suggest that the impact trigger was a one-off event or the ongoing risk is unlikely to be significant at a population scale, no further action would be necessary. This decision will be determined in consultation with DBCA/DCCEEW, based on available evidence.
- If the on-site investigation suggests that the impact trigger may be a regular occurrence, additional monitoring will be undertaken. During the additional monitoring period, periodic reports will be provided to the Proponent by the ecologist and further reported to DBCA/DCCEEW in agreed timeframes with DBCA/DCCEEW.
- Should the investigation process conclude meeting the impact trigger may be a regular occurrence and lead to an unacceptable impact to the species, responsive mitigation measures will be developed and as agreed with DBCA and/or DCCEEW. Examples of mitigation measures may include but are not limited to those outlined in Section 7 and 8.3.

Any evaluation of impacts and decisions regarding mitigation measures and further investigations required will be undertaken in consultation with DBCA/DCCEEW. Any required investigation, and recommended management and supplementary mitigation measures, will be documented in the site management log and detailed in annual reports as required by any project approvals. This site management log will be made available for inspection on request from DCCEEW, DBCA, or the Shire of Dandaragan.

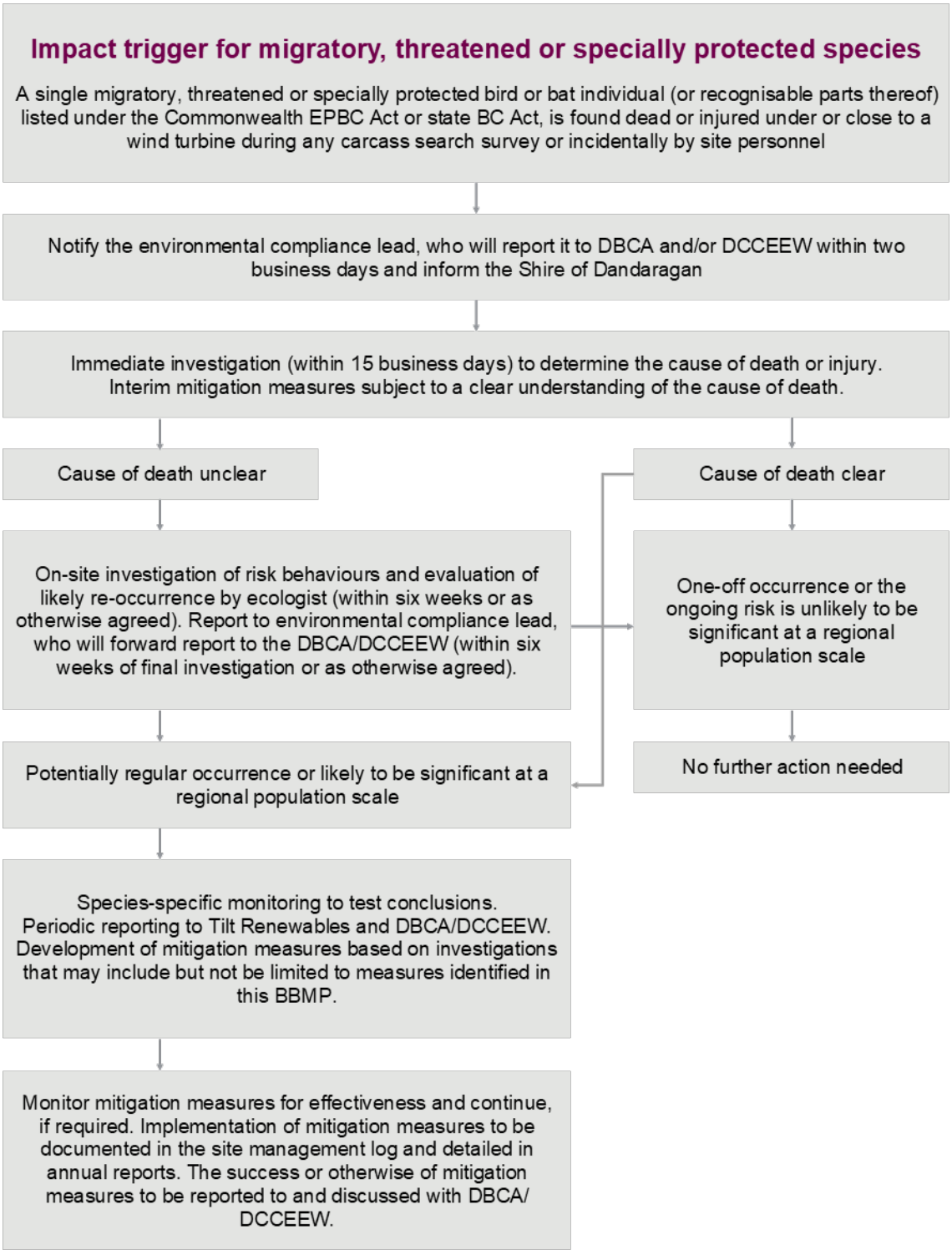


Figure 8: Adaptive management framework for identifying and mitigating impact triggers for migratory, threatened or specially protected species

8.2 DBCA-listed priority and non-threatened species

8.2.1 Definition of impact trigger and unacceptable impact

Under this BBMP, the circumstances that define an impact trigger and significant impact for DBCA-listed priority and non-threatened birds[7] and / or bats are detailed below.

Impact triggers for and unacceptable impacts on DBCA-listed priority and non-threatened species are defined as follows:

- Impact trigger
  - A total of ten or more bird or bat carcasses, or parts thereof, of the same species in two successive searches for the turbines monitored of a DBCA-listed priority or non-threatened species.
- Unacceptable impact
  - Where population numbers are known and reported by DBCA for the period concerned, an unacceptable impact is any impact that is likely to:
    - Lead to a greater than 50% reduction over a five-year period in the immediate population (i.e. local population, where known) that utilises the wind farm; AND
    - Act in an ongoing way to reduce the wider, regional population (where known) by more than 30% over a five-year period; OR
    - Reduce the total species' population (where known) by more than 10% over a five-year period.

8.2.2 Adaptive management framework and reporting

If an impact trigger for DBCA-listed priority and non-threatened species occurs, the decision-making framework outlined below will be followed (Figure 9):

- DBCA (Turquoise Coast office in Jurien Bay; jurien@dbca.wa.gov.au) and the Shire of Dandaragan will be notified of the impact trigger within ten business days of recording the event. An appropriate scale to consider population effects of the impact trigger will be agreed between DBCA and the Proponent on a case-by-case basis with consideration given to the species in question
- An evaluation of impacts to the DBCA-listed priority or non-threatened species will be undertaken
- A report on the investigation will be delivered to the relevant personnel at DBCA and the Shire of Dandaragan within three weeks.

If the evaluation indicates that the event was a one-off occurrence or is unlikely to be an unacceptable impact at a relevant population scale for the species in question, no further action will be necessary (Figure 9).

If the event is deemed to be a potentially regular occurrence or likely to lead to an unacceptable impact on the species in question, additional monitoring will be undertaken (Figure 9). If further monitoring confirms that impacts are likely to lead to an unacceptable impact on the species, mitigation measures will be required. Potential mitigation measures are outlined in Section 7, however specific mitigation measures will be determined based on the species involved and the outcome of investigations.

Any evaluation of impacts and decisions regarding mitigation measures and further investigations required will be undertaken in consultation with and agreement from DBCA. Any required investigation, and recommended management and supplementary mitigation measures, will be documented in the site management logs and detailed in annual reports. This site management log will be made available for inspection on request from DCCEEW, DBCA, or the Shire of Dandaragan.

[7] Two non-threatened bird species have been excluded from activating this impact trigger. This includes the galah and western corella (northern), as they are Declared Pests under the *Biosecurity and Agriculture Management Act 2007* (DPIRD 2024b).

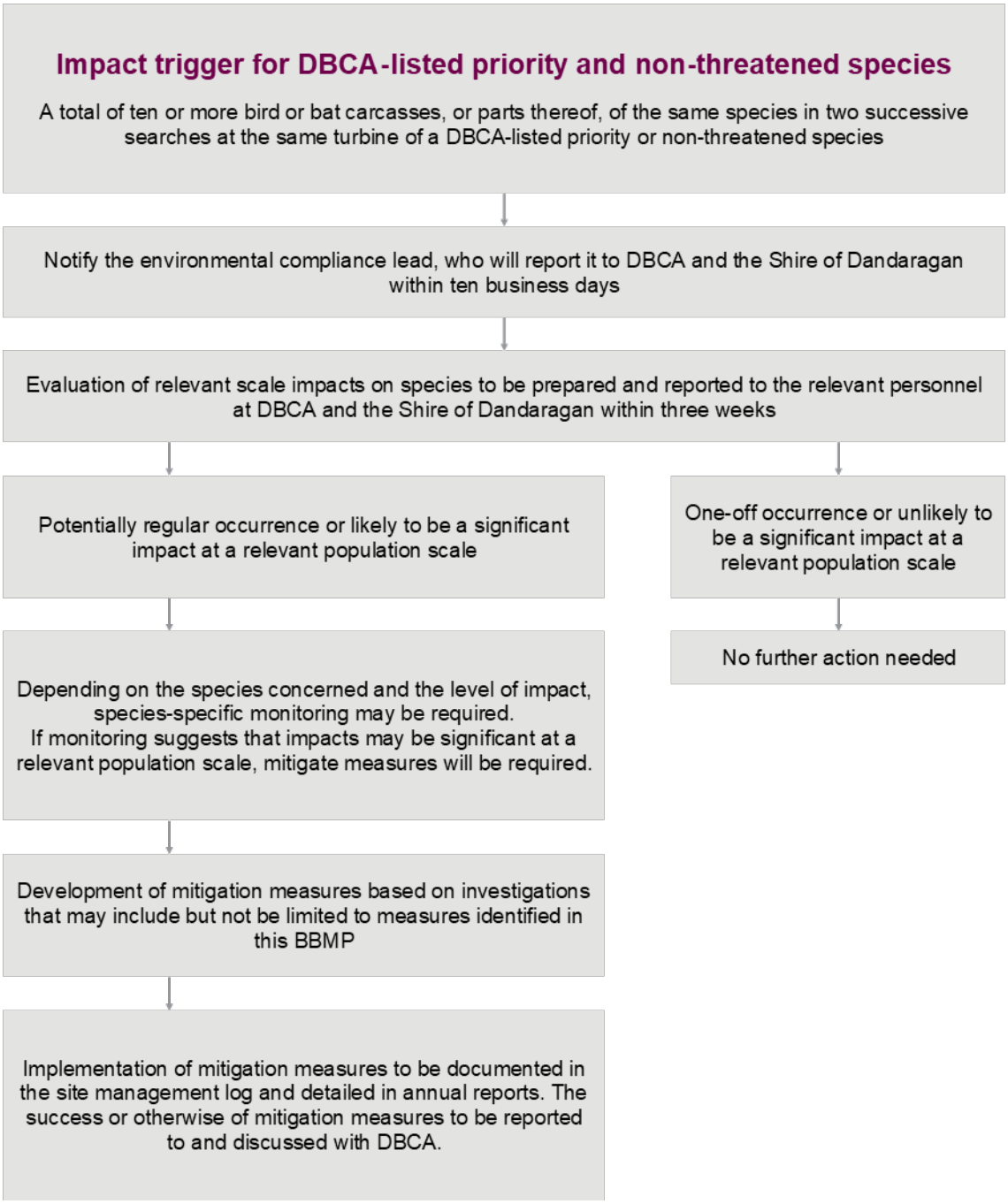


Figure 9: Adaptive management framework for identifying and mitigating impact triggers for DBCA-listed priority and non- threatened species

8.3 Supplementary mitigation measures

Supplementary mitigation measures will be implemented in consultation with DBCA and/or DCCEEW if an impact trigger occurs. The purpose of supplementary mitigation measures will be to prevent the impact from continuing to occur. Specific mitigation measures will be implemented depending on the nature, cause and significance of any impact recorded and in response to the results of investigations of the event and of the species concerned on the Project Area.

It is difficult at this stage to know what the cause of an unacceptable impact trigger will be, therefore possible examples of impacts and potential mitigation measures specific to the impact trigger, and the time taken to implement these measures, are detailed in Table 28. Note that in implementing mitigation measures, a suite of measures that may or may not include those in Table 28 would need to be implemented, depending on management response to particular circumstances.

Although it is unknown what supplementary mitigation measures may be required in response to a particular situation, some hypothetical examples are provided in Table 28. These are examples of potential issues not considered to-date but describe useful and tested responses from other wind farms in addressing the issues. Should these be implemented as a management response at the Proposed Action, the response of birds and bats to these measures will be recorded.

The purpose of investigations will be to identify clearly the most relevant, effective, and commercially viable mitigation measures.

Table 28: Supplementary mitigation measures in the event of an unacceptable impact trigger occurring

Hypothetical cause of impact	Mitigation measure[8]	Likelihood of impact continuing following mitigation	Time to implementation
Foraging source identified that attracts bird and bat species to impact areas	Consider the use of acoustics and/or ultrasonic deterrent devices to discourage birds from foraging in this location	Unlikely	Implement according to agreed plan
Wind / rain / fog causing low visibility	If low visibility at the Proposed Action is identified as an issue, carcass searches may be repeated during periods of low visibility to measure mortality rates	Rare	Immediately low visibility is identified as the cause of unacceptable impacts on migratory, threatened or specially protected species
	Prepare a testing and monitoring program for painting single blades of wind turbines and alternate colour (e.g. black) subject to turbine warranty specifics, regulatory approval conditions and energy generation efficiency	Unlikely	Implement according to agreed plan
Attraction to small dams within the Project Area	Provide alternative stock watering arrangements	Unlikely	Implement as soon as possible after recording the impact trigger if the dam is the cause of the problem

8.3.1 Shutdown procedures / curtailment

Altering wind turbine cut-in speeds and/or temporary shut-down of wind turbines (broadly defined as curtailment) will be considered by the Proponent as a last resort option should the implementation of other mitigation measures fail to reduce or remove the occurrence of impact triggers. A decision to implement curtailment will be based on specific scientific evidence and advice that it would be effective in meeting the objectives of the BBMP, including information relating to:

- Ongoing unacceptable impacts, including the level of risk to the species' regional and overall populations, where known
- The findings of detailed investigations undertaken in response to the impact trigger, focussing on the species' use of the immediate area around affected turbines
- Clear scope for on-going monitoring to identify triggers for turbine shutdown
- Agreed triggers for turbine shutdown and restart
- Reporting and consultation arrangements

[8] Note that the mitigation measures in Table 28 are examples of what may be possible. Ultimately, the chosen mitigation measure will be identified as part of the impact-trigger investigations shown in Figure 8 and Figure 9, and may not include any of these examples if they are not relevant.

- Any curtailment program would be prepared in consultation with DBCA and/or DCCEEW and will consider the potential effects to the ongoing economic viability of the Proposed Action from the proposed curtailment regime. Any curtailment proposal should be targeted to specific wind turbines and distinct time periods aimed at addressing the specific impact trigger under consideration.

8.3.2 Environmental offset requirements

An Offset Management Strategy is being prepared to counterbalance the loss of Carnaby's cockatoo foraging, potential breeding and potential roosting habitat attributable to the Proposed Action, that are not able to be otherwise avoided or mitigated onsite.

Offsetting impacts of migratory, threatened or specially protected species due to collision with turbines may be considered in consultation with DBCA and DCCEEW if the implementation of other mitigation measures are found to not adequately minimise or remove impacts, and no additional mitigations can be implemented to address residual impacts.

The types of measures considered includes, but is not limited to:

- The management or improvement of habitat of breeding sites away from the subject site to improve breeding productivity (e.g. installation of artificial nest boxes, revegetation programs)
- Funding a conservation measure (e.g. funding contributions to published recovery programs or breeding and/or monitoring programs)
- Funding and facilitation of research programs and projects with local universities.

Appropriate environmental offsets will be considered with DBCA and/or DCCEEW as part of any impact trigger incident investigation and as appropriate for the level and type of impact associated with the Proposed Action.

8.4 Specific management objectives, activities, timing, and performance criteria

Table 29 summarises specific management objectives, activities, timing, and performance criteria for the implementation of this BBMP. It can be used for monitoring and reporting on the implementation of this BBMP. Any non-conformance with the management objectives listed in Table 29 is likely to be reportable following state and Commonwealth approval of the Proposed Action, with any non-compliance requiring notification to DBCA/DCCEEW in line with regulatory approvals for the Proposed Action.

Table 29: Specific management objectives, activities, timing, and performance criteria

Management objectives	Management activities and controls	Timing	Performance criteria for measuring success of methods	Corrective action
Utilisation surveys	Obtaining operational phase bird site utilisation data	**Operational phase** • Multiple field campaigns over a two-year period to capture Carnaby's cockatoo major life stages **During the first two years of monitoring.**	Bird utilisation surveys for birds identified in the long-term impact risk assessment as at low risk from the Proposed Action (Table 17) will be undertaken for the Project Area, as detailed in Section 6.2.	If the operational phase bird site utilisation surveys are not commenced at practical completion of the Proposed Action, the surveys are to commence immediately once the oversight has been detected.
Mortality monitoring	Carcass search surveys undertaken monthly at nine turbines in accordance with the inner and outer carcass search zones. The same turbines will be searched each month for a period of two years, following which the need for further surveys will be reviewed based on the results of the first two years of monitoring.	**Commissioning and operational phase** • Monthly until end of the second year of operational mortality monitoring	• The field methods of the initial carcass search will be supervised and audited by the qualified ecologist to ensure that methods are being implemented correctly. The findings of the audit will be provided to the environmental compliance lead. • Commissioning and operational phase carcass search surveys undertaken monthly at nine turbines for at least two years, with a review after the first year of carcass persistence trials to determine if a change in the frequency is required.	• If the carcass search surveys are not being undertaken correctly, additional training will be provided to personnel undertaking these activities. • If the carcass search surveys are not commenced at the relevant milestone of the Proposed Action (i.e. commissioning or operation), the surveys are to commence immediately once the oversight has been detected.
	Carcass persistence trials and detectability trials The same turbine locations subject to carcass search surveys will be trialled, following which the need for further trials will be reviewed based on the results of the first year of monitoring.	**Operational phase** • Twice during the first year of mortality monitoring	Operational phase carcass persistence and detectability trials undertaken twice for at least one year, with a review of the requirement for additional carcass persistence and/or detectability trials and their frequency to determine if this would be necessary or appropriate.	If the operational phase carcass persistence and detectability trials are not commenced at practical completion of the Proposed Action, the trials are to commence immediately once the oversight has been detected.
	Calculating annual mortality of birds and bats per turbine based on operational phase repetition of monitoring activities. Mortality estimates should include correction factors from carcass persistence and detectability trials.	**Operational phase** • At the end of the second year of mortality monitoring	• Carcass persistence and detectability trials undertaken. • Estimates of mortality for birds and bats made after a full year of monitoring	If estimates of bird and bat mortality are not included in annual reports, they are to be included in an amended or updated report.
Annual reports	Preparation of annual reports to be submitted to the DBCA and DCCEEW for the first two years after the completion of the first year of monitoring.	**Operational phase** • After the first year of monitoring • After the second year of monitoring	• Annual reports for the first two years delivered within three months of completion of yearly monitoring. • Annual reports to include (but not be limited to): – Results of monitoring surveys for that year – Any impact triggers or unacceptable impacts identified – Mitigation measures implemented – Application of the decision-making framework – Recommendations for the following year. • Further annual reports upon agreement	If annual reports are not submitted to the DBCA and DCCEEW, they are to be prepared and submitted immediately once the oversight has been detected.
Mitigation measures to reduce risk	Carrion removal program Stock and kangaroo carcasses will be removed from areas of operational control (or land access is allowed in line with land agreements) monthly and disposed of.	Operational phase	• Carcasses removed • Activity recorded in site management log • Increase frequency of stock and kangaroo carcass removal and disposal if required	If the carrion removal program has not been undertaken based on an audit of the site management log, this is to be commenced immediately.
Supplementary mitigation measures to reduce risk	Habitat improvement or protection to encourage animals to use habitats away from turbines and transmission line	Operational phase	Protection of the proposed offset site situated in heath vegetation habitat.	If protection measures of the proposed offset site are not in place, this is to be commenced immediately.
	Implement an acoustics system targeted to turbines or segments of transmission line to discourage birds foraging close to an impact area. Particular technology and devices to be used will be made strictly through consultation with DBCA and / or DCCEEW with consideration of current technology.	Operational phase	• Installation of acoustics system • Monitor effectiveness of acoustic deterrents on bird mortality at the turbines or transmission line.	Alternative acoustic deterrents will be implemented.
	Minimising external lighting, if required. There are only low levels of lighting on within the Project Area during operation.	Operational phase	Bird and bat mortality at turbines adjacent to potential night-time light sources (i.e. operations and maintenance facility, on-site substation, Cataby substation, turbine external stair lighting) must not regularly exceed that of activity at turbines removed from the potential night-time light sources.	The type and duration of lighting will need to be reviewed, subject to security and occupational safety and health limitations.
	Remove permanent lights on the operations and maintenance facility and on-site substation to avoid light spillage and visibility from above where not necessary for health and safety requirements.	Operational phase		
	Baffle security lighting to avoid light spillage and visibility from above.	Operational phase		
	Install transmission line warning markers to allow for birds to visualise the transmission lines during flight. Installation may consider marker balls, flags, or rotating markers.	Operational phase	• Installation of transmission line warning markers • Monitor effectiveness of visual deterrents on bird mortality at the transmission line	More obvious transmission line marking will be implemented.

Management objectives	Management activities and controls	Timing	Performance criteria for measuring success of methods	Corrective action
	Painting turbine blades in line with a testing and monitoring program prepared in consultation with the DBCA and / or DCCEEW with consideration of current scientific literature. Painting turbine blades will occur on a subset of turbines to allow for comparison between painted and unpainted turbine blades and will be selected according to the impact triggers and visual impact. The feasibility of painting turbine blades will be subject to confirmation from the Proponent.	Operational phase	Analysis of results to determine effectiveness of painted turbine blades at managing impacts from collision or barotrauma to birds and bats.	Alternative visual deterrents will be implemented.
	Prepare an environmental offset in consultation with DBCA and / or DCCEEW.	Operational phase	Subject to development of an environmental offset (Section 8.3.1).	The effectiveness of the current environmental offsets will be reviewed, and additional offsets will be considered in consultation with DBCA and / or DCCEEW.
	Implement shutdown procedures / curtailment as a last resort option should the implementation of other mitigation measures fail to reduce or remove the occurrence of impact triggers. Any curtailment program would be prepared in consultation with DBCA and/or DCCEEW.	Operational phase	Subject to development of agreed triggers for shutdown and restart (Section 8.3.1).	The effectiveness of the current agreed triggers for shutdown and restart will be reviewed, and revised triggers will be considered in consultation with DBCA and/ or DCCEEW .

9 REPORTING AND REVIEW

9.1 Reporting

The reporting requirements of this BBMP are identified in Table 30, which align with the BBMP's reporting requirements to the DCCEEW set out in the request for additional information (DCCEEW 2023a). There are no reporting requirements associated with the Shire of Dandaragan development approval condition 20.

Table 30 will be updated to incorporate any reporting requirements from the Commonwealth and state environmental approvals once granted.

9.2 Audit and review

Within three months of the commencement of operations, the qualified ecologist will supervise the initial carcass search to ensure that field methods are being undertaken correctly and undertake an audit to ensure that methods are being implemented correctly. The findings of the audit will be provided to the environmental compliance lead.

This BBMP and its implementation will be reviewed following the first and second year of operation of the Proposed Action. Following this, the BBMP will be reviewed on an as needs basis during operation of the Proposed Action and prior to decommissioning. The review will consider the following:

- Efficacy of management practices and mitigation strategies in relation to level of risk to avifauna
- Complaints
- Incident reports
- Changes in organisational structure
- Changes in novel monitoring and mitigation strategies
- Changes in legislation and standards.

The findings from the first and second annual report and first and second annual review of the BBMP and their implications will be discussed with DBCA and DCCEEW. The discussion outcomes from the second review of the BBMP will determine any additional management requirements for future years across the operation of the Proposed Action.

Table 30: Reporting requirements

Report	Description	Timing	Performance criteria	Responsible person
Impact trigger reporting	• DBCA and / or DCCEEW and the Shire of Dandaragan will be notified within two business days when impact triggers are met for migratory, threatened or specially protected species (Section 8.1). • DBCA and the Shire of Dandaragan will be notified within ten business days when impact triggers are met for DBCA-listed priority species or non-threatened species (Section 8.2). • If further on-site investigations are undertaken, the findings will be submitted to DBCA and / or DCCEEW within six weeks of the final investigation (or otherwise agreed timeframe). • If additional monitoring is undertaken, the findings will be submitted to DBCA and / or DCCEEW periodically within agreed reporting timeframes.	If an impact trigger occurs in accordance with Section 8.	Impact trigger reporting completed in accordance with content and timing requirements in Section 8.	• Environmental compliance lead – impact trigger breach notification • Ecologist – preparation of impact trigger reporting
Annual reporting	• Annual reports are required each year for two years from the commencement of operation. • The first annual report will be submitted to the DCCEEW and DBCA following completion of the first year of carcass search surveys and bird surveys. The first annual report will include: – Results of commissioning and operational carcass search surveys and analysis – Results of operational bird surveys – Results of carrion removal program – Recommendations to refine monitoring activities, if required. – DCCEEW specifically require (2023a): ○ Annual turbine strike reports comprising raw strike data and strike notifications, survey methodologies, results of detectability and carcass persistence trials, environmental / meteorological conditions and associated statistical analysis. ○ Estimations of annual mortality rate for each relevant migratory, threatened or specially protected species, comprising supporting evidence from case studies of EPBC species carcass size classes, results of persistence trials, searcher efficiency trials and substitute carrion trials, and annual probability of detection and monthly strike monitoring. • The second annual report will be submitted to the DBCA and DCCEEW following completion of the second year of carcass search surveys and bird surveys. The second annual report will include: – A brief description of the management prescriptions implemented, and identification of any modifications made to the original management practices. – The survey methods (including list of observers, dates, and times of observations) – Results of operational bird surveys – Results of carrion removal program – Results of carcass search surveys and incidental carcass observations – Estimates of bird and bat mortality rates (avifauna impacted per turbine per year) based on statistical analysis. – Seasonal and annual variation in the number and composition of bird and bat strikes, where detectable – Any other mortality recorded on site but not during designated carcass searches (i.e. incidental records by site personnel) – Identification of any unacceptable impacts or impact triggers, and application of the decision-making framework and relevant adaptive management measures – A summary of livestock carcass removal for the purposes of predator reduction – Details of any landowner feral animal control programs and their timing – A discussion of the results, including ○ Whether indirect impacts on bird and bat use of the site are of significance at a regional, state or national level, or if species of concern have been affected. ○ Bird risk reduction measures ○ Any further recommendations for reducing mortality, if necessary ○ Whether the level of mortality was unacceptable for affected listed (‘at risk’) species of birds or bats ○ Usage of the wind farm area by ‘at risk’ species and factors influencing this (i.e., climatic, geographical and infrastructure) ○ Analysis of the effectiveness of the decision-making framework ○ Recommendations for further monitoring. – DCCEEW specifically require (2023a): ○ Annual turbine strike reports comprising raw strike data and strike notifications, survey methodologies, results of detectability and carcass persistence trials, environmental / meteorological conditions and associated statistical analysis. ○ Estimations of annual mortality rate for each relevant migratory, threatened or specially protected species, comprising supporting evidence from case studies of EPBC species carcass size classes, results of persistence trials, searcher efficiency trials and substitute carrion trials, and annual probability of detection and monthly strike monitoring.	Annually for two years.	Annual reports to be submitted to DBCA and DCCEEW within three months of completion of annual monitoring. Annual reports are to include all information listed in the Description column.	• Environmental compliance lead – submission of annual reports • Ecologist – preparation of annual reports
Species occurrence records for migratory or threatened species listed under the EPBC Act	• Species occurrence records will be submitted to DCCEEW at speciesmetadata@environment.gov.au, noting the EPBC Act Referral number. • Data will be prepared in accordance with the Guidelines for biological survey and mapped data (Department of the Environment and Energy 2018) using the species observation data template on the DCCEEW’s website (https://www.dcceew.gov.au/environment/environmental-information-data/information-policy/guidelines-for-biological-survey-mapped-data). • Sensitive ecological data must be identified and treated in accordance with the Sensitive Ecological Data – Access and Management Policy V1.0 (Department of the Environment 2016 or subsequent revision).	Annually for two years.	Species occurrence records to be submitted to DCCEEW within three months of completion of annual monitoring. Species occurrence records are to include all information listed in the Description column.	• Environmental compliance lead – submission of species occurrence records • Ecologist – preparation of species occurrence records

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