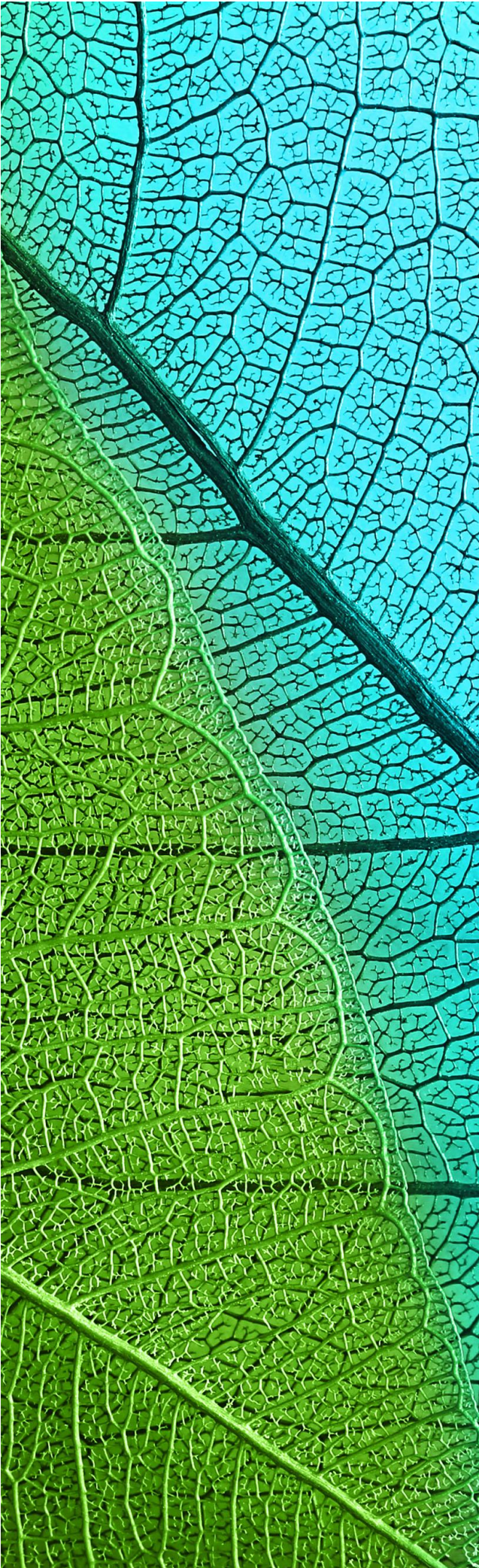




West Arthur Wind Farm

Bird and Bat Adaptive Management Plan

**Prepared for
NGH Brisbane**

September 2026
Report No. 25069.02 (1.3)



**Nature
Advisory**

5/61-63 Camberwell Road
Hawthorn East, VIC 3123
PO Box 337, Camberwell VIC 3124
(03) 9815 2111
www.natureadvisory.com.au

Nature Advisory acknowledges the traditional owners and sovereign custodians of the land on which we work. We extend our respect to their Ancestors and all First Peoples and Elders, past and present.

Document History and Status

The following table outlines the revisions made to this document

Version	Date of Issue	Description	Issued By	Reviewed by	Approved by
V 1.0	17/03/2026	First draft to client	Dr Kate Callister	Dan Delany	Dr Inga Kulik
V 1.1	01/05/2026	Second draft to client to update to recommended format	Dr Kate Callister	Elinor Ebsworth & Robin Leppitt	Dr Kate Callister
V 1.2	02/07/2026	Third draft following Lacour feedback	Dr Kate Callister	Dan Delany & Dr Danielle Estwick	Dr Kate Callister
V1.3	05/08/2026	Fourth draft following turbine layout update	Dr Kate Callister	Dan Delany	Dr Kate Callister

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Glossary of terms

AGL	Above ground level (m)
BACI	Before-After-Control-Impact
BBAMP	Bird and bat adaptive management plan
BC Act	(Western Australia) <i>Biodiversity Conservation Act 2016</i>
BBUS	Bird and bat utilisation survey
BUS	Bird utilisation survey
Commissioning	All activities, including turning of turbines, after the components of the wind turbines are installed.
Cwth	Commonwealth
DAWE	(Cwth) former Department of Agriculture, Water and the Environment
DCCEEW	(Cwth) Department of Climate Change, Energy, the Environment and Water
DBCA	(Western Australia) Department of Biodiversity, Conservation and Attractions
DSEWPac	(Cwth) former Department of Sustainability, Environment, Water, Populations and Communities
EPBC Act	(Cwth) <i>Environment Protection and Biodiversity Conservation Act 1999</i>
Full operation	Once all wind turbines have been commissioned and are able to operate simultaneously.
Listed species	Any bird/bat species listed as threatened or migratory under the EPBC Act or listed as threatened under the BC Act.
Non-listed species	Any bird/bat species not listed as threatened or migratory under the EPBC Act and not listed as threatened under the BC Act. While not listed, all fauna defined as a native animal species are protected under Part 10 of the BC Act.
RSA	Rotor swept area. RSA height is considered 59 to 252 m above ground level. A conservative RSA of 40 to 280 m has been used for bat and avifauna risk assessments.
Study area	Development envelope containing all wind turbine generators proposed for the West Arthur Wind Farm.
Suitably qualified bird and bat ecologist	A person who has relevant professional qualifications, at least three years of work experience undertaking bird and bat utilisation surveys in Australia and can give an authoritative assessment and advice on bird and bat utilisation surveys using relevant protocols, standards, methods and/or literature.
Suitably qualified ecologist	A person who has relevant professional qualifications, at least three years of work experience preparing and implementing management plans for the conservation of and habitat improvement for the MNES relevant to the management plan which they are preparing and can give an authoritative assessment and advice on the habitat requirements of that/those MNES using relevant protocols, standards, methods and/or literature.

WAWF	West Arthur Wind Farm
WTGs	Wind turbine generators

1. Introduction

1.1. Background, project description and location

NGH Brisbane engaged Nature Advisory Pty Ltd to develop a bird and bat adaptive management plan (BBAMP) for the West Arthur Wind Farm (WAWF). The proposed WAWF is located directly south of Darkan in Western Australia, approximately 80 km east of Bunbury, and encompasses approximately 14,000 ha of land. The proponent is proposing to develop a wind farm with up to 92 wind turbine generators (WTGs) (Figure 1; Table 1). The BBAMP will accompany the approval applications to outline proposed measures to mitigate the identified risks of construction and operation of the proposed wind farm, with a focus on collision of birds and bats with WTGs.

Table 1: Specifications for the proposed WTGs at the WAWF

Number of turbines	92
Maximum hub height (m)	164
Maximum blade length (m)	92
Rotor swept area (RSA) minimum height (m)	59
RSA maximum height (m)	253

This BBAMP aims to achieve the following:

- Assessing the potential impacts from the WAWF on threatened and migratory bird and bat species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and/or the Western Australian *Biodiversity Conservation Act 2016* (BC Act)
- Minimising the risk of turbine collision to bird and bat species in the study area
- Improving understanding of changes in behaviour (if any) of birds and bats due to wind farm construction and operation
- An effective and efficient monitoring program for the detection of carcasses from turbine collisions including the collection and analysis of mortality data
- Adopting an adaptive management approach to the reduction of impacts from the WAWF by providing a pathway for updating management actions in response to mortality data
- Developing and implementing effective mitigation measures to reduce the risk of turbine collisions to birds and bats, when required

1.2. Regulatory Framework

This BBAMP has been prepared in accordance with the draft Onshore Wind Farm Guidance Best practice approaches when seeking approval under Australia's national environment law (DCCEEW 2024) to support approval applications under the:

- Environmental Protection Act 1986 (EP Act)
- Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).
- Planning and Development Act 2005 (PD Act).

The draft Renewable Energy Planning Code and associated guidance from the Western Australian Planning Commission (2025) was also considered in the formulation of this BBAMP.

The BBAMP has been informed by desktop and field surveys performed in accordance with federal departmental, state government and other widely accepted expert provided survey guidelines including:

- Survey guidelines for Australia's threatened birds (DoE 2010a)
- Survey guidelines for Australia's threatened bats (DoE 2010b)
- Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020)
- Referral guideline for 3 WA threatened black cockatoo species (DAWE 2022b)
- Wind Farms and Birds: Interim Standards For Risk Assessment (Australian Wind Energy Association 2005)

Species Profile and Threats (SPRAT) database, Protected Matters Search Tool and relevant, verifiable departmental documents including conservation advice, recovery plans, threat abatement plans, published research and other relevant EPBC Act policy statement and guidelines have also been considered in the development of this BBAMP.

1.3. BBAMP structure

This BBAMP details the objectives and strategies required and is divided into the following sections:

Section 2 details the pre-construction baseline monitoring undertaken to date.

Section 3 includes a bird and bat risk assessment and documents species of concern determined from the pre-construction monitoring and desktop searches.

Section 4 details the preventive management measures to reduce bird and bat impacts.

Section 5 details the operational phase bird and bat monitoring and the carcass search program.

Section 6 defines impact triggers and procedures for listed and non-listed fauna, mitigation, compensatory measures, and the adaptive decision-making framework for these triggers.

Section 7 provides species-specific management strategies for target species.

Section 8 describes the reporting and review process.

This BBAMP will be further informed by and updated throughout the WAWF approval process and the results of pre- and post-construction ecological surveys.

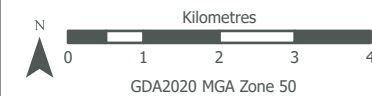
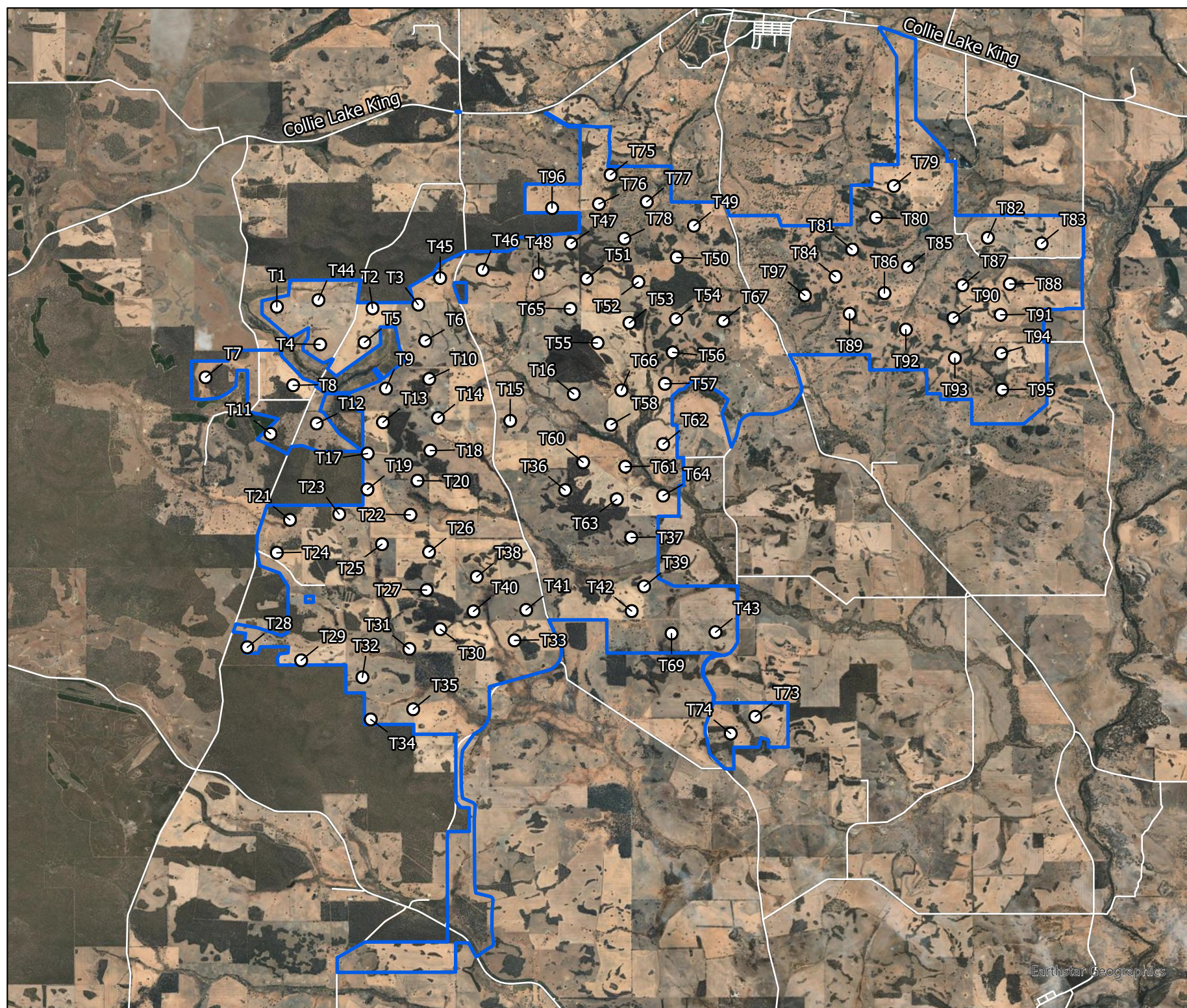
1.4. Qualifications and Experience

This plan was prepared in line with the *Environmental Management Plan Guidelines* (DCCEEW 2024a) and the *Commonwealth Onshore Wind Farm Guidance* (DAWE 2022a and DCCEEW 2024b) by a team of suitably qualified ecologists from Nature Advisory comprising Dr Danielle Eastick (Senior Zoologist), Guille Mayor (Senior Ecologist), Dan Delany (Senior Zoologist), Dr Robin Leppitt (Senior Ornithologist), Dr Kate Callister (Senior Ecologist & Project Manager) and Dr Inga Kulik (Director).

Figure 1. Study area with proposed wind farm footprint and turbine locations

Project No: 25069.01
Project: West Arthur wind farm, WA
Date: 8/6/2026

-  Study area
-  Turbine



PO Box 337, Camberwell, VIC 3124, Australia
www.natureadvisory.com.au
03 9815 2111 - info@natureadvisory.com.au

Earthstar Geographics

2. Baseline pre-construction monitoring

Six seasonal baseline (pre-construction) bird and bat utilisation surveys (BBUSs) have been undertaken at WAWF to date.

The dates of each pre-construction survey are presented in Table 2. Two more seasonal BBUSs are planned for 2026.

Table 2: Baseline (pre-construction) surveys conducted at the WAWF

Survey – field assessments	Date
Birds	
Bird Utilisation Surveys – Nature Advisory (Nature Advisory 2026b)	- Autumn 2025: 28–31 May - Winter 2025: 28 July to 2 August - Spring 2025: 1-5 October - Summer 2025: 8-12 December - Autumn 2026: 9-13 March - Winter 2026: 15-19 June - Spring 2026: planned - Summer 2026: planned
Black cockatoo (Carnaby's, Baudin's, Forest Red-tailed) targeted surveys for nesting, foraging, and roosting habitat.	Spring (August-October) 2025 undertaken by SW Environmental (2026).
Bats	
Bat Utilisation Surveys – Nature Advisory (Nature Advisory 2026a)	- Autumn 2025: 27 May to 1 June - Winter 2025: 28 July to 2 August - Spring 2025: 1–8 October - Summer 2025: 8–19 December - Autumn 2026: 11-23 March (bat call data pending) - Winter 2026: 15-19 June (bat call data pending) - Spring 2026: planned - Summer 2026: planned

2.1. Site description

The study area is situated near the township of Darkan, in the Shire of West Arthur, within the eastern extent of the Jarrah Forest Bioregion in south-west Western Australia. This region represents a transitional landscape between intact forested uplands to the west and cleared, intensively farmed agricultural zones to the east. Despite extensive clearing, the landscape retains a mosaic of habitat types important to both birds and bats, and contributes to regional-scale movement and dispersal corridors. The combination of vegetation remnants, topographic variation, water availability, and connectivity with broader movement corridors shapes the ecological value of the site. Remnant vegetation includes scattered patches of native woodland, remnant roadside vegetation and riparian corridors. These features provide habitat for a diverse range of birds and bats.

The site sits within the Jarrah Forest Black Cockatoo Referral Guideline Region (DAWE 2022b), which supports important breeding habitat for all three black cockatoo species and represents the main breeding habitat for Baudin's Cockatoo and Forest Red-tailed Black Cockatoo (DAWE 2022b).

Importantly, the site is located just east of the Collie–Wellington–Preston Forest Corridor, a recognised ecological linkage across south-western Western Australia (Norman & Mackey 2024). Although the surrounding landscape is fragmented, the project area may still function as a seasonal movement route, particularly for wide-ranging species such as Carnaby's Cockatoo, which migrate between forest blocks and foraging grounds in the western wheatbelt (Rycken et al. 2023).

Key ecological linkages within the site include:

- **Remnant woodland patches** of Marri (*Corymbia calophylla*), Jarrah (*Eucalyptus marginata*), Wandoo (*E. wandoo*), and Jam Acacia (*Acacia acuminata*), which provide foraging habitat and hollow-bearing trees for birds and microbats;
- **Riparian corridors** along the Arthur River and tributaries, supporting mesophilic vegetation suitable for insectivorous bats and woodland birds;
- **Wetlands and farm dams**, which offer localised water and foraging resources for waterbirds and bats, particularly where fringed by native vegetation;
- **Scattered paddock trees and shelterbelts**, which act as stepping stones for mobile species, aiding bat navigation and bird movement across open farmland; and
- **Roadside and fenceline remnant vegetation**, providing continuous linear habitat through the cleared matrix and facilitating fauna dispersal between woodland patches.

During the field assessment, a rudimentary assessment of the major habitat types present within the study area was conducted. Four primary habitat categories were identified:

- **Ridgeline Pasture** – The dominant habitat type within the study area, occurring extensively across the elevated components of the gently undulating landscape, particularly on ridgelines and upper slopes. These open paddocks are primarily dominated by exotic grasses and annual crops such as canola, with minimal vegetation structure complexity. Their exposed nature offers broad sightlines for aerial foragers such as swallows and woodswallows and provides ideal conditions for detecting soaring raptors such as Wedge-tailed Eagles and Nankeen Kestrels. Although habitat complexity is low, these areas contribute to the landscape matrix and influence bird movement patterns.
- **Scattered Paddock Trees** – Farmland is interspersed with isolated mature trees, particularly marri and wandoo. These scattered trees can provide limited foraging resources or perching sites for birds and occasional roosts for bat species. Although degraded, these areas may still be used by wide-ranging threatened species such as Carnaby's Cockatoo during seasonal movements.
- **Woodland Edge** – Transition zones bordering remnant Marri, Jarrah or mixed eucalypt woodland. These areas offer the highest habitat value for birds and bats, supporting woodland specialists, hollow-dependent fauna, and providing key foraging resources for threatened species such as Carnaby's and Baudin's Cockatoos.
- **Roadside Vegetation** – Narrow corridors of native shrubs and trees along roadsides and fencelines. Despite their linear nature, these habitats contribute significantly to movement and dispersal for small woodland birds and edge-adapted bat species. Their continuity enhances habitat connectivity across fragmented agricultural landscapes and may serve as travel routes for mobile threatened species moving between foraging areas.

2.2. Bird utilisation surveys (BUS)

2.2.1. Methods

BUSs during pre-construction used a method to provide a baseline of bird species and activity (Nature Advisory 2026b) against which the impact on birds from the project can be ascertained after operations commence using a Before-After-Control-Impact (BACI) monitoring framework. The aim of the pre-construction BUS was to identify bird species that may be at risk of impacts from the WAWF using data on their abundance and behaviour at the site, with particular consideration of birds listed under the EPBC Act and the BC Act.

Nature Advisory undertook four seasonal surveys in 2025 and two surveys in 2026 to date. The remaining two seasonal surveys will be completed in 2026. During each season, a total of 12 BUS points, split between impact and reference locations were visited twice in each of the following time periods:

- Early morning – between first light and 10:30 am
- Late morning – between 10:30 am and 12:30 pm
- Early afternoon – between 12:30 pm and 3 pm
- Late afternoon – between 3 pm and dusk

This generally resulted in eight replicates at each point per survey period, though the occasional replicate was missed, usually due to a temporary lack of access due to weather. Observers reduced sampling bias by rotating between vantage points so that vantage points were surveyed on different days. During each survey all birds observed (heard or seen) were recorded with observational notes to assist with BACI and risk assessment (e.g., height, distance, observation (visual/aural)). Points were located evenly across the site and in representative habitats where turbines and infrastructure will be located (Figure 2).

2.2.2. Results

A total of 107 bird species were recorded over the five surveys. The bird species included:

- Three listed species: the threatened Carnaby's Cockatoo and Forest Red-tailed Black-Cockatoo, and the Peregrine Falcon (Other Specially Protected).
- Six diurnal raptor species (including Peregrine Falcon).

Observations of bird flight height showed 98.34% of all recorded flights were below the RSA height (between 59 to 252 m above ground level), with 1.58% at RSA height and 0.08% above RSA height. Species most frequently observed at RSA height were Tree Martin (102 flights), Wedge-tailed Eagle (53 flights), Australian Raven (12 flights), Elegant Parrot (11 flights) and Dusky Woodswallow (10 flights).

Carnaby's Cockatoo and Forest Red-tailed Black-Cockatoo were recorded flying below RSA height during all observations. A total of eight Carnaby's Cockatoos has been observed (heard/seen) across four observations at B10. Forest Red-tailed Black-Cockatoo had a total of 113 observations, with the majority observed at R02 (90) and smaller numbers observed at B07, B08, B10 and R01.

Peregrine Falcon had a total of eleven observations often in pairs or singles, across B03, B04, B05, B06, B09, B10 and R01. One of the flights observed was within RSA.

Wedge-tailed Eagle, the most abundant raptor species, was observed 78 times during fixed point surveys, and was seen across all seasons and at every survey site. Wedge-tailed Eagles were observed at RSA height during 53 of the 78 observations, highlighting the risk of turbine collision.

Other raptors, comprising Black-shouldered Kite, Brown Falcon, Brown Goshawk, and Nankeen Kestrel were also recorded, although in smaller numbers than Wedge-tailed Eagle.

2.3. Microbat surveys

2.3.1. Methods

Microbat surveys completed to date comprise four seasonal ground-level surveys completed in 2025 (Nature Advisory 2026a) and two in 2026. An additional two seasonal surveys are planned for 2026. The aim of the ground-level microbat surveys was to identify microbat assemblages (laryngeal-echolocating, insectivorous free-ranging bats) and activity of foraging guilds within the study area. Foraging guilds explain a species' utilisation of the environment and are an effective way of grouping bats when assessing risk in relation to wind farm projects due to the proportion of flight heights of each foraging guild that are likely to be above the canopy at RSA heights (Arnett et al. 2016; Roemer et al. 2017, 2019).

During the surveys, ultrasonic bat detectors (SM Mini Bat 1 & SM Mini Bat 2, Wildlife Acoustics) were placed at up to 16 sites per season to capture echolocation calls produced by microbats. Bat detectors were deployed in a range of representative habitats across the study area. During each survey season, detectors were deployed for 5–13 consecutive nights.

Bat calls were analysed using Anabat Insight (Titley-Scientific, Brendale, QLD) in several stages. Initially, calls were sorted using a custom decision tree to group similar calls based on call parameters and provide an initial 'identification'. These calls were then manually checked to confirm presence/absence of species at each site. Not every call was assigned a species identification, as files were only analysed to detect species presence at each site. Call identification was assigned using a combination of published keys and online resources (Armstrong et al. 2021a; Pennay et al. 2004; Reinhold et al. 2001; Thomson et al. 2024) and/or collected reference calls. As this analysis assessed species presence-only, foraging guilds were assigned predominantly based on the characteristic frequency (kHz) of echolocation calls using an automated search filter. Therefore, a proportion of noise or misidentified calls likely remain and consequently results are indicative only.

The results presented below reflect data from the first four surveys, as 2026 data was not yet analysed.

2.3.2. Results

A total of 104,686 microbat calls were recorded across the study area during the first four survey periods in 2025, with the most activity recorded in the edge-space foraging guild. This group consists of bats which tend to forage along the edges of wooded habitat; however some species do venture into open areas as well. Species within the open-space and clutter-adapted foraging guilds were also detected across the entire study area.

The microbat utilisation survey identified six species and one multi-species complex. Of the species identified, four are common and widespread in farmland and woodland habitats throughout south-western and southern Australia, and two species, the Western False Pipistrelle and South-western Free-tailed Bat, have a more restricted range within southern Western Australia. Two species possibly identified within the long-eared bat (*Nyctophilus* spp.) multi-species complex, the Greater Long-eared Bat and Holt's Long-eared Bat, also have restricted distribution to south-west Western Australia.

One species that was recorded in the study area is recognised as Priority Fauna by DBCA:

- Western False Pipistrelle – Priority 4 (definitely recorded)

No microbat species listed as threatened under the EPBC Act have been recorded at the study area and no EPBC Act listed bat species are likely to occur based on desktop searches completed (Section 3.1.2)

The bat species of concern for the study area are discussed further in Section 3.3.2.

Figure 2. BUS and bat detector survey sites at West Arthur Wind Farm

Project No: 25069.01
Project: West Arthur wind farm, WA
Date: 8/6/2026

- Study area
- BUS points
- Bat survey point
- Turbine



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www.natureadvisory.com.au
 03 9815 2111 - info@natureadvisory.com.au

Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community

3. Bird and Bat Risk Assessment

The purpose of a bird and bat risk assessment is to evaluate a wind farm site for the likelihood of occurrence and potential impacts to bird and bat species. The risk assessment considers the following impact paths:

Direct impact

- Direct collision of birds and bats with operating wind turbine blades or towers at Rotor Swept Area (RSA) height

Indirect impact

- Disturbance effects that exclude birds and bats from the area, including noise during construction and operation
- Barrier effects that limit bird and bat movements between essential resources, such as foraging and roosting areas

In addition to the above threats, a direct loss of habitat from wind farm construction is possible. This impact pathway has been excluded from analysis here as this will be assessed along with non-avifauna species.

An *Overview and Risk Assessment* (Nature Advisory 2026c) was completed by Nature Advisory in July 2025 for WAWF. The risk assessment component of that report has been updated, summarised and presented herein.

3.1. Likelihood of occurrence

3.1.1. Methods

The likelihood of occurrence refers to the probability of the species using or passing through the proposed wind farm footprint. Based on the desktop review of available resources and databases, the following criteria were used to define each species' likelihood of occurrence:

- *Known* – species recorded within the study area during surveys or from desktop sources;
- *Likely* – species not recorded within the study area during surveys or from desktop sources, although numerous individuals have been recorded within the search region and suitable habitat is present within the study area;
- *Potential* – species not recorded within the study area during surveys or from desktop sources, and few records occur within the search region; however, suitable habitat is present within the study area; and
- *Unlikely* – marginal or no suitable habitat is present within the study area.

Existing bird and bat records, including information on the potential occurrence of listed threatened, migratory, and marine species, were compiled through a desktop review of publicly available databases. The search area was defined as the proposed wind farm site with a 10 km buffer applied to capture broader habitat use and regional species movements. This approach supports a precautionary assessment of potential species presence and guides the design of subsequent field surveys and impact assessments. The following databases were searched for relevant records:

- Department of Biodiversity, Conservation and Attractions Dandjoo biodiversity data (DBCA 2025a);
- Department of Biodiversity, Conservation and Attractions Threatened species database search: Threatened, Specially Protected, and priority fauna (DBCA 2025b);

- EPBC Act Protected Matters Search Tool (PMST) (DCCEEW 2025);
- eBird (2025) database; and
- Atlas of Living Australia (2025).

Records from the above databases were combined with data collected from Nature Advisory surveys to date (Section 2) to determine the likelihood of species occurrence within the study area. This included an analysis of the availability of suitable habitat within the study area for each species assessed, based on the general habitat assessment described in Section 2.1.

3.1.2. Results

Birds

A total of 19 bird species listed under the EPBC Act, BC Act and/or Priority listed by the DBCA were identified through desktop assessment as having potential to occur in, or fly over, the study area. These include two endangered black-cockatoos, one vulnerable black-cockatoo species and several migratory shorebirds and raptors.

Most migratory waders and riparian species are considered unlikely to occur due to the absence of suitable wetland, tidal, or shoreline habitat within the project area. In contrast, wide-ranging species such as Carnaby's and Baudin's Cockatoos and the Peregrine Falcon are more likely to use the site periodically due to the presence of scattered woodland, roadside vegetation, and suitable foraging and flight paths.

A summary of the conservation status and likelihood of occurrence for each species is provided in Table 3.

Table 3: Likelihood of occurrence for listed bird species

Common name	Scientific name	EPBC Act	WA BC Act / DBCA Priority List	Occurrence analysis	Source	Nearest record from Study area
Baudin's Cockatoo	<i>Zanda baudinii</i>	En	En	Likely to occur	DBCA	<1 km, 2017
Blue-billed Duck	<i>Oxyura australis</i>	-	P4	Potential to occur	DBCA	~ 11 km, 2015
Carnaby's Cockatoo	<i>Zanda latirostris</i>	En	En	Known to occur	Study area survey	
Common Sandpiper	<i>Actitis hypoleucos</i>	Mig.	Mig.	Potential to occur	DBCA	<1 km, 2000
Curlew Sandpiper	<i>Calidris ferruginea</i>	Cr, Mig.	Cr, Mig.	Potential to occur	DBCA	~12 km, 2000
Fork-tailed Swift	<i>Apus pacificus</i>	Mig.	Mig.	Likely to occur	PMST	> 10 km
Forest Red-tailed Black-Cockatoo	<i>Calyptorhynchus banksia naso</i>	Vu	Vu	Known to occur	Study area survey	
Grey Falcon	<i>Falco hypoleucos</i>	Vu	Vu	Potential to occur	PMST	> 10 km

Common name	Scientific name	EPBC Act	WA BC Act / DBCA Priority List	Occurrence analysis	Source	Nearest record from Study area
Grey Plover	<i>Pluvialis squatarola</i>	Vu, Mig.	Mig.	Unlikely to occur	PMST	> 10 km
Grey Wagtail	<i>Motacilla cinerea</i>	Mig.	Mig.	Unlikely to occur	PMST	> 10 km
Little-winged Kite	<i>Elanus scriptus</i>	-	P4	Unlikely to occur	DBCA	~ 8 km, 1981
Malleefowl	<i>Leipoa ocellata</i>	Vu	Vu	Unlikely to occur	PMST	> 10 km
Marsh Sandpiper	<i>Tringa stagnatilis</i>	Mig.	Mig.	Potential to occur	DBCA	~12 km, 2010
Masked Owl (southwest)	<i>Tyto novaehollandiae novaehollandiae</i>	-	P3	Unlikely to occur	eBird mapping	> 10 km
Pectoral Sandpiper	<i>Calidris (Erolia) melantos</i>	Mig.	Mig.	Unlikely to occur	PMST	> 10 km
Peregrine Falcon	<i>Falco peregrinus</i>	-	OS	Known to occur	Study area survey	
Red-necked Stint	<i>Calidris ruficollis</i>	Mig.	Mig.	Likely to occur	DBCA	< 1 km, 1999
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	Vu, Mig.	Mig.	Potential to occur	DBCA	< 1 km, 1999
Western Rosella (inland)	<i>Platycercus icterotis xanthogenys</i>	-	P4	Potential to occur	DBCA	~ 4 km, 1987
Wood Sandpiper	<i>Tringa glareola</i>	Mig.	Mig.	Potential to occur	DBCA	~12 km, 2000

EPBC Act threatened or migratory species status under EPBC Act (Cr = Critically Endangered; En = Endangered; Vu = Vulnerable; Mig. = Migratory)

BC Act threatened species status (Cr = Critically Endangered; En = Endangered; Vu = Vulnerable, OS = Other Specially protected species)

DBCA Priority listing (P3 = Priority 3 - Poorly known, few records, P4 = Priority 4 - Rare or near-threatened).

Bats

Desktop analysis identified at least nine insectivorous bat species with potential to occur within or adjacent to the proposed wind farm site. These species are typically associated with woodland, riparian zones and open agricultural areas common in the region.

One species is recognised as Priority Fauna by the DBCA:

▪ *Falsistrellus mackenziei* (Western False Pipistrelle) – Priority 4

The presence of remnant vegetation, scattered paddock trees, and water sources (e.g. creeks, tributaries, farm dams) within the landscape provides potentially suitable roosting and foraging habitat. A summary of listed bat species is included in Table 4. No bat species identified are listed under the EPBC Act,

Table 4: Likelihood of occurrence for listed bat species

Common name	Scientific name	EPBC Act	WA BC Act / DBCA Priority List	Occurrence analysis	Source	Nearest record from Study area
Western False Pipistrelle	<i>Falsistrellus mackenziei</i>	-	P4	Known to occur	Study area survey	

DBCA Priority listing (P4 = Priority 4 - Rare or near-threatened).

3.2. Bird and Bat Risk Assessment

3.2.1. Methods

The risk assessment methodology is consistent with the requirements for “Level One” investigations in the *Wind Farms and Birds - Interim Standards for Risk Assessment* issued by the Australian Wind Energy Association (2005). This methodology is based on the Risk Evaluation Matrix Model, which complies with the AS ISO 31000:2018 *Risk Management Guidelines* (ISO 2018). This model is currently used across a wide range of industry sectors, in particular for assessing environmental risk.

The model is used to measure the risk of an event, in this case, fauna striking wind turbine blades and wind turbine towers (direct impact) or being deterred from using part of the study area due to disturbance or barrier effects (indirect impact). The risk assessment is based on the likelihood of an event occurring, and should it occur, its consequences.

The Risk Evaluation Matrix Model risk assessment is designed to continue to be reviewed and updated following future surveys and reporting, as well as following the completion of each annual monitoring report during the operational phase of the project, to ensure that the monitoring and mitigation measures are adaptive.

Only listed species that are known to occur, considered likely to occur, or have the potential to occur, are considered in the risk assessment. For non-listed species, only species known to occur and taxa considered at-risk from collision and potentially impacted by a wind farm development are included, primarily diurnal raptors and microbats known to occur.

The assessment required criteria to be developed for likelihood and consequence. These criteria are provided respectively in Table 5 and Table 6. In the absence of collision risk modelling for individual species in the study area, a conservative approach has been taken in determining the likelihood and consequence of an impact.

The consequence criteria in Table 6 determines the ecological significance of a population. For the purposes of this assessment, a significant proportion of the population is considered to be 0.1%. A combination of conservation advice, Species Profile and Threat Database (DCCEEW 2025b) and the Action Plan for Australian Birds 2020 (Garnett and Baker 2021) provides national population estimates.

Table 7 shows the risk rating matrix applied for the risk assessment.

The relevant likelihood and consequence criteria were applied to each species/group of species of concern based on the available information on the population and distributions.

Table 5: Likelihood criteria for impact occurring

Likelihood	Across a 12-month period	
	Description	Approximate probability (%)
Very rare	Very improbable that impact could occur.	<5
Less likely	Less probable than more probable that impact could occur.	5 to < 50
Possible	Equally probable that impact could or could not occur.	50
Likely	More probable than not that impact could occur.	>50 to 95
Almost certain	Very probable that impact could occur.	>95

Table 6: Consequence criteria for populations

Predicted to seriously disrupt an ecologically significant proportion of:		Consequence
Total population annually	Population in the study area and surrounds	
No	None	Negligible
No	Short-term	Low
No	Medium-term	Moderate
Yes	Medium-term	High
Yes	Long-term	Severe

Table 7: Risk ratings

		Consequence				
		Negligible	Low	Moderate	High	Severe
Likelihood	Very rare	Very low	Very low	Very low	Low	Low
	Less likely	Very low	Very low	Low	Medium	High
	Possible	Very low	Low	Medium	High	High
	Likely	Very low	Low	Medium	High	Very high
	Almost certain	Very low	Low	High	Very high	Very high

3.2.2. Results

Birds

This assessment reviewed the potential ecological risks posed by the proposed wind farm development to bird species of conservation significance, with a primary focus on species listed under the EPBC Act and the BC Act. A total of 14 bird species listed under these Acts were identified as having some likelihood of occurrence within the study area (i.e. known, likely, or potential to occur).

As described in the methods, bird species known to occur and considered at-risk from collision and potentially impacted by a wind farm development are also included in the risk assessment (i.e., diurnal raptors).

Table 8: Bird species risk assessment summarised results

Species	EPBC Act	WA BC Act / DBCA Priority List	Impact pathway	Likelihood of impact	Consequence	Risk Rating
Baudin's Cockatoo	En	En	Direct	Less likely	Moderate	Low
			Indirect	Less likely	Moderate	Low
Blue-billed Duck	-	P4	Direct	Less likely	Low	Very Low
			Indirect	Very rare	Low	Very Low
Carnaby's Cockatoo	En	En	Direct	Less likely	Moderate	Low
			Indirect	Less likely	Moderate	Low
Common Sandpiper	Mig.	Mig.	Direct	Less likely	Low	Very Low
			Indirect	Less likely	Negligible	Very Low
Curlew Sandpiper	Cr, Mig.	Cr, Mig.	Direct	Very rare	Moderate	Very Low
			Indirect	Very rare	Negligible	Very Low
Fork-tailed Swift	Mig.	Mig.	Direct	Less likely	Low	Very Low
			Indirect	Less likely	Negligible	Very Low
Forest Red-tailed Black-Cockatoo	Vu	Vu	Direct	Less likely	Moderate	Low
			Indirect	Less likely	Moderate	Low
Grey Falcon	Vu	Vu	Direct	Very rare	Low	Very Low
			Indirect	Very rare	Negligible	Very Low
Marsh Sandpiper	Mig.	Mig.	Direct	Less likely	Low	Very Low
			Indirect	Less likely	Negligible	Very Low

Species	EPBC Act	WA BC Act / DBCA Priority List	Impact pathway	Likelihood of impact	Consequence	Risk Rating
Peregrine Falcon	-	OS	Direct	Possible	Moderate	Medium
			Indirect	Less likely	Low	Very Low
Red-necked Stint	Mig.	Mig.	Direct	Less likely	Low	Very Low
			Indirect	Less likely	Negligible	Very Low
Sharp-tailed Sandpiper	Vu, Mig.	Mig.	Direct	Less likely	Moderate	Low
			Indirect	Very rare	Negligible	Very Low
Western Rosella (inland)	-	P4	Direct	Less likely	Low	Very Low
			Indirect	Less likely	Low	Very Low
Wood Sandpiper	Mig.	Mig.	Direct	Less likely	Low	Very Low
			Indirect	Less likely	Low	Very Low
Non-threatened/not priority listed diurnal raptors, including but not limited to:						
Black-shouldered Kite (<i>Elanus axillaris</i>)	-	-	Direct	Likely	Moderate	Medium
Brown Falcon (<i>Falco berigora</i>)			Indirect	Possible	Low	Low
Brown Goshawk (<i>Accipiter fasciatus</i>)						
Nankeen Kestrel (<i>Falco cenchroides</i>)						
Wedge-tailed Eagle (<i>Aquila audax</i>)	-	-	Direct	Likely	Moderate	Medium
			Indirect	Less Likely	Moderate	Low

Among the species evaluated, several were identified as at risk of direct impact from turbine collision (Table 8), based on flight height, behaviour, and habitat use patterns with a high, medium or low direct risk as a result of the installation of the WTGs proposed for the WAWF.

Medium-risk:

- Wedge-tailed Eagle (*Aquila audax*) – due to frequent soaring at rotor-swept area (RSA) heights, territorial behaviour, and regular presence within the site.
- Peregrine Falcon (OS)– confirmed presence during surveys; high-speed flight and high mobility place it at moderate risk.

- Non-threatened raptors, including:

Black-shouldered Kite (*Elanus axillaris*), Brown Falcon (*Falco berigora*), Brown Goshawk (*Accipiter fasciatus*), and Nankeen Kestrel (*Falco cenchroides*) are assessed as medium risk based on known soaring behaviour, use of RSA height for hunting or territorial flight, and evidence of collision at wind farms in other parts of Australia (e.g. Symbolix 2020).

Low-risk:

- Baudin's Cockatoo – is likely to occur on site given nearby recorded occurrence. It is considered likely to engage in low-to-mid elevation flights, similar to other black cockatoo species.
- Carnaby's Cockatoo – due to known seasonal movements across the landscape and frequent low-to-mid elevation flights.
- Forest Red-tailed Black-Cockatoo – based on known occurrence in the region and foraging movements through fragmented woodlands.

In contrast, potential indirect impacts from disturbance, operational activity, and landscape-scale barrier effects were deemed low to very low for all species assessed. However, this rating is contingent on the retention of existing habitat quality and connectivity. Degradation of remnant woodland, riparian corridors, or key movement linkages could increase species' sensitivity to disturbance or displacement, particularly for forest-dependent or wide-ranging birds.

Bats

As with bird species, the microbat risk assessment reviewed the potential ecological risks posed by the proposed wind farm development to bat species of conservation significance, with a primary focus on species listed under the EPBC Act and the BC Act as well as those listed as a Priority fauna species by the DBCA. No listed species were identified or considered to have potential to occur within the WAWF area. One bat species, Western False Pipistrelle, recorded as P4 priority list by the DBCA was identified as having some likelihood of occurrence within the study area (i.e. known, likely, or potential to occur).

As described in the methods, microbat species that are known to occur and considered at-risk from collision and potentially impacted by a wind farm development are also included in the risk assessment.

Table 9: Bat species risk assessment summarised results

Species	EPBC Act	WA BC Act / DBCA Priority List	Impact pathway	Likelihood of impact	Consequence	Risk Rating
Western False Pipistrelle	-	P4	Direct	Less likely	Moderate	Low
			Indirect	Very rare	Moderate	Very low
Non-threatened/not priority listed microbats, including but not limited to:						

Species	EPBC Act	WA BC Act / DBCA Priority List	Impact pathway	Likelihood of impact	Consequence	Risk Rating
Chocolate Wattled Bat (<i>C. morio</i>)	-	-	Direct	Less likely	Low	Very low
Greater Long-eared Bat (<i>N. major major</i>)						
Lesser Long-eared Bat (<i>N. geoffroyi</i>)			Indirect	Very rare	Negligible	Very Low
Holt's Long-eared Bat (<i>N. holtorum</i>)						
Southern Forest Bat (<i>Vespadelus regulus</i>)						
Gould's Wattled Bat (<i>Chalinolobus gouldii</i>)	-	-	Direct	Likely	Low	Low
			Indirect	Very rare	Negligible	Very Low
White-striped Free-tailed Bat (<i>Austronomus australis</i>)	-	-	Direct	Almost certain	Moderate	High
			Indirect	Very rare	Negligible	Very Low
South-western Free-tailed Bat (<i>Ozimops kitcheneri</i>)	-	-	Direct	Likely	Low	Low
			Indirect	Very rare	Negligible	Very Low

There were no bat species identified at very high risk of direct or indirect impacts. Only one priority fauna P4 species was identified, Western False Pipistrelle, an edge-foraging species that may occasionally fly at RSA. This species was considered at low risk.

White-striped Free-tailed Bat, an open-space foraging species that frequently flies at rotor-swept area (RSA) heights was identified as being at high risk. This species is considered high risk across Australia at all locations where the species is abundant.

Other low risk bat species include Gould's Wattled Bat, an edge foraging species that comprises around 20% of all bat collisions at monitored wind farms (Nature Advisory 2025), and South-western Free-tailed Bat, an open-space foraging species, recorded in moderate abundances at the study area. Other *Ozimops* sp. are known to occasionally collide with turbines.

In contrast, potential indirect impacts from disturbance, operational activity, and landscape-scale barrier effects were deemed very low for all bat species assessed. However, this rating is contingent on the retention of existing habitat quality and connectivity. Degradation of remnant woodland, riparian corridors, or key movement linkages could increase species' sensitivity to disturbance or displacement, particularly for forest-dependent or wide-ranging bats. Moreover, microbat species have not been

conclusively determined to be either deterred or attracted to wind turbines and as such until evidence of impacts are illustrated, the primary impacts are likely to be direct.

3.3. Species of concern

3.3.1. Birds

The following bird species of concern were identified as potentially vulnerable to collisions during pre-construction surveys and assessments:

Baudin's Cockatoo (EPBC: Endangered, BC Act: Endangered)

Not recorded at the study area but has been identified during desktop searches. Foraging habitat for the species is likely present within the study area. No known breeding sites within the study area and no known *Zanda* spp. roosts located near to the study area (within 10 km).

There has been no recorded wind farm mortality of black cockatoos in Australia (Johnstone 2025). The species generally flies at about 5 to 15 m above the ground (Johnstone 2025). Therefore, this species is most likely to fly below the RSA. It may occasionally fly above canopy height and therefore potentially within the RSA; however, it is considered a very competent flyer with excellent vision at night and in poor light and is therefore capable of avoiding wind turbines on the rare occasions that it flies within the RSA (Johnstone 2025).

Therefore, the likelihood of impact is considered less likely. The species has a small total population, strong pair bonding and slow breeding and recruitment. In the unlikely event of the loss of low numbers of individuals is likely to have moderate impact on the species. Based on the above the risk to this species from the operation of WAWF is considered low.

Carnaby's Cockatoo (EPBC: Vulnerable, BC Act: Vulnerable)

Carnaby's Cockatoo is known to occur at the study area. The species was observed on four occasions, both during spring (October) 2025 and autumn (March) 2026 BUSs. In spring, seven cockatoos were seen across a total of three observations during a single survey at site B10 and another single bird was heard at B10 although could not be sighted. In autumn, two individuals were incidentally observed during the BUS survey. None were observed flying at RSA height. The spring observations were restricted to woodland habitats on the western side of the site, adjacent to extensive areas of woodland. The autumn observation was made near the township of Darkan at the northern end of the study area.

The population of Carnaby's Cockatoo in Western Australia is estimated at 34,000 mature individuals (Garnett and Baker 2021) and while some groups have distinct preferred areas and patterns of habitation, they are recognised as one population (Garnett and Baker 2021). Carnaby's Cockatoo are highly mobile, with seasonal migration occurring in many areas for breeding between late July and December, although a number of resident populations do not migrate (DPW 2013).

Carnaby's Cockatoos have not been recorded to collide with WTGs or power lines and are reported to avoid hazards during flight (Johnstone 2025). Published information on the flight heights of Carnaby's Cockatoos is lacking, but impact assessments for other Western Australian wind farm projects have noted that the species most often flies at canopy height or just above. Despite a growing number of wind turbine installations within its range, collision with turbines is not recognised as a key threatening process for the species (Garnett and Baker 2021). Known causes of direct mortality that could be associated with construction and operation include impacts to (occupied) nests during construction, and roadkill of birds foraging on roadsides, due to their slow take off. Over 100 birds are brought into care each year due to car strikes with many more likely never found or reported (DPW 2013).

Given that Carnaby's Cockatoo has not been documented colliding with WTGs elsewhere and the species is a capable flier typically avoiding infrastructure and utilising lower heights, impacts from WTGs at the study area are less likely to occur and the resulting risk to this species from the operation of WAWF is considered low.

Forest Red-tailed Black Cockatoo (EPBC Act: Vulnerable, BC Act: Vulnerable)

The population of Forest Red-tailed Black-Cockatoo is estimated at 16,800 mature individuals (Garnett and Crowley 2000). During BUS, Forest Red-tailed Black Cockatoo had a total count of 113 individuals across 25 observations, with 17 of those observations and the larger flocks (> 5 individuals) observed at R02 and with sightings also at B07, B08, B10 and R01. Observations were largely within woodland habitat on the western side of the site, adjacent to extensive areas of remnant woodland. No flights were observed at RSA height.

As with Carnaby's and Baudin's Cockatoo, collision with turbines is not recognised as a key threatening process for the species (Garnett and Crowley 2000) and from the available limited data, Forest Red-tailed Black Cockatoos are not reported to collide with infrastructure or with turbines. Known causes of direct mortality that could be associated with construction and operation are attributed to impacts to occupied nests during construction, and roadkill of birds foraging on roadsides, due to their slow take off.

Along with the other black-cockatoo's, Forest Red-tailed Black Cockatoo has not been documented colliding with WTGs elsewhere and the species is a capable flier typically avoiding infrastructure and utilising lower heights. Impacts from WTGs at the study area are therefore considered less likely to occur and the resulting risk to this species from the operation of WAWF is considered low.

Peregrine Falcon (BC Act: Other Speciality Listed)

Peregrine Falcon is a wide-ranging raptor known to inhabit diverse environments, including open farmland, cliffs, woodlands, and urban areas. In Western Australia, the species is widespread but sporadically recorded (Birdlife Australia 2023a). Across Australia, there is thought to be approximately 3000 – 5000 pairs (Birdlife Australia 2023a). The population Australia-wide is stable with the largest threats being chemical residues in the environment and land clearance (Birdlife Australia 2023a). The species is versatile in its nest site selection (Birdlife Australia 2023a) and potential breeding habitat may occur in the study area. They often forage in open landscapes and likely often fly at rotor swept area height (RSA).

Peregrine Falcons have been observed on nine occasions during BUS at seven different sites, suggesting a broad use of the study area. One of the falcon observations was of a flight at RSA height (at B06) and two other observations were seen above RSA height. While agile and highly manoeuvrable, their tendency to pursue prey near structures may elevate collision risk. The species is known to be found during mortality searches at other operating wind farms and are known to collide with infrastructure (Moloney et al. 2019). Given the possibility of collision with WTGs and moderate consequences to the population surrounding the study areas, the species has been allocated a medium risk rating.

Non-threatened bird species at-risk of collision

The Wedge-tailed Eagle is included as species of concern despite not being listed as a threatened species, as they were recorded relatively regularly, including at RSA height. Other non-threatened raptors are also at risk of collision due to flight behaviour at RSA.

Wedge-tailed Eagle (BC Act: Least Concern)

Wedge-tailed Eagles use a wide range of habitats but frequently occupy open areas with scattered woodland and scrub (Debus and Kirwan 2020). Monogamous adult pairs are sedentary and aggressively

protect breeding territories of several nests typically in taller trees (Debus and Kirwan 2020). The median nest territory has been calculated as 35.6 km² in the Perth area (Cherriman 2007) and territory size is typically a function of prey abundance, with small territories having higher prey abundance (Ridpath & Brooker 1987). Much of the site presents potentially suitable habitat and the species has been recorded in the study area, with the potential for nesting in taller trees within shrubland, woodland remnants or scattered woodland.

During BUS surveys, Wedge-tailed Eagles were observed 57 times with a total count of 78 during fixed point surveys, making them the most abundant raptor species (the next most observed raptor was the Nankeen Kestrel with a count of 17). Wedge-tailed Eagles were observed throughout much of the site and roughly evenly throughout the seasons. Wedge-tailed Eagles were observed at RSA height, with a count of 53 seen flying within RSA height out of the total count of 78, demonstrating their potential to collide with turbines.

This species has been struck at most wind farms in Australia (Symbolix 2020; Hull & Muir 2010)

Other non-threatened raptors known to occur

Non-threatened raptors known to occur at the study area include:

- Black-shouldered Kite (*Elanus axillaris*; BC Act: Least Concern)
- Brown Falcon (*Falco berigora*; BC Act: Least Concern)
- Brown Goshawk (*Accipiter fasciatus*; BC Act: Least Concern)
- Nankeen Kestrel (*Falco cenchroides*; BC Act: Least Concern)

Non-threatened raptors are considered susceptible to turbine collision due to their use of open landscapes, soaring flight behaviours, and frequent activity within the RSA. Several species within this group, such as the Nankeen Kestrel, are known to hover or glide at heights overlapping with turbine blades, particularly when foraging over paddocks or ridgelines. While many of these species are highly mobile, and diurnal raptors are thought to have strong visual acuity, documented turbine collisions at other Australian wind farms confirm that they are not immune to strike risk (Symbolix 2020; Hull & Muir 2010). The risk is further elevated when individuals are engaged in territorial disputes or hunting, where attention may be focused away from moving blades.

During BBUS, raptors made up just 0.8% of all bird observations but comprised 19.8% of the birds seen flying at RSA height. Raptors were observed in small numbers, with a single Black-shouldered Kite (site B03), a single Brown Falcon (site R01), three Brown Goshawk observations (one at site B07 and two at R01) and nine Nankeen Kestrel observations. This represents relatively low raptor abundance and distribution for the project site in comparison to other wind farm sites studied by Nature Advisory. Raptor observations peaked in spring with 29 observations.

3.3.2. Bats

The following bat species of concern was identified as potentially vulnerable to collisions during pre-construction surveys:

Western False Pipistrelle (BC Act: Priority 4)

The Western False Pipistrelle has a restricted distribution from Darken west to the coast and south to Albany (Australasian Bat Society 2026c), within or adjacent to stands of old growth forest (Churchill 2008). The species prefers tall mature forests of Jarrah, Karri, Marri and Tuart but has also been recorded from *Banksia* woodland on the Swan Coastal Plain (Armstrong et al. 2021b; Hosken and O'Shea 1995; Start and McKenzie 2008).

Very little is known on the ecology of the Western False Pipistrelle, but it is reported to forage in the ‘cathedral-like’ spaces between the canopy and the understorey of the tall karri-jarrah-marri-tuart forests and wandoo woodlands in the high rainfall zones, and along nearby corridors associated with roads and watercourses (Bullen et al. 2023). Therefore, the species is likely to forage and commute through treed areas of the study area, particularly along the forested creek lines and roadside vegetation. Marri and Jarrah woodland areas on site will contain potential roosting and breeding sites for the species.

The Western False Pipistrelle was either *definitely* or *probably* recorded during all four seasons surveyed, with its presence *definitely* recorded at all 16 sites during the spring 2025 survey. There is no publicly available information available on the turbine collision history for these species, therefore it is unknown if they fly at RSA height. The Western False Pipistrelle is closely related to the Eastern False Pipistrelle (*F. tasmaniensis*) and has a similar foraging strategy (edge-space forager). The Eastern False Pipistrelle has been recorded colliding with turbines in eastern Australia (Molony et al. 2019).

Other species at-risk of collision

The following bat species were identified as potentially vulnerable to collisions during pre-construction surveys, as they are known to occur at the study area and are known to regularly collide with operating turbines:

Gould’s Wattled Bat (Chalinolobus gouldii; BC Act: Least Concern)

The Gould’s Wattled Bat is an edge-adapted species that regularly flies at RSA height and has a widespread distribution across Australia (Australasian Bat Society 2026d). The species roosts in hollows, and is found in dense forest, open woodland, mallee, tall shrubland, and open areas (Lumsden et al. 2021).

Gould’s Wattled Bat is the second-most frequently observed bat species found to collide with turbines (Molony et al. 2019, Nature Advisory 2024) in eastern Australia. During BBUS, the species was detected across all sites and during all seasons, therefore likely commutes, roosts and forages across the study area.

South-western free-tailed Bat (Ozimops kitcheneri; BC Act: Least Concern)

The South-western Free-tailed Bat ranges throughout native bushland, agricultural and urban areas. It is found from the semi-arid eucalypt woodlands to higher rainfall forests in the far south-west and probably relies on patches of remnant vegetation and isolated paddock trees in agricultural lands for roosting habitat (Reardon and Armstrong 2021). It has a restricted distribution to south-west Western Australia (Australasian Bat Society 2026e). The species forages in open spaces above the canopy and between trees (McKenzie and Bullen 2008, Reardon et al. 2014).

During BBUS, the species was detected across all sites and during all seasons. Due to its open-space foraging nature, and collisions of other free-tailed bats in eastern Australia (Molony et al. 2019), it is likely this species will fly at RSA heights within the study area.

White-striped Freetail Bat (Australopus australis; BC Act: Least Concern)

White-striped Freetail Bat is an open-space adapted species that typically fly high above the ground (Rhodes and Richards 2023) and have a widespread distribution across Australia (Australasian Bat Society 2026). They can occur over a variety of habitats including urban areas, forests, woodland, shrubland, open farmland with scattered stands of trees, grasslands and deserts (Churchill 2008), and foraging areas are not restricted to remnant treed areas (Rhodes and Wardell-Johnson 2006). They are a fast flyer (median speed of more than 40 km/h, but up to 61 km/h) and forage in open areas, capturing flying insects as prey 50 m or more above the ground (Bullen & McKenzie 2001, Churchill 2008, Rhodes

and Catterall 2008). When commuting across the landscape, they fly very fast in a relatively straight line (Rhodes and Catterall 2008)

During BBUS, calls of White-striped Free-tailed Bat were detected across all sites across the study area. The White-striped Free-tailed Bat frequently flies at rotor-swept area (RSA) heights and is known to collide regularly with wind turbines across Australia (Moloney et al. 2019; Nature Advisory 2025; Symbolix 2020) and therefore is generally considered at high risk of collision at most wind farms.

There is some evidence that this species migrates, with evidence from Western Australia indicating a proportion of the WSFB population migrate north during winter and return south with the onset of hotter and more humid summer conditions (Rhodes and Richards 2023). This coincides with the findings at WAWF where no calls of the species were recorded during winter, and few in late autumn, indicating reduced risk over this time.

4. Preventive management measures

The following preventative management measures will be applied for the duration of WAWF operations to reduce the risk of an impact trigger occurring.

Turbine design

Turbines design incorporates embedded features to minimise collision risk including a smooth exterior to minimise perching opportunities and raised minimum blade height to reduce collision risk to threatened black cockatoos. Turbines at the WAWF have been deliberately designed with a minimum RSA height of 59m for this reason.

Expert elicitation performed elsewhere in Australia suggests that RSA height changes have a species-specific impact with likely benefits to all parrot species (Regan et al. 2025). For microbats, an analysis undertaken by Nature Advisory using monitoring data collected at ten wind farms across southern Australia showed that an increase in the minimum RSA height resulted in a decrease in microbat mortality (Barati et al. 2026).

Carcass removal

The presence of animal carcasses (e.g. dead livestock) can attract scavenging birds such as some raptors. The removal of these carcasses as soon as they are detected can therefore reduce the chances of scavenging raptors colliding with turbines. The following carcass removal procedures below will be adopted:

- Designate a suitable wind farm staff member to perform the function of ‘carcass removal coordinator’
- Monthly inspections of the entire wind farm site by the carcass removal coordinator to search for carcass that may attract raptors (generally mid to large-sized mammals)
- Any carcasses and/or remains found that are within 200 m of turbines will be collected and disposed or relocated as soon as practicable, in a manner that will avoid attracting raptors, in consultation with the landowner
- Carcass occurrence and removal will be recorded by the carcass removal coordinator and incorporated into the annual report.

Lighting avoidance or reduction

Lighting can attract insects, which are prey for microbats and some species of birds. To reduce features within the wind farm that may attract additional birds or bats, there will be no turbine lighting unless specifically required by regulatory authorities.

5. Operational (post-construction) phase monitoring

This section describes the methods for the operational phase bird and bat monitoring program once the WAWF is commissioned and operational.

5.1. Operational phase bird and bat monitoring

5.1.1. Bird utilisation surveys

Post-construction BUS (also known as operational phase BUS) will commence once the WAWF is fully commissioned. Post-construction BUSs will occur in twice, once between August and October and once between Feb and April in the first two years and replicate the methods and points of pre-construction surveys. These surveys aim to identify changes, if any, in bird diversity, abundance and use of the site compared to the pre-construction period. They can also help identify if any turbines pose a particular risk to listed bird species.

Relevant details of the post-construction BUS are detailed below.

- They will be undertaken at the same survey points and reference points used in the pre-construction surveys, using the same methodology.
- They will provide a context for the carcass searches and elucidate the indirect effects of the wind farm on bird use of the site by comparing the bird abundance and diversity recorded during post-construction surveys with the baseline pre-construction BUS data.

After the completion of the two years of operational BUS, subsequent BUSs will be undertaken every five years (i.e. year seven, twelve, etc.) for the lifetime of the wind farm. BUSs at five-year intervals will be completed during spring and summer, as this season represents a period of high activity and detectability for bats, birds, and particularly species of concern. These surveys differ in purpose from the initial four-season BUS, as they aim to identify any changes in the presence or abundance of species of concern or other listed species not previously recorded, and to assess whether the level of risk has increased (e.g., due to a significant rise in numbers or emerging spatial patterns compared to previous BUS results).

Findings from the post-construction two-year BUS, together with data from targeted surveys and carcass searches, will inform decisions on the need for additional targeted or species-specific monitoring. The ongoing five-year BUS will then serve to detect any new or increased risks and guide subsequent decision-making.

5.1.2. Species of concern nest & hollow monitoring (if required)

Black-cockatoos

No known nesting trees¹ for black cockatoos have been identified during surveys, however, if any of the potential nesting trees within 300 m of turbines become utilised during construction or operation, monitoring of these is to occur in conjunction with carcass monitoring (refer to section 5.2.5 and 5.2.6) during the breeding season (July to December (DAWE 2022)). Monitoring will determine hollow use, if nesting is occurring and its outcome.

¹ Trees (live or dead but still standing) which contains a hollow where black cockatoo breeding has been recorded or which demonstrates evidence of breeding (i.e., showing evidence of use through scratches, chew marks or feathers) (DAWE 2022b).

Surveys would involve observers initially standing at a discrete vantage point approximately 50 m from the hollow to avoid disturbance, noting occupancy. If it is occupied by Black-cockatoos document observations from a distance including:

- any evidence of potential competing species using hollow (e.g., other parrot species, European honey bee)
- any damage to the hollow, noting storms as well as degradation of old trees may occur over time
- any evidence of use by Black-cockatoos including:
 - chew marks
 - physical use

If no visible occupation by Black-cockatoos is noted then the ecologist will approach the hollow and use a telescopic pole-mounted camera or camera drone technology to observe the hollow for the above (e.g., evidence of competing species, damage to the hollow and evidence of use) as well as:

- eggs, feathers, debris or active use not noted from a distance

Results from hollow monitoring are to be provided in annual reporting. Passive monitoring techniques provide an alternative so long as the overall aim of sufficiently monitoring nest activity and outcome at black-cockatoo nesting hollows or potential hollows is achieved.

Peregrine Falcon and Wedge-tailed Eagle

No Wedge-tailed Eagle or Peregrine Falcon potential or known nests have been recorded to date at WAWF. However, if Wedge-tailed Eagle or Peregrine Falcon nests are identified they will be recorded with a GPS location and revisited during the relevant breeding season (Peregrine Falcon; August to October and Wedge-tailed Eagle: July to December). The suitably qualified ecologist will monitor any identified known or potential Peregrine Falcon and Wedge-tailed Eagle nest locations within 300 m of turbines. The specific methodology will be determined by the suitably qualified ecologist including the frequency and methodology that least disturbs nests but sufficiently monitors nest activity and outcome.

5.1.3. Microbat surveys

Post-construction microbat surveys will be conducted once the wind farm is fully commissioned and during its first two years of operation. Post-construction microbat surveys will occur twice, once between August and October and once between Feb and April in the first two years and replicate the methods and points of pre-construction surveys. The surveys will seek to demonstrate whether the site continues to be utilised by the range of species identified in the pre-construction surveys and whether any turbines pose a particular risk to threatened species.

Relevant details of the microbat surveys are presented below.

- Surveys will be undertaken at approximately the same survey points and timing used in the pre-construction surveys, using the same methodology.
- Surveys will provide a context for the carcass searches and elucidate the indirect effects of the wind farm on bat use of the site.
- Surveys will specifically focus on the presence of, and potential impacts on, species of concern identified during pre-construction bat surveys and assessments.

During call analysis, ambient conditions, principally wind speed and temperature, will be recorded to enable future analysis to investigate any correlations with bat activity, if required. Analysis can also

identify trends in activity over time of night and seasons. The ongoing monitoring and analysis of bat activity will help inform the adaptive management approach.

After the completion of the two years of operational bat surveys, subsequent surveys will be undertaken every five years (i.e. year seven, twelve, etc.) for the lifetime of the wind farm. Bat surveys will be completed during spring and summer, as this season represents a period of high activity and detectability for bats.

5.2. Carcass monitoring

A monthly carcass monitoring program will be undertaken for two years once the wind farm is fully commissioned. It should continue at five-year intervals after the initial two years of carcass monitoring (i.e. year seven, twelve, etc), for the life of the project.

The aim of carcass monitoring is to quantify the direct impacts of turbine collisions on birds and bats and to collect data that can inform adaptive management of collision risk. Carcass monitoring will provide data on the location, number and species of birds and bats impacted by turbine collision. The data collected by the program will be used to estimate annual total mortality of listed and non-listed bird and bat species, which can be used to understand bird and bat impacts. The data may also detect patterns of mortality related to a particular turbine, a time of day/year or local conditions (such as storm fronts, concentration of prey species), which can be used to inform targeted mitigation or curtailment strategies.

Implementation of carcass monitoring programs in Australia is still developing, and the techniques described here are based on programs already implemented (e.g., Hull et al. 2013) and recent feedback from regulatory authorities.

5.2.1. Definition of 'mortality'

Mortality is defined as any dead bird or bat detected within the specified search radius (refer to section 5.2.7). Detection can be either during the formal carcass monitoring program (designed to generate an estimate in accordance with a statistically rigorous sampling design) or at other times (incidental observation, often by operational staff). A protocol is triggered for every carcass detection, either within the formal searches or incidentally, with responses proportionate to the species found (see Section 6).

All bird or bat carcasses or bird feather spots (defined as a clump of five feathers or more with no associated carcass) detected within the search radius of an operating turbine will be assumed to have died due to collision with turbine blades, unless there are obvious signs of another cause of death (e.g. bullet/shotgun pellet wounds).

5.2.2. Overview of method

The WAWF carcass monitoring program will consist of the following approaches:

1. **Incidental carcass detection** (refer to Section 5.2.3); and
2. **Interim carcass search program (if the WF is developed in stages)** (refer to Section 5.2.4); and
3. **Formal carcass search program** – to be implemented after all turbines are operational. (refer to Section 5.2.6 for more details).

5.2.3. Incidental carcass detection

It is acknowledged that during the construction and commissioning phase of the WAWF, once turbine components are being installed but are not operating, risks to avifauna exists. While the chances of collision with stationary structures are minimal in comparison to wind turbines that are operating and generating electricity, it is a risk that should not be ignored. During this time:

- There will be increased worker activity on and around turbine hardstands and surrounding areas as commissioning activities are occurring.
- Incidental carcass detection will be conducted by personnel and contractors who are approved to work within the construction exclusion zones that will exist around the hardstands.
- Any carcasses detected during this period will be recorded in accordance with the carcass finds protocol at Section 5.2.10. Awareness training is to be provided to the proponent and contractor teams to ensure that protocol can be implemented effectively.
- The incidental carcass detection will continue as the primary carcass detection method, until the full carcass search program commences.

Incidental carcass detection will remain a key element of bird and bat monitoring throughout the construction and full operation of the WAWF. An incidental find is defined as any bird or bat carcass found at the study area outside of the formal searches by any site personnel and any carcass found by formal searchers outside the search radius (130 m from the base of a searched turbine). All construction and operational personnel will be provided with these protocols as part of their site training and induction.

5.2.4. Turbine selection

Given that WAWF is a large project comprising up to 92 turbines, a subset of 30% of the turbines will be searched monthly once the project is commissioned. Turbines will be selected using spatially stratified random sampling to ensure even distribution across the site (i.e., avoiding clustering). Some selected turbines may be substituted with more accessible turbines or where on-ground conditions make it unsafe to cover the full search radius. The selection of the turbines to be included in the search will be made prior to the commencement of the first monthly search and they will remain the same for the duration of carcass monitoring to reduce sampling error, enabling the most accurate estimates of bird and bat mortality rates.

Note that the results of any turbine searches outside the core randomly selected fixed turbines (i.e., incidental findings or in response to impact triggers; Sections 5.2.3 and 5) will not be used in the mortality estimates. These searches depart from the rigorously designed statistical sampling framework and would render estimates invalid.

Information collected at each turbine will include the species and number of carcasses found, location, any relevant details on vegetation and habitats, and any relevant observations indicating risk behaviours involving listed species.

In addition to the selected turbines, impact triggers may prompt temporary search regimes on unselected turbines (as detailed in Section 6).

5.2.5. Interim carcass search program

If the wind turbines at WAWF will be commissioned in stages across different sections of the wind farm, an interim carcass search program will be implemented during the period when some but not all the turbines at the site are operational. The interim carcass search program will use the same methodology as the full carcass search program, with the following additions:

- The interim carcass search program will begin one month after all turbines within a stage are operational, with searches to be conducted monthly
- The interim carcass search program will be implemented at turbines that will form part of the ongoing monitoring within that stage.

- Interim searches will only be undertaken at turbines where there is no safety exclusion zone in place
- The interim carcass search program will be progressively expanded to each stage of the wind farm as they become operational.

When all stages of the wind farm are operational, the formal carcass search program will commence.

5.2.6. Formal carcass search program

The formal carcass search program will commence within one month of the wind farm being in full operation (fully commissioned) and will be undertaken for an initial period of two years. The results of the program will be presented in an annual report to be prepared after each year of carcass survey. The report will review the program to identify issues (if any) and provide recommendations for improvement (see Section 7 for reporting requirements). Oversight requirements of these reports will be determined through the Shire Development Application process to ensure the monitoring program is responding appropriately to any impacts on species of concern.

The carcass search program will provide data on:

- The species, number, age and sex (if possible) of detected bird and bat carcasses;
- Annual estimated mortality rates for each bird and bat species detected in the carcass search program;
- Spatial or temporal variations in bird and bat carcass detections, if they are detected.

For details on reporting of the carcass search program, see Section 7.

5.2.7. Carcass search protocol

Searches are to be undertaken by experienced dog handlers with scent dogs, or where scent dogs are unavailable, trained human searchers.

The size of the carcass search zone radius (130 m) is considered appropriate for the turbine specification at WAWF (Hull & Muir 2010). The Hull and Muir (2010) model predicts that smaller carcasses will land closer to the base of the turbine. The model calculates that 100% of bat carcasses and 95% of bird carcasses are expected to be within 130 m of the turbine. The exception is very large birds, which have a small probability of exceeding this distance. Such large birds are likely to be spotted by carcass search personnel due to their size, even if they fall outside the 130 m search area.

A carcass data sheet must be completed for each carcass detected. This can be found in Appendix 1.

5.2.8. Scent dog searches

The use of trained scent dogs in carcass searches improves the detection rate of carcasses (Bennett 2014). Dog handlers will be capable at identifying dead and living bird and bat species of Western Australia. In scent dog assisted searches, the handler will start down wind of the turbine and walk transects that are 20 m apart and perpendicular in direction to the wind. The handler will use commands to encourage the dog to move across the transect, covering more ground. Scents (such as those from a carcass) are carried downwind, forming a 'cone' of scent (Figure 3). By moving perpendicular to the wind, the chance of the dog encountering the scent cones from carcasses within the search area is increased. As the distance scent travels is influenced by wind, the distance between transects will narrow to 15 m when wind speeds are high. A GPS collar will be fitted to the dog which will allow the handler to check whether the entire search area has been effectively covered by the dog.

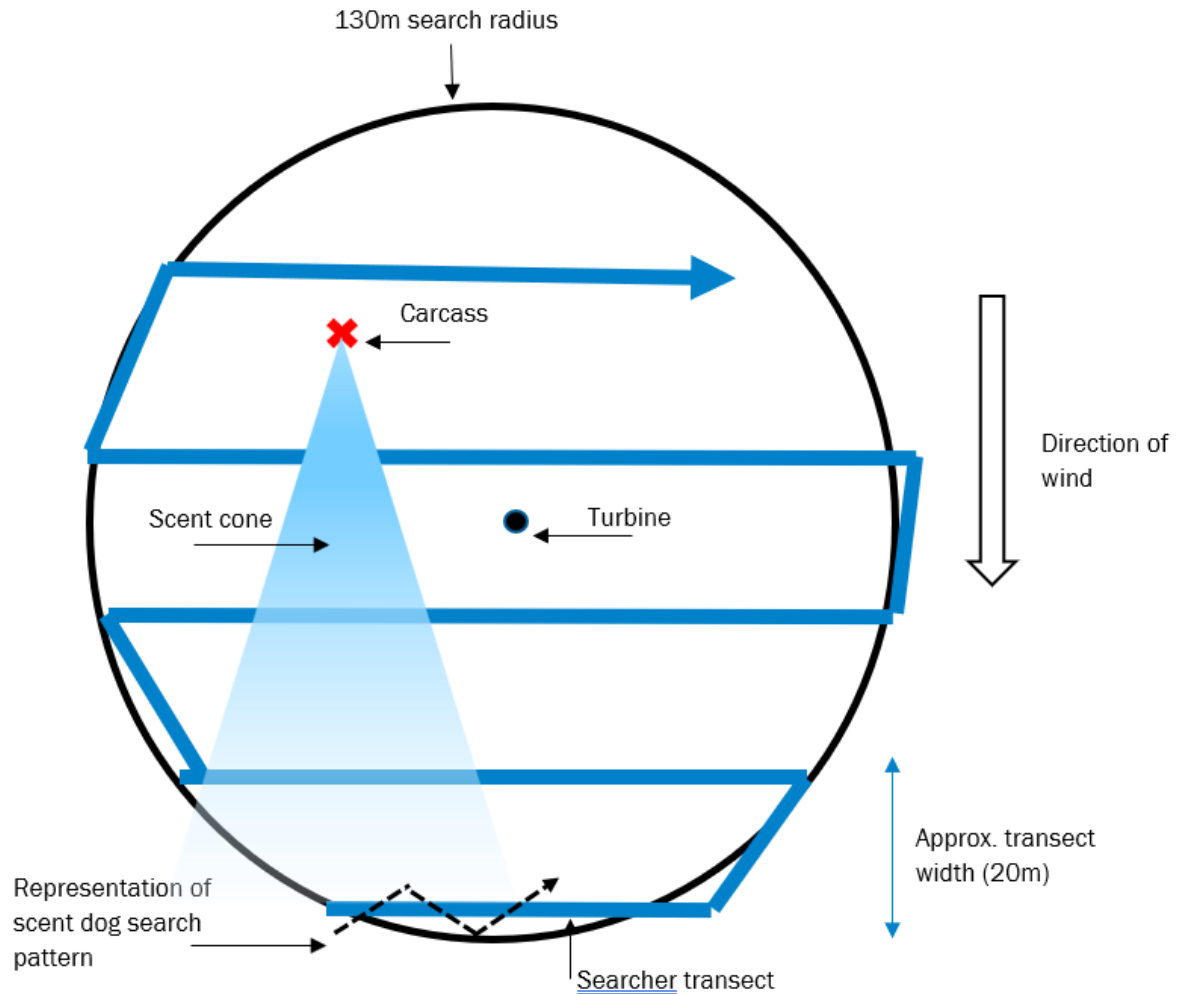


Figure 3: Search pattern for scent dog assisted carcass search.

5.2.9. Human searcher (secondary option)

Smaller carcasses are hard to detect for humans than large carcasses. As smaller carcasses are predicted to fall closer to the turbine base, there will be two search zones within the search radius, an inner search zone and an outer zone. In the inner search zone, transects will be spaced 6 m apart to increase the likelihood of finding smaller carcasses. In the outer search zone where smaller carcasses are much less likely to occur, transects will be spaced at 12 m, which should still facilitate the finding of larger carcasses (Figure 4). Searchers are to track their searches with a GPS unit.

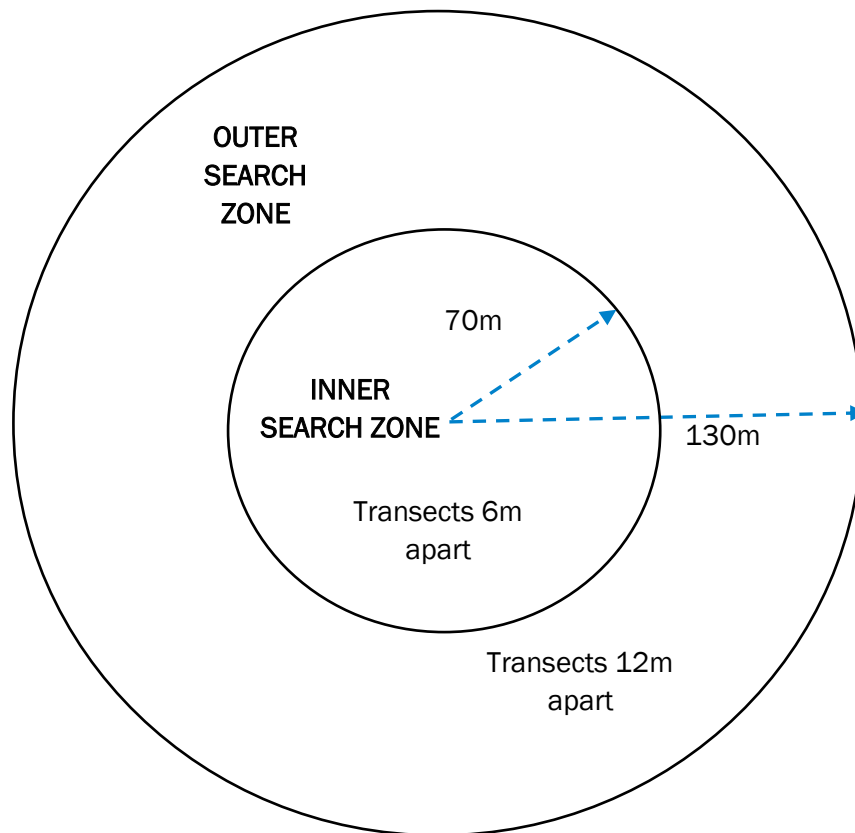


Figure 4: Inner and outer carcass search zones underneath the turbines

5.2.10. Carcass handling and injured wildlife protocols

Carcass handling protocol

Detected carcasses will be documented on the mortality data sheet (Appendix 1) with the following information collected:

- GPS location
- Condition of carcass
- Substrate and vegetation type
- Position of carcass (distance (m) and compass bearing from the base of the nearest turbine)
- Species, age, and sex (if possible)
- Description of visible injuries
- Estimated date of strike (based on decomposition)
- Weather conditions influencing carcass detectability and
- if the species is not able to be immediately identified, photos of the carcass for consultation with a qualified ecologist. If carcass identification is not possible, samples may be sent for DNA analysis.

Detected carcasses will be removed from the turbine search area to avoid re-counting. The wind farm operator will obtain and supply any required permit to handle and keep native wildlife (even dead wildlife) prior to the start of the monitoring program. Handling carcasses has health risks, and as such, carcass handling will follow the following protocol:

- The carcass will be handled with rubber gloves, packed into a plastic bag, then placed in a second plastic bag.
- The carcass bag will be clearly labelled with the time and date the carcass was found, the turbine it was found under, and the species name.
- Carcass of all positively identified and unidentified species will be initially retained in a site freezer. It will be to the discretion of the suitably qualified bird and bat ecologist as to the timing of carcass disposal. Noting carcasses are often used and may be required for scavenger rate and searcher efficiency trials (see section 5.3.1 and 5.3.2).
- The freezer will only be used for holding carcasses and not for other uses.

Injured wildlife response

All on-site staff will be advised of the correct procedure for assisting injured wildlife. Staff who find injured wildlife will be required to report the find to the Project's Responsible Officer to organise a response:

- If safe to do so, the animal will be placed into a dark box or cloth bag for transfer to the nearest wildlife carer or veterinarian.
- Injured animals must be handled with rubber gloves.

Special care will be taken to avoid bat borne viruses (i.e., Australian Bat Lyssavirus and Hendra Virus). Only staff with appropriate vaccinations will handle bats (living or deceased).

5.2.11. Estimating annual mortality due to collision

The sampling design of the carcass monitoring program at WAWF aims to provide reliable estimates of annual bird and bat mortality. Factors such as carcass scavenging and carcass detectability can affect mortality estimates and estimates of these factors must be included in any estimate of overall mortality rates. To account for these factors, mortalities will be adjusted using scavenger and detectability corrections as detailed in sections 5.3.1 and 5.3.2.

Mortalities will be estimated with a Horvitz-Thompson style estimator (Huso 2011), with an extract of the equations provided below.

$$\hat{M}_{ij} \cong \frac{C_{ij}}{(\hat{g}_{ij})} \quad (1)$$

where

- $\hat{M}_{ij}$ is the estimated mortalities at turbine i during search j
- C_{ij} is the number of carcasses found
- $\hat{g}_{ij}$ is the estimate of the detection probability for that search and turbine

For a given turbine, $\hat{g}_{ij}$ is a function of

$$\hat{g}_{ij} \cong a_i r_{ij} p_{ij} \quad (2)$$

- a_i is the fraction of total carcasses within the searched area (note this is *not* the same as the fraction of area searched)
- r_{ij} is the fraction of the carcasses that arrived at turbine i but have not been lost to scavenge or decay before search j
- p_{ij} is the probability that an existing carcass will be detected by the searcher

Therefore, a robust mortality program requires the following components:

- a formal mortality monitoring survey where found carcasses are recorded, to determine C_{ij}
- an estimate of the fall zone of carcasses to determine a_i (this also accounts for potentially only searching a subset of all turbines)
- scavenger trials to estimate r_{ij}
- searcher efficiency trials to estimate p_{ij}

5.3. Scavenger Trials and Searcher Efficiency Estimates

5.3.1. Scavenger rate trials

Carcasses of animals killed by turbine collisions are often removed by scavengers (e.g. foxes, dogs, ravens) before they can be detected resulting only a proportion of carcasses found during searches. The rate at which a carcass is scavenged (expressed as the number of days a carcass is present before it is removed by a scavenger) can be used to estimate the total impact on birds and bat at WAWF.

A trial will be conducted at the WAWF site to generate a ‘scavenger correction factor’. The trial will involve planting 30 intact carcasses (Table 10) with an accompanying camera trap for each carcass in random locations within 70 m of the base of turbines selected for regular searches. 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.

Table 10: Number of replicates per season of scavenger rate trial

Season	Microbat	Medium sized birds	Large birds (large raptor size)
Autumn - short grass	10	10	10
Late winter/spring – Longer grass	10	10	

The camera (e.g., infrared motion detector) will be 1–2 meters from the intact carcass and will trigger when it detects movement. Movement of the scavenger on the carcass and the associated record date and time will determine the date and time that the carcass was scavenged. If movement from the scavenger is not detected, the time when a carcass was last photographed can be substituted. The camera along with the carcass will be retrieved by day 30 if the carcass remains.

The size of the carcass and the length of the grass in which the carcass is planted may influence the detectability of that carcass to predators. To account for this, the planted carcasses will be of varying size (as much as is practically possible) to represent the different sizes of the birds and bats that may be impacted by turbine collisions, from microbat size to raptor size, and the trials will be conducted twice across different seasons, once in autumn when the grass is short, and again in late winter-spring when the grass is longer. A mix of carcass sizes (if available) will be obtained for use in the scavenger trials. Scavenger trials for large raptors will only be conducted once as obtaining carcasses of a commensurate size to a raptor can be difficult. Trials at other wind farms indicate a low level of scavenging of raptor carcasses and a high level of detectability that is consistent across the year during all seasons as larger carcasses are easier to find in long vegetation. Conducting scavenger trials at seasonally different times is also designed to account for occasional seasonal changes in scavenging activity by some scavenger species. For example, fox scavenging rates can be dependent on the availability of other sources of prey (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 by foxes.

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 (a feather spot being a cluster of five or more feathers). Intact or partial carcasses and feather/fur spots will all be recorded as a 'find'. However, the scavenger correction factor will not be applied to fur and feather spots as these most likely represent the remains of carcasses after they have been scavenged and not to do so would significantly bias mortality estimates upwards.

Where carcasses of a species group cannot be found, a similar-sized substitute (i.e., mice substituted for bats, pest birds collected from control programs Common Myna/Common Starling/Rainbow Lorikeets/Laughing Kookaburra substituted for medium-sized birds) will be used to reduce bias by visual predators.

Scavenger trials will be undertaken twice during the first two years of carcass monitoring. The second-year report will provide the first estimate based on real, site-specific data, of the precision of the estimates of the various parameters required to estimate mortality rate, including scavenging rate and searcher efficiency (see below).

5.3.2. Searcher efficiency trials

To account for the imperfect detection of carcasses during carcass searches, a searcher efficiency rate will be conducted in an experimental trial, which will run concurrently with the scavenger rate trial. On the same days that the carcasses have been planted for the trials prior to the placement of trail camera, carcass searchers will conduct a carcass search of each of the turbines where carcasses have been planted using the standard carcass search protocol. The same total and type of carcasses used in scavenger trials will be used in searcher efficiency trials.

The searcher will not be aware that the trial is taking place and will have had no role in planting the carcasses. The location and nature of the carcasses will be recorded by the person who plants the

carcass. At the conclusion of the trial, the percentage of carcasses that the searcher found will be calculated and incorporated into future estimates of mortality rates.

As with the scavenger rate trials, the searcher efficiency trial will occur twice within the first two years, to account for differences in grass length that may impact carcass detectability. The carcass controller will throw each carcass into the air and allow it to land on the ground to simulate a fall from turbine height. Analysis of past trials from other wind farms 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 percent even with 50 replicates; Symbolix 2020). 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).

5.4. Operational monitoring summary

Management actions, survey details and timelines for post-construction bird and bat impact monitoring are summarised in Table 11.

Table 11: Timeline for surveys after commissioning of turbines at the West Arthur Wind Farm.

Management Action	Details	Report timing	Responsible
Bird Utilisation Surveys Section 5.1.1	Twice per year over 2 years, once between August and October and once between Feb and April, then twice yearly every 5 years for the life of the project	Incorporated into annual reports.	Suitably qualified ecologist
Bat Utilisation Surveys Section 5.1.3	Twice per year over 2 years, once between August and October and once between Feb and April, then twice yearly every 5 years for the life of the project	Incorporated into annual reports.	Suitably qualified ecologist
Carcass monitoring program Section 5.2	30% of turbines following the commencement of full operations at WAWF will be searched every month, initially for a minimum of two years.	Incorporated into annual reports.	Suitably qualified ecologist
Scavenger trials Section 5.3.1	Experimental trials twice in within the first two years to determine scavenging rate; once when grass is long and once when grass is short.	Incorporated into annual reports.	Suitably qualified ecologist
Searcher efficiency trials Section 5.3.2	Experimental trials twice within the first two years to determine detection rate.	Incorporated into annual reports.	Suitably qualified ecologist

6. Adaptive Management

An adaptive management framework has been developed to achieve the environmental outcomes listed in Section 1.1 by establishing effective and timely measures in response to certain scenarios regarding carcass detections. This section includes:

- A definition of impact triggers for listed and non-listed species
- Description of an adaptive decision-making framework for these triggers
- Discussion of the timing and nature of mitigation measures in response to impact triggers

6.1. Impact triggers

The proponent will be responsible for the implementation of impact triggers (and the BBAMP more broadly), including initiating communication with the regulator as outlined below. Impact triggers will be implemented for the life of the project, from the commencement of operations until turbine decommissioning. Impact triggers should adopt a conservative approach, whereby uncertainty over the extent of an impact should not prevent the implementation of mitigation measures. Impact triggers apply to carcasses found within the study area.

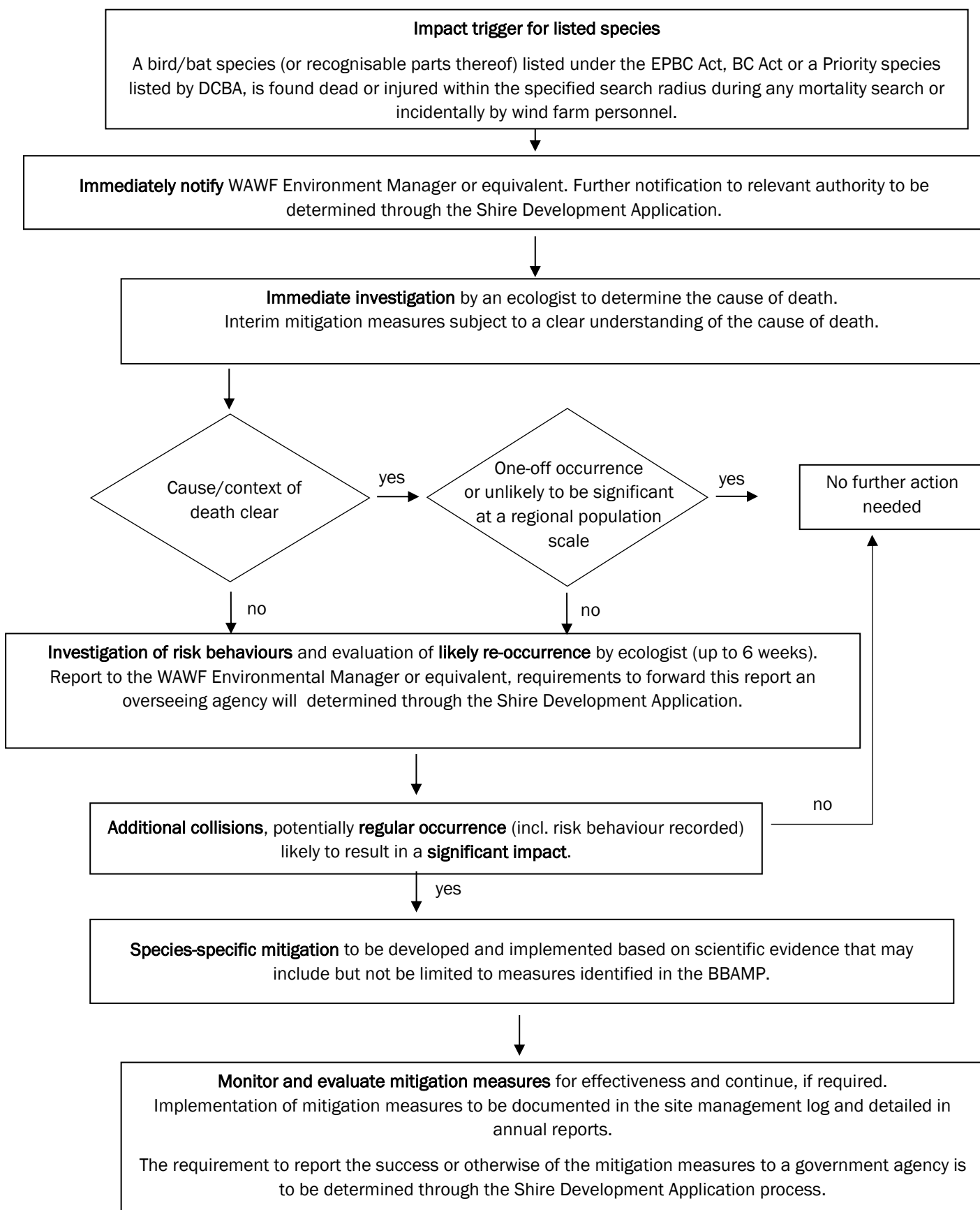
6.1.1. Impact triggers for listed bird and bat species

Definition of impact trigger

An **Impact Trigger** for a listed species occurs if a bird or bat (or recognisable parts thereof) listed under the EPBC Act or BC Act or a Priority species listed by DBCA is found dead or injured within the study area during any mortality search or incidentally during commissioning or operation. A species-specific response has been developed for Baudin's and Carnaby's Cockatoo and Forest Red-tailed Black Cockatoo (detailed in Section 1).

Operational procedure

If an **Impact Trigger** for a listed species occurs, further investigation will commence immediately, and the procedures outlined in Figure 5 will be followed.

Figure 5: Decision-making framework in response to an impact trigger for a listed species

6.1.2. Impact triggers for non-listed bird and bat species

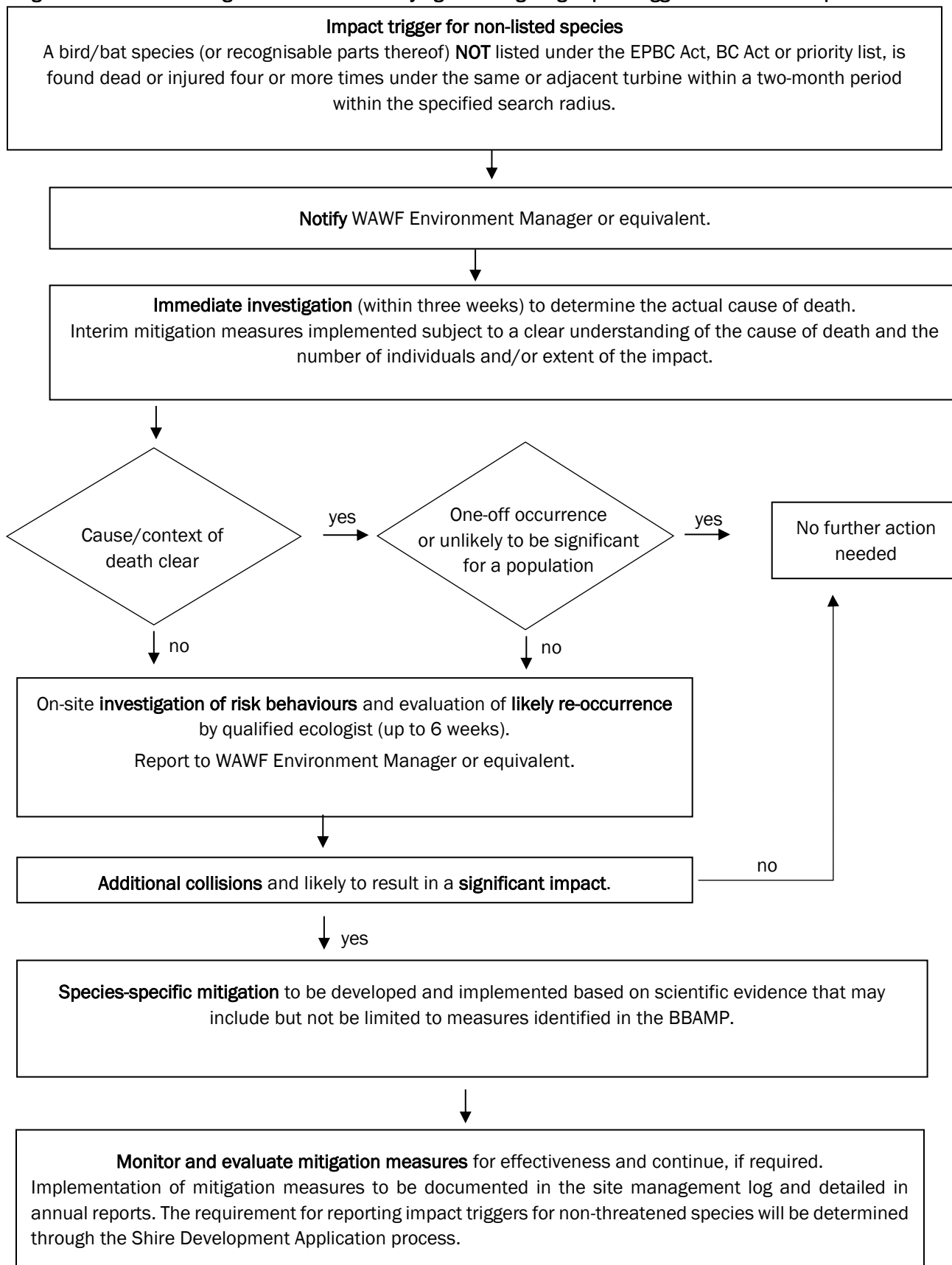
Definition of impact trigger

An **Impact Trigger** for a non-listed species occurs if a bird or bat (or recognisable parts thereof) NOT listed under the EPBC Act or BC Act is found dead or injured within the specified search radius (up to 130 m from the base of a turbine) during any mortality search or incidentally during commissioning or operation four or more times under the same WTG or adjacent turbines of the identified incident within a two-month period.

An impact trigger for non-listed species **will not apply to ravens, magpies or introduced species**; however, any detected mortalities for these species will still be reported as part of the annual reporting process.

Operational procedure

If an **Impact Trigger** for a non-listed species occurs, further investigation will commence immediately, and the procedures outlined in Figure 6 will be followed.

Figure 6: Decision-making framework for identifying and mitigating impact triggers for non-listed species

6.2. Mitigation and management measures

Mitigation and management measures may be required as a result of an impact trigger. Mitigation measures play a key role in ensuring the objectives listed in Section 1.1 will be achieved. The objective of mitigation is to ensure that the WAWF does not lead to significant impacts on listed or non-listed bats and/or birds over the life of the wind farm. This approach aims to achieve the objectives set out in this BBAMP.

6.2.1. Mitigation measures

The development and implementation of required mitigation measures will be guided by a range of sources including available literature and database records, pre-and post-construction survey results and the results of the carcass monitoring program.

Potential mitigation measures include (but are not limited to):

- Habitat modification, vegetation planting/removal;
- Changes in land use practices (including stock management, stock grain-feeding) beneath or near turbines, subject to negotiation with landowners;
- Cessation or reduced cropping/sowing beneath or near turbines;
- Blade feathering to manufacturers cut-in speed
- Bird deterrence;
- Increasing turbine and powerline conspicuousness by rotor patterns, marking and/or audible signals;
- Changes to lighting of turbines, if installed;
- Temporary turbine curtailment for high-risk periods/locations;
- Trialling ultrasonic deterrents to deter bats at night; and
- Bird protection systems that automatically curtail turbines on approach to reduce raptor fatalities (e.g., Bioseco®, IdentiFlight®; Duerr et al. 2023, Szurlej-Kielanska & Pilacka 2022).

Mitigation measures are site and species-specific, and will require thorough investigation. The list above is not exhaustive, emerging techniques and technologies will also be considered. As described in sections 6.1.1 and 1, a monitoring program will be implemented to assess the effectiveness of ongoing mitigation measures to evaluate their success or failure with reporting requirements and updates on efficacy to be determined through the Shire Development Application process.

7. Reporting and review

7.1. Annual reports

Reports will be completed on an annual basis with monthly summary reports of any formal carcass searches to be provided to the Project Owner. The oversight and reporting of annual reports will be determined through the Shire Development Application process.

The first annual report will be prepared within three months of the completion of the first year of carcass monitoring after the first stage of the wind farm becomes operational. Annual reporting will continue until the final commissioned stage has completed two years of formal carcass searches. Annual reports will have, as a minimum the content described below.

- Annual strike reports, raw strike data and strike notifications.
- A summary of the results of the carcass monitoring program, including the species and total number of birds and bats detected;
- Seasonal and annual variation in the number and composition of bird and bat strikes, where detectable.
- Analysis of impacts detected so far and their likely significance;
- A summary of stock, feral and native animal carcass removal for the purposes of predator reduction;
- Analysis of any new technologies that could assist in more effective monitoring or mitigation;
- Recommendations for investigation and implementation of any mitigation measures required;
- A summary of results of operational monitoring including a comparison to pre-operational monitoring (bird utilisation surveys, if performed in that year, to detect if species are being displaced);
- A summary of any impact triggers and the subsequent response to that impact trigger, including types of mitigation measures instigated and their level of effectiveness in preventing further impact triggers. Please note that reporting requirements for impact triggers is further outlined in Sections 6 and 1; and
- An analysis of the effectiveness of the monitoring in achieving the environmental outcomes listed in section 1.1

Annual or trigger reports content may also inform a revised BBAMP about any proposed changes related to monitoring responsibilities, protocols, frequency and intensity in the following years. The requirement for a revised BBAMP, annual or trigger reports to be reviewed by an external agency will be determined during the Shire Development Application process.

7.2. Reporting timing

Table 12: Timeline for reporting.

Reporting action	Details	Report timing	Responsible
Impact triggers (incl. species of concern) Section 6.1	Investigation of the circumstances surrounding the detected mortality of a listed species, as defined in Section 6.1.1	Reporting of any impacts on EPBC listed species to be determined through the Shire Development Application process.	Proponent

Reporting action	Details	Report timing	Responsible
	Investigation of the circumstances surrounding the detected mortalities of non-listed species, as defined in Figure 6	Reporting requirements and updates on investigations to be determined through the Shire Development Application process.	Proponent
Annual reports Section 7.1	A summary of all carcass and operational monitoring activities performed	Within three months of the conclusion of the first and second year of the carcass monitoring program.	Proponent

8. References

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Appendices

Appendix 1: Carcass data sheet

WEST ARTHUR WIND FARM CARCASS DATA-SHEET*				
Please fill out all details above the heavy line for each site searched All details below the line are required if a carcass is found Do not move a carcass until the details below have been completed				
Reference number				
Date:				
Start Time:				
Finish Time:				
Turbine Number:				
Wind direction and strength in preceding 24 hours:				
Any unusual weather conditions in last 48 hours?				
Distance of Carcass from Tower (m):				
Bearing of Carcass from Tower (magnetic deg):				
Preliminary Species Identification:				
Photo Taken**	Yes / No			
Signs of injury:				
How old is carcass estimated to be (tick category):	<24 hrs	1-3 days	> 3 days	Other
Other Notes (i.e. sex/age of bird) and substrate:				
Post Find Actions: 1. Place carcass in sealable plastic bag then wrap it in newspaper and into another plastic bag (with copy of this sheet within) and take to freezer at site office. 2. Contact project ecologist to confirm identification of carcass				
* One form should be completed for each carcass found				
** Please attach photos to this form				