Appendix AA

Bird and Bat Adaptive Management Plan

KENTBRUCK GREEN POWER HUB

DRAFT Bird & bat adaptive management plan for Kentbruck Green Power Hub

Preliminary Draft

Prepared for Neoen Australia Pty Ltd

19 August 2024

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Contents

1 Introduction

This document has been prepared as a draft. It is intended to provide the framework and rationale for a plan that will be finalised prior to operation of the Kentbruck Green Power Hub Project. Neoen Australia intends to collaborate closely with regulatory authorities in development of a final plan. At the time of preparing this draft, the Project, if approved, is not expected to be operational for some years. Understanding of bird and bat interactions with wind energy facilities is in a stage of rapid growth and methods and techniques to minimise negative effects of wind energy on fauna are also progressing rapidly. In preparing this draft it has been necessary to provide a level of detail, but knowledge and management measures set out here may be superseded prior to the Project becoming operational.

Neoen Australia is committed to implementation of a final Bird and Bat Adaptive Management Plan that will provide management measures with demonstrable effectiveness current at the time of Project commencing operation. The final Plan will provide detailed allocation of roles, responsibilities and commitments for all management actions. Commitments made in this draft are firm and will be carried forward into the final Plan.

1.1 Policy framework and plan objectives

This draft Bird and Bat Adaptive Management Plan (BBAMP) for Kentbruck Green Power Hub (KGPH) has been prepared for Neoen Australia in line with the Policy and Planning Guidelines for Development of Wind Energy Facilities in Victoria (DELWP 2021) which provides example permit conditions, as set out below:

Bats and Avifauna Management Plan

1. The Environmental Management Plan must include a Bat and Avifauna Management Plan (BAM Plan), which must:
    a) include a statement of the objectives and overall strategy for minimising bird and bat strike arising from the operation of the facility include a mortality monitoring program of at least two years duration that commences when the first turbine is commissioned, or such other time approved by DEECA (Environment Portfolio). The monitoring program must include:
        i. procedures for reporting any bird and bat strikes to DEECA (Environment Portfolio) monthly
        ii. information on the efficacy of searches for carcasses of birds and bats, and, where practicable, information on the rate of removal of carcases by scavengers, so that correction factors can be determined to enable calculations of the likely total number of mortalities
        iii. procedures for the regular removal of carcasses likely to attract raptors to areas near turbines
    b) be approved by DEECA (Environment Portfolio) prior to submission to the responsible authority.
2. When the monitoring program required under the BAM Plan is complete, the operator must submit a report to the responsible authority and DEECA (Environment Portfolio), setting out the findings of the program. The report must be:

a) to the satisfaction of the responsible authority and DEECA (Environment Portfolio)

b) made publicly available on the operator's website.

3. After considering the findings of the monitoring program and consulting with DEECA (EnvironmentPortfolio), the responsible authority may direct further investigation of impacts on birds and bats. The further investigation must be undertaken to the satisfaction of the responsible authority and DEECA (Environment Portfolio).

The draft BBAMP has been prepared with consideration of bird and bat species potentially at risk of turbine collision at the proposed wind farm.

It has also been informed by the Australian Government guidance documents:

Environmental Management Plan Guidelines 2024 (DCCEEW 2024), and

Onshore Wind Farms – interim guidance on bird and bat management (DAWE 2022).

DCCEEW (2024) sets out requirements for inclusion of a number of specific items, such as administrative information and a declaration of accuracy; an executive summary or introduction; conditions of approval reference table; particulars of environmental management roles and responsibilities, reporting arrangements; environmental management measures; audit and review conditions, etc. A number of these aspects are incorporated into this draft BBAMP, while others cannot yet be specified, but will be included in detail in a final version of the BBAMP.

DAWE (2022) is specific to management for birds and bats at onshore wind energy projects. It provides a useful summary of data and reporting requirements for BBAMP's and has been followed in the preparation of this plan.

'Collision' is used here in reference to incidents in which an animal physically strikes, or is struck by, the moving blades of a turbine and to the potential for barotrauma. Barotrauma in bats was described by Baerwald *et. al*. (2008) as the fatal effect on an animal's respiratory tract due to its encountering a rapid change in air pressure close to a moving turbine blade. The effect has since been questioned as it has been shown to be difficult to diagnose and may have been confused with traumatic injury associated with direct collisions (Rollins et al. 2012).

Under the three phases of a Bird and Bat Management Package set out in DAWE (2022), this draft BBAMP forms the third phase designed to address *"post commissioning requirements, including monitoring and adaptive management to identify any impacts and ongoing improvement measures*". The draft BBAMP has also taken account of recently endorsed BBAMP's for other onshore wind energy facilities in south-west Victoria. Likely planning permit conditions are noted in general terms, and this draft plan has been formulated in response to these and project specific characteristics, including the nature of the site and the species at risk.

The details of the final BBAMP will be developed in response to planning permit conditions and in consultation with DEECCA and the responsible authority. It is anticipated that permit conditions will require a final BBAMP to be prepared in consultation with DEECA and to the satisfaction of the responsible authority and that it will be a requirement for the BBAMP to operate for at least five years.

The primary objective of this BBAMP is:

To ensure operations of Kentbruck Green Power Hub do not result in net significant or lasting impacts on the viability or conservation status of birds and bats.

In order to achieve this overall objective, this draft BBAMP sets out a program to be implemented at the operational wind farm that is designed to achieve the following:

- Measure bird and bat activity in a manner that maximizes the capacity to detect change in activity rates and that permits comparison with rates measured prior to construction and operation of the facility. Measure impacts on birds and bats due to collisions with project infrastructure in a manner that permits calculation of estimates of annual total collisions by species of concern (Lumsden et al. 2019) that are as precise as is practicable.
- Use information obtained from the above to ascertain whether the project may be causing net significant or lasting impacts on the viability or conservation status of bird and bat species of concern. It is recognised that the potential to determine effects on viability of populations may be limited by available information about them.
- Implement measures to reduce the likelihood of any collisions by species of concern. These measures may entail reduced electricity generation by the Project.
- In response to the detection of prescribed trigger levels of bird and bat mortalities due to collision, implement measures to reduce the likelihood of further collisions by species of concern, regardless of possible impacts at the population level. These measures may entail reduced electricity generation by the Project.

In recognition of the potential 30-year life of the Project and of current uncertainties about the potential responses of birds and bats to the Project, the draft BBAMP proposes a flexible adaptive management approach.

2 Project background

2.1 Overview of Kentbruck Green Power Hub

The final Project (Figure 1 Project location and layout) as proposed would comprise:

- A wind farm of up to 600 MW, consisting of up to 105 wind turbines and associated permanent and temporary infrastructure.
- A new 275 kV transmission line, which would connect the Project to the existing AusNet electricity transmission network. The transmission line would extend from the eastern boundary of the wind farm site to the existing 275/500 kV Heywood Terminal Station. The transmission line would be approximately 26.6 kilometres in length and be entirely underground.

The Project is located around 330 kilometres west of Melbourne between Portland and Nelson, Victoria.

The wind farm portion of the Project Area encompasses approximately 8,318 hectares of private and public land including some road reserves, and a transmission line connection to the electricity grid. Two export transmission line options were investigated. Option Two was removed as a viable option by Neoen in June 2021 and is therefore not considered further in this BBAMP.

The Project Area is within the:

- Glenelg Plain, Bridgewater and Victorian Volcanic Plains Bioregions
- Glenelg River Basin
- Management area of the Glenelg Hopkins Catchment Management Authority (CMA)
- Glenelg Shire local government area.

2.2 Wind farm and turbines

Portland–Nelson Road bisects the wind farm site in a generally east-west direction. The site is generally bound by plantation forestry to the north, highly modified grazing land to the east and west, Discovery Bay Coastal Park to the south, and the Lower Glenelg National Park and Cobboboonee National Park to the east and north-east (Figure 1a and b).

The proposed wind farm site is approximately 8,318 hectares in area and comprises 121 individual land parcels owned by 22 different landholders. The site is located primarily within an area that has been substantially modified and is used for commercial Radiata Pine softwood forestry production, with a small portion of land used for agricultural purposes (primarily grazing). The plantation area has an existing network of public and private roads.

At this stage, 4 MW to 8 MW wind turbines are proposed and will have the following features:

- Maximum rotor tip height of 270 metres.
- Maximum rotor diameter of 190 metres.
- Minimum lower blade sweep height of 60 metres.

The KGPH contains turbines in locations with contrasting environmental characteristics, including commercial Radiata Pine plantations, commercial Blue-gum Plantations and areas of cleared farmland managed for grazing and cropping. The characteristics of these environments are summarised in the sections below.

2.2.1 Pine plantation

The majority of turbines are located within a commercial plantation of Radiata Pine *Pinus radiata*. These plantations are managed on a rotation of approximately 30 years, with a range of thinning operations undertaken at various times. Mature trees reach heights of approximately 35 m prior to final clear-felling. The rotor swept zone of turbines will be between 60 m to 270 m above ground, meaning that when trees are mature, the rotor swept zone will commence approximately 25 m above the tallest trees in the plantation. All trees will be cleared up to 50 m from each turbine location. Additional cleared areas near turbines will include access roads and hard stands.

2.2.2 Blue-gum plantation

Two small areas of Blue Gum *Eucalyptus globulus* plantations are located in the eastern portion of the KGPH. Plantation management is similar to the pine plantations, with a rotational period of approximately 30 years, and trees reaching heights of 35 m. All trees are cleared up to 50 m from each turbine location. Additional cleared areas near turbines will include access roads and hard stands.

2.2.3 Farmland

Two areas of farmland are included in the KGPH, one small area at the far western end of the site, and a larger area in the east, to the north-east of Portland Nelson Road. These areas have been cleared of native vegetation relatively recently and are managed for grazing and cropping. The eastern farmland area supports numerous small wetlands and is positioned adjacent to the Kentbruck Heath. Turbine development has been excluded in all of the eastern farmland to avoid disturbance to Brolga breeding sites.

2.3 Transmission lines

2.3.1 Export transmission line

The route for a transmission line to export electricity from the wind farm to the external electricity grid generally extends between the eastern boundary of the proposed wind farm site and the existing Heywood Terminal Station located inside the western boundary of the Narrawong Flora Reserve / Mount Clay State Forest (on land owned by AusNet). This transmission line connection is approximately 26.6 kilometres long. Within Cobboboonee National Park and Cobboboonee Forest Park, the transmission line would be located beneath Boiler Swamp Road (for a distance of approximately 17.6 kilometres) which bisects the Parks in an east to west direction. The underground section would be constructed within a 6.5 metre construction footprint, with cabling buried at a depth of approximately 1.25 metres beneath the existing road. Construction would be mostly via trenching, with horizontal directional drilling (HDD) used in several locations to avoid impacts on waterways, including the Surrey River. After exiting Cobboboonee Forest Park the underground line would continue for 1.2 kilometres through freehold agricultural land to the Surrey River. To the east of the Surrey River, the transmission line would continue underground to

2.3.2 Onsite wind farm powerlines

The Project would involve the installation of up to 190 kilometres of underground powerlines (33 kV or 66 kV) connecting the wind turbines to collector substations, and up to 27.8 kilometres of a high voltage powerline connecting the collector substations to the main substation. The high voltage powerline would likely be 275 kV (subject to detailed design) and would run overhead along Portland–Nelson Road from the western collector substation to the eastern collector substation. From there it would either continue overhead along Portland–Nelson Road to a transition station at the Portland–Nelson Road / Sandy Hill Road intersection or would transition to underground at the collector substation and run beneath existing roads in the GTFP pine plantation to the Sandy Hill Road intersection. From there it would pass beneath Portland–Nelson Road then continue underground to the main substation through agricultural land.

Figure 1 Project area location

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Matter: 35014,
Date: 01 December 2023,
Checked by: IV, Drawn by: JPT, Last edited by: jturner
Layout: aa_F1_Locality_singlepage
Location: P:\31900s\31983\Mapping\31983_Project.aprx

3 The Adaptive Management approach and this Plan

As outlined above, the BBAMP is a key document in the planning permit framework for the KGPH Project and, in its final form is expected to be a condition of a planning permit for the Project.

Adaptive Management is a widely used process in environmental management. It is a relevant process to the KGPH project because of the nature of uncertainties inherent in limited knowledge of ecological systems and of the capacity to forecast impacts with a high level of precision. Thus, to some degree, there is little alternative but to learn by empirical experience and adapt accordingly. The adaptive management approach proposed for this BBAMP can be summarised as follows: (Figure 1):

Plan – identification of an environmental impact and determination of objectives and management strategies.

Do – implementation of initial management strategies and introduction of monitoring to obtain relevant information or data on the impact.

Evaluate and Learn - evaluation of these data for evidence of effects or the need for modifications to monitoring, the preparation of trials or tests of potential mitigation strategies.

Adjust – if identified in the previous process step (evaluate and learn) implement necessary adjustments to management strategies, monitoring, operational approaches.

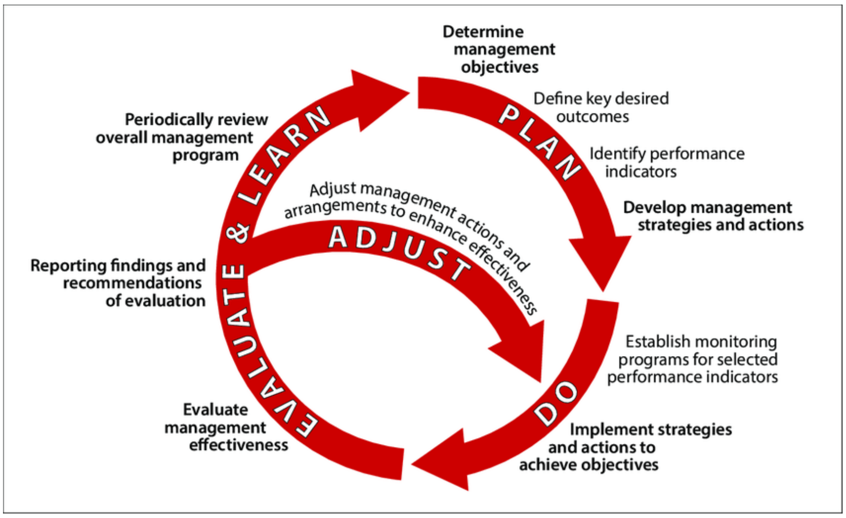

Figure 3 The adaptive management process (based on Walters 1986)

The process is intended to be reiterative and continue for as long as reasonably practicable, with the logical end point being when the impact has been resolved or is sufficiently understood (and does not require further management intervention).

This BBAMP provides more detail on the overall application of the process to the issue of impacts on birds and bats that may result from the KGPH Project and expands on the details of the commitments made.

The approach should be considered in the context of current knowledge and management strategies and it is acknowledged that intrinsic to the adaptive management process is review and adjustment, and on this basis, there may be merit in adjusting the current approach.

4 Background to wind energy impacts on birds and bats

4.1 Summary of the issues

Wind farms have been documented to have various effects on birds and bats. Most of them appear to be species-specific and influenced by the behaviours of the species involved and the design, siting and operational control of the wind farm infrastructure. The potential effects on birds and bats include disturbance at various spatial scales and collisions with wind turbines, particularly with moving rotor blades of wind turbines.

Some level of disturbance of birds and bats may occur due to the presence or operation of turbines or other activities associated with wind energy facilities, but such effects are extremely difficult to quantify. Siting of infrastructure at minimum distances from key habitat resources is the most widely adopted measure aimed at reducing negative disturbance effects. Displacement, in which some species preferentially avoid an entire wind farm has been demonstrated for some species of marine birds in the northern hemisphere but has not been documented for species using onshore wind farm areas in Australia.

The primary focus internationally, and in Australia is on the potential for birds and bats to collide with turbines.

'Collision' is used here in reference to incidents in which an animal physically strikes, or is struck by, the moving blades of a turbine and to the potential for barotrauma. Barotrauma in bats was described by Baerwald *et. al*. (2008) as the fatal effect on an animal's respiratory tract due to its encountering a rapid change in air pressure close to a moving turbine blade. The effect has since been questioned as it has been shown to be difficult to diagnose and may have been confused with traumatic injury associated with direct collisions (Rollins et al. 2012).

Significant effort has been put into monitoring of collisions at onshore wind farms and usually entails a regime of carcass searching, frequently using purpose-trained dogs. In Australia, it is now a routine condition of approval for wind farms to undertake a prescribed program of carcass monitoring and to report results to regulatory authorities and to the public.

To-date, there has been limited published analysis of bird and bat fatalities at Australian wind farms. Hull & Cawthen (2013) and Hull et al. (2013) published results from two Tasmanian wind farms with a combined total of 62 turbines that were monitored for different periods but over a total span of eight years. They detected 245 bird carcasses and 54 bat carcasses during a total of 12,908 searches. It is important to note that due to sampling methods detection rates do not equate to total numbers of collision fatalities that may have occurred. Nonetheless, extrapolating from their samples it appears unlikely that total collision fatalities represent significant impacts on the population viability of any species.

The number of documented mortalities from turbine collisions at Victorian wind farms was collated in Moloney et al. (2019). They point out that "any consideration of the magnitude or rate of turbine collisions necessarily must account for uncertainties due to factors such as representative sampling and the influences of searcher efficiency and carcass persistence rates." They also conclude that, "An analysis of the available data showed that there is a high level of variability in the quality of the data collected and the resulting annual mortality estimates" (Moloney et al. 2019). As of 2023 we still lack comprehensive, quantified empirical information about collision rates for any Victorian species.

4.2 Measures to avoid, reduce and mitigate impacts

Multiple strategies and techniques are in use to avoid, reduce and/or mitigate effects of wind energy on birds and bats. Details of methods and their potential for application at the KGPH Project are provided in Sections 6 and 7.

Avoidance or reduction of disturbance and collisions is clearly the best approach and can include multiple aspects of the siting and design of a wind farm. It may also involve operational strategies such as curtailment in which turbines are prevented from operating during key times or by systems that detect and shutdown turbine(s) when significant species fly close to them.

If a residual level of impact still exists following the implementation of measures to avoid and reduce collisions, it may be appropriate to enact measures to compensate for the residual impacts. The intention of such efforts is to ensure that there is no net loss in the overall population of any significant species. This offsetting approach is an element of policy under Commonwealth and Victorian biodiversity legislation.

5 Baseline information for Kentbruck Green Power Hub

5.1 Information sources

Pre-construction surveys for birds and bats at the site of KGPH were undertaken in accordance with *Survey guidelines for Australia's threatened birds. Guidelines for detecting birds listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999* (DEWHA 2010a) and *Survey guidelines for Australia's threatened bats. Guidelines for detecting bats listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999* (DEWHA 2010b) and project-specific guidance from DEECCA. As noted in those guidelines, the surveys were designed to determine presence or the probability of presence of various species. Bird utilisation surveys were designed to establish and assess species abundance or other measures such as quantified flight rates for different species.

Pre-construction surveys have been conducted by Biosis, and are documented in the following reports:

- Kentbruck Green Power Hub Environment Effects Statement Technical Report - Flora and Fauna Existing Conditions and Impact Assessment (Biosis 2024a)
- Kentbruck Green Power Hub Environment Effects Statement Technical Report – Southern Bent-wing Bat Impact Assessment (Biosis 2024b)
- Kentbruck Green Power Hub Environment Effects Statement Technical Report – Brolga Impact Assessment (Biosis 2024c)

Field investigations undertaken for the Project include:

- General fauna surveys: 2018-2021
- Bird utilisation surveys: every second month from April 2020 to February 2021, inclusive.
- Targeted surveys for Brolga: 2018–2021 including aerial surveys in 2020.
- Acoustic monitoring for microbats, including detectors at ground level and at multiple heights on met masts: 2018-2020.

Details of survey effort, results, impact assessment and mitigation recommendations can be found in the relevant technical reports.

5.2 Taxa covered by the Plan

The impact assessment presented in Biosis (2024a) highlights species of conservation concern (listed as threatened and/or migratory under the EPBC Act and/or as threatened under the FFG Act) that have potential to be impacted by the project.

This draft BBAMP is applicable to all the taxa listed in Table 1. In this plan, these are collectively termed 'species of concern'. A list of such species for Victoria is provided in Lumsden et al. (2019). Table 1 includes species that are considered to have some potential to fly through the project area, and that are:

- listed as threatened or migratory under provisions of the EPBC Act or FFG Act;
- non-threatened species considered to have potential for collisions due to flight behaviours (e.g. raptors), or habitat preferences (e.g. Yellow-tailed Black Cockatoo).
- species listed as of concern in Lumsden et al. (2019).

In addition to species listed in Table 1, the BBAMP is applicable to any species subsequently found to occur at the site and that is listed as:

- threatened or migratory under provisions of the EPBC Act or FFG Act;
- non-threatened species listed as of concern in Lumsden et al. (2019) that were not previously known or predicted to occur at the site.
- non-threatened species listed as contributing to the protected values of the Glenelg Estuary and Discovery Bay Ramsar site as listed in the site's ecological character definition (DELWP 2017).

All species specifically mentioned in Appendix A of the Scoping Requirements for Kentbruck Green Power Hub Environmental Effects Statement are encompassed in the above categories.

Where available, the estimated population sizes of species are shown in Table 1. For subspecies or geographically discrete subpopulations (e.g. Brolga) the estimate for the relevant portion of the overall population is shown. The estimates for birds are sourced from Garnett and Baker (2021) or BirdLife International (2023). Estimates for bats are sourced from Westcott et al. (2015) and Threatened Species Scientific Committee (2021). Many of the estimates for species are acknowledged to have low precision and estimates quoted are the mean values of substantial ranges. Estimates that are from counts considered to have good precision are shown in **bold**. Subspecies and subpopulations are shown in square brackets.

Table 1 Bird and bat species at potential risk of collision

Common name	Scientific Name	EPBC Status	FFG Status	Australian or regional population estimate
Lewin's Rail	*Lewinia pectoralis*		VU	
Caspian Tern	*Hydroprogne caspia*	Mi	VU	
Crested Tern	*Thalasseus bergii*	Mi		
Grey Plover	*Pluvialis squatarola squatarola*	Mi	VU	
Hooded Plover	*Thinornis cucullatus cucullatus*	VU	VU	[3,000]
Double-banded Plover	*Charadrius bicinctus*	Mi		**13,000**
Bar-tailed Godwit	*Limosa lapponica*	Mi, VU	VU	41,500
Black-tailed Godwit	*Limosa limosa*	Mi	CR	126,300
Common Greenshank	*Tringa nebularia*	Mi	EN	**23,700**
Red-necked Stint	*Calidris ruficollis*	Mi		305,900
Sharp-tailed Sandpiper	*Calidris acuminata*	Mi		71,000
Sanderling	*Calidris alba*	Mi		
Latham's Snipe	*Gallinago hardwickii*	Mi		19,000
Australian Painted Snipe	*Rostratula australis*	EN	CR	340
Brolga	*Grus rubicundus*		EN	**[800]**
Little Egret	*Egretta garzetta*		EN	
Eastern Great Egret	*Ardea alba modesta*		VU	
Australian Little Bittern	*Ixobrychus dubius*		EN	
Australasian Bittern	*Botaurus poiciloptilus*	EN	CR	1,300
Magpie Goose	*Anseranas semipalmata*		VU	
Freckled Duck	*Stictonetta naevosa*		EN	
Hardhead	*Aythya australis*		VU	

Common name	Scientific Name	EPBC Status	FFG Status	Australian or regional population estimate
Blue-billed Duck	*Oxyura australis*		VU	15,000
Musk Duck	*Biziura lobata*		VU	
Spotted Harrier	*Circus assimilis*			
Swamp Harrier	*Circus approximans*			
Brown Goshawk	*Accipiter fasciatus*			
Collared Sparrowhawk	*Accipiter cirrocephalus*			
Wedge-tailed Eagle	*Aquila audax*			
Little Eagle	*Hieraaetus morphnoides*		VU	55,000
White-bellied Sea-Eagle	*Haliaeetus leucogaster*		EN	>1,000
Whistling Kite	*Haliastur sphenurus*			
Black-shouldered Kite	*Elanus axillaris*			
Australian Hobby	*Falco longipennis*			
Peregrine Falcon	*Falco peregrinus*			
Brown Falcon	*Falco berigora*			
Nankeen Kestrel	*Falco cenchroides*			
Powerful Owl	*Ninox strenua*		VU	2500
Red-tailed Black-Cockatoo	*Calyptorhynchus banksia graptogyne*	EN	EN	[**1100**]
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*			
Gang-gang Cockatoo	*Callocephalon fimbriatum*	EN		25,300
Orange-bellied Parrot	*Neophema chrysogaster*	CR	CR	**70**
Blue-winged Parrot	*Neophema chrysostoma*	EN		10,000
Ground Parrot	*Pezoporus wallicus*		EN	
White-throated Needletail	*Hirundapus caudacutus*	Mi, VU	VU	**41,000**
Chestnut-rumped Heathwren	*Calamanthus pyrrhopygius*		VU	
Rufous Bristlebird (Coorong)	*Dasyornis broadbenti broadbenti*		EN	[17,800]
Grey-headed Flying-fox	*Pteropus poliocephalus*	VU	VU	**680,000**
Yellow-bellied Sheathtail Bat	*Saccolaimus flaviventris*		VU	
Southern Bent-winged Bat	*Miniopterus orianae bassanii*	CR	CR	**44,300** [**1445** Portland subpopulation]

6 Project design aimed at avoidance of impacts

6.1 Landscape-scale avoidance

Avoidance of potential impacts through landscape-scale spatial planning and site design is considered the most effective primary means of achieving good ecological outcomes.

The wind farm component of the KGPH Project is intentionally sited largely within a commercial pine plantation that has low habitat values for the great majority of native birds and bats.

In addition, turbines that were originally planned to be sited in an area of agricultural grazing land at the eastern extremity of the Project area have been removed from the design to reduce the potential for impacts on Brolga and other species of birds and bats that may utilise the adjacent Kentbruck Heath and / or move between that area and Discovery Bay Coastal Park. The layout design for the Project has also removed proposed turbines from the north-western extremity so that the distance between turbines and known roost sites of Southern Bent-winged Bat near Glenelg River is a minimum of five kilometres.

The Project's site was selected to:

- Avoid large areas of native vegetation
- Avoid remnant patches of native vegetation with higher condition scores
- Avoid areas of medium and high value habitat for species with a high biodiversity risk rating
- Avoid listed threatened ecological communities
- Use land identified as suitable for wind energy facility use and development in the Glenelg Planning Scheme
- Avoid areas of identified important breeding, roosting or foraging habitat for listed threatened or migratory bird species.

6.2 Avoidance of potential for collisions and disturbance

The design of KGPH Project has reduced the potential for turbine collisions and disturbance by the allocation of turbine-free buffers from the wetlands used for any known or potential breeding by Brolgas. The process applied to determine these buffers, and the resulting buffer sizes and locations, are documented in the Brolga Impact Assessment report (Biosis 2024c). Where those buffers exist they will act to limit potential risk of turbine collision for all birds and bats that use the relevant wetlands. The Project has also been designed so that no wind farm infrastructure will be sited within 300 metres of any common boundary with the Glenelg Estuary and Discovery Bay Ramsar site or within 500 metres of any wetland within the Ramsar site.

The use of turbines with a lowest blade-tip height of 60 metres above the ground is significantly higher than turbines at existing onshore wind farms in Australia and is a measure specifically designed to reduce the potential for collisions by many species of birds and bats whose flight activities are concentrated in the airspace below that height.

Undergrounding of a significant portion of the export transmission cable is a further measure that has been incorporated into the Project design for the purpose of eliminating the potential for birds and bats to collide with or to be electrocuted by an overhead transmission line.

Table 2 shows bird and bat species, including all listed threatened and / or migratory species that have some potential of collision with Project infrastructure. The table shows five key siting and design factors of the Project with a tick mark indicates the potential for each factor to limit potential for collisions by each species.

Table 2 KGPH Project siting and design factors likely to limit potential risk of collision by birds and bats

Common name	Siting on land managed for plantation forestry	Siting on land cleared for agriculture	Buffers from Ramsar boundary or other wetland	60 metre lower blade tip height	Underground transmission lines
Lewin's Rail	✓	✓	✓	✓	✓
Caspian Tern	✓	✓	✓	✓	✓
Crested Tern	✓	✓	✓	✓	✓
Grey Plover	✓	✓	✓	✓	✓
Hooded Plover	✓	✓	✓	✓	✓
Double-banded Plover	✓	✓	✓	✓	✓
Bar-tailed Godwit	✓	✓	✓	✓	✓
Black-tailed Godwit	✓	✓	✓	✓	✓
Common Greenshank	✓	✓	✓	✓	✓
Red-necked Stint	✓	✓	✓	✓	✓
Sharp-tailed Sandpiper	✓	✓	✓	✓	✓
Sanderling	✓	✓	✓	✓	✓
Latham's Snipe	✓		✓	✓	✓
Australian Painted Snipe	✓	✓	✓	✓	✓
Brolga	✓		✓	✓	✓
Little Egret	✓		✓	✓	✓
Eastern Great Egret	✓		✓	✓	✓
Australian Little Bittern	✓	✓	✓	✓	✓
Australasian Bittern	✓	✓	✓	✓	✓
Magpie Goose	✓		✓	✓	✓
Freckled Duck	✓		✓	✓	✓
Hardhead	✓		✓	✓	✓
Blue-billed Duck	✓		✓	✓	✓
Musk Duck	✓		✓	✓	✓
Spotted Harrier	✓			✓	✓
Swamp Harrier	✓	✓	✓	✓	✓
Brown Goshawk	✓	✓		✓	✓
Collared Sparrowhawk	✓			✓	✓
Wedge-tailed Eagle	✓				✓
Little Eagle	✓				✓
White-bellied Sea-Eagle	✓		✓		✓
Whistling Kite	✓			✓	✓
Black-shouldered Kite	✓			✓	✓
Australian Hobby	✓				✓
Peregrine Falcon	✓				✓
Brown Falcon	✓				✓

Common name	Siting on land managed for plantation forestry	Siting on land cleared for agriculture	Buffers from Ramsar boundary or other wetland	60 metre lower blade tip height	Underground transmission lines
Nankeen Kestrel	✓				✓
Powerful Owl	✓	✓	✓	✓	✓
Red-tailed Black-Cockatoo	✓	✓	✓	✓	✓
Yellow-tailed Black-Cockatoo		✓		✓	✓
Gang-gang Cockatoo	✓	✓	✓	✓	✓
Orange-bellied Parrot	✓		✓	✓	✓
Blue-winged Parrot	✓			✓	✓
Ground Parrot	✓	✓	✓	✓	✓
White-throated Needletail					✓
Chestnut-rumped Heathwren	✓	✓	✓	✓	✓
Rufous Bristlebird (Coorong)	✓	✓	✓	✓	✓
Grey-headed Flying-fox		✓		✓	✓
Yellow-bellied Sheathtail Bat	✓	✓	✓	✓	✓
Southern Bent-winged Bat		✓	✓	✓	✓

7 Potential operational project measures to minimise impacts on birds and bats

This section offers a brief review of potential methods to reduce turbine collision risk for birds and bats that may be applicable for the KGPH Project. Several of these measures could be implemented for routine operation of the KGPH Project or as adaptive responses to impacts that are determined to occur during operation of the Project. The discussion is divided into the following basic concepts:

- Automated systems designed to detect birds or bats in proximity to a turbine and curtail it.
- Curtailment of turbines as a pre-emptive method that may reduce collision risk
- Methods aimed at deterring bats and some birds from the proximity of turbines

For completeness, we also provide information about automated systems to detect collisions.

Several of these methods have potential for application to particular taxa and an indication of the primary species to which each method may be relevant for the KGPH Project is provided. For the purposes of the draft BBAMP, these are indicative only and specific applications will need to be fully informed by detailed information from manufacturers, experience at other wind farms and comprehensive consideration of suitability to specifics of the project and the project site prior to decisions about particular systems or applications to be used at the KGPH Project. With that in mind, discussion here avoids reference to particular manufacturers or suppliers. No consideration is given here to capital or running costs of any system.

As noted previously this is a draft BBAMP. The purpose of this section is to outline current methods and techniques while recognising that understanding of bird and bat interactions with wind energy facilities is in a stage of rapid improvement and methods and techniques to minimise negative effects of wind energy on fauna are also progressing rapidly. In preparing this draft it has been necessary to provide a level of detail, but knowledge and management measures set out here may be superseded prior to the Project becoming operational.

The literature on this field is extensive. Recent international reviews of current technologies and specific systems are provided in *Proceedings from the state of the science and technology for minimizing impacts to bats from wind energy* (Hein & Straw 2021) and *Review of seabird monitoring technologies for offshore wind farms* (Nicholls et al. 2022). The latter is aimed at offshore wind energy but virtually all of the technologies reviewed are applicable to the onshore environment.

The Project proponent is committed to implementation of a final BBAMP that will provide management measures with demonstrable effectiveness current at the time of Project commencing operation.

7.1 Turbine curtailment

A number of methods have the potential to reduce the incidence of fauna colliding with turbines by acting pre-emptively to reduce their exposure to the turning rotors of operational wind turbines. The following is a brief review of those methods and a consideration of their potential application at KGPH Project.

These methods fall into the following two broad categories:

- Automated systems designed to detect fauna within a prescribed proximity to a turbine and shut it down until the animal has moved way.

- Setting the minimum wind-speed at which turbines begin to operate (turbine 'cut-in' wind-speed) at a level above the range of wind-speeds during which a bat species of concern spends most time in flight. This approach is termed 'low wind-speed turbine curtailment'.

To-date an automated curtailment system is known to be in operation at one wind farm in Australia and use of a prescribed cut-in wind speed is known to have been used in an experimental manner at two Australian wind farms. There is thus limited empirical experience of the capacity of these methods and of their applicability to various species of Australian birds and bats.

7.1.1 Automated systems to reduce collision risk

The most current and/or promising methods to minimise bird and bat collisions with turbines are technologies that detect an animal that is approaching the turning turbine rotor in real time and integrate with the turbine control system (SCADA) to rapidly turn the turbine off. While messages can be transmitted quickly, turbines still require substantial time to come to a halt, which may require approximately 30 seconds depending on the turbine model. As a result, these systems, as they are currently developed, are most suited to detecting birds or bats that are large enough to be detected with sufficient time and distance to allow for the turbine to be shut down before a collision can occur. Even with this limited warning time, these systems may still have a role in reducing collision risk for species that fly in groups, or species that may not have a linear flight path towards turbines.

A variety of such systems are now commercialised and in use at operating wind farms overseas and, at the time of writing at one wind farm in Tasmania (see section 7.1.1.2). In some cases, this approach has capacity to be species-specific and minimise loss of electricity generation by its operation on individual turbines and the ability to power-down only for the duration of the animal's presence. These methods are generally termed 'smart turbine curtailment'. The important advantage of these types of systems is that they are triggered by the detected presence of a target species and can thus be expected to be the most efficient means to both reduce collision risk and to minimise lost electricity generation.

As these technologies are progressing very rapidly and confirmation of their abilities is also improving at pace, it will be appropriate to recommend specific applications during the final design and construction stages of the Project.

Commercially available systems differ primarily in the technology for detection of relevant species and to some extent they have applications to different fauna. They employ radar, infrared and/or visible light imaging cameras or detection of bat calls to determine the presence of an animal and its proximity to a turbine. Some now use integration of more than one of these technologies into a single system.

7.1.1.1 Integrated radar systems

A number of commercially available automated systems use radar, linked to the turbine SCADA system to detect target species and to respond by shutting down turbines when an animal is within a prescribed radius of a turbine or turbines. Radar uses radio waves to scan a given radius to detect objects within the airspace.

Major advantages of radar as a detection method include:

- The capacity for a single unit to simultaneously scan and plot the positions and movements of multiple targets over horizontal distances spanning several kilometres, subject to environmental conditions including topography and interference by clutter.
- Simultaneous use of horizontal and vertical surveillance radars allows scanning in three dimensions, limited to a small proportion of the total airspace.
- The capacity to detect objects throughout the 24-hour cycle.

Where the surrounding terrestrial landscape has a complex topography or multiple obstacles such as the wind turbines themselves, trees or buildings, this 'clutter' renders radar ineffective for detecting targets that are close to the ground or amongst those obstacles. Capacity of radar can also be substantially limited or reduced by rain or other weather conditions.

A major drawback of radar is that it does not have intrinsic capacity to distinguish particular species. Radar alone may also not function well to provide smart curtailment. This is because a radar beam sweeps through 360° in a defined interval which may allow sufficient time for a bird that was not on a collision trajectory to change course and collide before a curtailment can be instigated.

Information about the use of radar at wind farms elsewhere suggest that its primary applications are where the species of concern are large birds or flocks of birds that are approaching a wind farm from outside its boundaries. It has been of value in detecting the approach of migrating flocks of birds or of individuals of large species like eagles, vultures or cranes. This type of application is of particular relevance where such events may occur seasonally or infrequently and a turbine shut-down can be used to reduce collision risk while the animals pass through the wind farm.

Possible applications for KGPH

Radar detection may be suitable to detection of medium to large species of birds and, while it does not have capacity to distinguish between species, its generic application could be expected to detect medium to large species including South-eastern Red-tailed Black Cockatoo, Australasian Bittern, Brolga and raptors. It may also be suitable to detection of flocks of migratory shorebirds and White-throated Needletail. It may also detect medium to large nocturnal birds, such as owls, and the flights of Grey-headed Flying-fox. The Project proposes to use turbines with a lowest rotor tip height of 60 metres above the ground. Mature plantation trees have a maximum height of approximately 30 – 40 metres. A risk of collision will thus exist only for birds and bats flying above the tree canopy and it is thus possible that radar mounted at an appropriate height may not be affected by the presence of trees and could effectively detect animals flying within rotor height. This requires confirmation from experienced radar technicians.

Radar is not likely to be suitable for detection of small birds or microbats, especially if they are active amongst trees and, as it does not have capacity to distinguish between species it is not likely to be of value to trigger turbine curtailment specifically for species like *Neophema* parrots or Southern Bent-wing Bat.

7.1.1.2 Integrated imaging systems

A number of commercially available automated systems use visible light cameras for daytime detection of flying animals and/or thermal imaging (infra-red) detectors for nocturnal detection. In a similar manner to the use of radar, these systems are linked to the turbine SCADA system to respond to an animal detected within a given radius of a turbine by shutting it down.

Various diurnal birds systems now in use at some facilities use high precision optical cameras programmed to track the movement of a target bird and calculate its trajectory relative to the rotor swept area of turbines in real time. Optical imaging requires a view that is not interrupted by items that might obscure the image of a fauna target (Cattle Hill Wind Farm 2023). The system requires a period of 'learning' in which multiple images of target species are used so that the system builds and refines its capacity to 'recognise' target species. The system is integrated with the turbine SCADA mechanism to feather the turbine blades out of the wind and thus stop it from turning until the bird has moved out of a predetermined zone and is no longer in danger. This type of system is in operation at the Cattle Hill Wind Farm in Tasmania for the detection of large raptors (Rogers 2022). Over four years it has been largely, but not entirely, effective in preventing collisions by Wedge-tailed Eagles. A recent refinement has been made to provide improved coverage of a forested area with a view to further reducing collisions (Cattle Hill Wind Farm 2023). Current commercially available systems may have limited capacity to detect small species of birds and bats.

Thermographic cameras detect radiation in the long-infrared range of the electromagnetic spectrum. Effectively this allows an image to be made from the variable temperatures of items in the absence of visible light. Detection of birds and mammals that maintain a constant body temperature can usually be achieved but is most effective when the temperature of the animal is substantially different from the ambient temperatures of the surrounding landscape. Thermal imaging requires a view that is not interrupted by items with thermal properties that might obscure the image of a fauna target. Thermal imaging cameras have now been used widely to detect and 'see' nocturnal wildlife and hand-held thermal imaging was used effectively to detect microbats at and near the KGPH Project.

It is worth noting that the majority of the international literature related to the use of thermal imaging at wind farms relates purely to detection of volant fauna at wind farms, and while thermal imaging has been widely used and reporting for that purpose, there appear to be few integrated turbine-control systems triggered by thermal imaging that have been fully tested beyond the experimental concept stage. One or two imaging systems that entail the use of thermal cameras to detect a target and then follow its movements are in development and may be available overseas. The alternative is the use of fixed thermal cameras that have a defined field of view and may require cameras to be mounted on each turbine. Available information suggests it is uncertain whether such systems can reliably and consistently monitor the entire rotor-swept areas of turbines, or the distance at which they might detect any particular species before it is at risk of a collision.

To-date, no commercial-scale wind energy project in Australia is known to have installed an integrated thermal imaging system to reduce collision risk for fauna. This is likely to be due to uncertainty about their reliability in the current, early conceptual stage of such systems and to the high initial capital and running costs of such systems.

A major advantage of visible light or thermal imaging as detection methods is that they have capacity to identify many animals directly to species.

Visible light cameras can be used only to detect diurnal species and they are dependent on appropriate light conditions and an uncluttered view. Thermal imaging functions best at night when there is a greater temperature differential between birds and bats and their surrounds. Both systems can operate over distances that are substantially shorter than those over which radar functions.

Possible applications for KGPH

For the KGPH site, visible light or thermal imaging may require cameras designed to view multiple turbines to be mounted above the maximum height of tree-tops and/or require individual camera(s) for each turbine.

It is not known whether the machine learning used by these systems has the capacity to successfully respond to multiple target species as would be required at the KGPH site. If it does not, it may still be of value to detection of the highest priority species.

Visible light or thermal imaging may be applicable to detection of species including South-eastern Red-tailed Black Cockatoo, Gang-gang Cockatoo, Orange-bellied Parrot, Blue-winged Parrot, Australasian Bittern, Brolga and medium to large raptors. Current technology is unlikely to be able to identify these species to species level, but may be able to assign them to wingspan size categories. Thermal imaging may be suitable to detect owls and the nocturnal flights of other birds and of Grey-headed Flying-fox.

Appropriately calibrated thermal imaging is used at some overseas wind farms to detect microbats but it is not likely to have capacity to distinguish between species and is thus not likely to be of value to trigger turbine curtailment specifically for Southern Bent-wing Bat. Given the number of other species of microbats and that they are likely to be routinely present, this type of system may have limited application to Southern Bent-wing Bat for the KGPH Project.

Visible light or thermal imaging may be applicable to detection of species including South-eastern Red-tailed Black Cockatoo, Gang-gang Cockatoo, Orange-bellied Parrot, Blue-winged Parrot, Australasian Bittern, Brolga and medium to large raptors. Current technology is unlikely to be able to identify these species to species level, but may be able to assign them to wingspan size categories. Thermal imaging may be suitable to detect owls and the nocturnal flights of other birds and of Grey-headed Flying-fox.

At the time of preparing this draft BBAMP, systems using a combination of optical and thermal imaging have a demonstrable track record for preventing many collisions by large species of birds. This is the currently recommended technology to be used to trigger smart turbine curtailment for a variety of species for the KGPH Project (see also 7.1.1.3).

7.1.1.3 Combined radar and camera systems

Skov et al. (2018) developed and implemented an integrated system using radar, laser-ranging finding automated cameras and thermal cameras to observe real-life behaviour of birds at the Thanet (UK) Offshore Wind Farm for 22 months. The study's monitoring system was designed to collect representative data on actual bird behaviour in the presence of wind turbines to determine empirical avoidance rates. While the system in that application was used for offshore wind turbines and was not intended to curtail turbines, a combined system of this type could readily by used to trigger turbine curtailment (H. Skov pers. comm. 2023).

It is likely that systems using multiple technologies in combination to trigger smart turbine curtailment will rapidly become the most effective in reduction of fauna collisions with wind turbines.

Possible applications for KGPH

A system employing a combination of radar, optical and thermal imaging is likely to provide improved smart of turbine curtailment over currently available systems that use cameras or radar alone. Recent communications with Henrik Skov indicate this system works for cranes (Common Crane, *Grus grus*) and could be trained to detect bitterns and other nocturnal species using thermal video footage (H. Skov pers. comm. 2024). Combined radar and camera systems at offshore wind turbines have been used to recognise and track Common Crane behaviour around turbines. Radar system with camera-tracking and automated shut-down has been implemented recently for an offshore wind energy project in Poland to avoid Common Crane collisions during migration. This technology could be used to mitigate collisions of the threatened species listed in Section 7.1.1.1 and Section 7.1.1.2.

At the time of preparing this draft BBAMP, systems using a combination of radar with optical and thermal imaging are not known to be commercially available, but it is likely that they may be prior to operation of the KGPH Project. It is recommended that the Project keeps up-to-date with developments to determine their potential application for the Project.

7.1.1.4 Integrated systems triggered by animal calls

Systems that use acoustic bat-call detectors mounted on turbines are in use for microbats at a number of wind farms overseas. When the call of a target species is detected the turbine control mechanism is programmed to stop the rotor from turning until no further calls by the particular species have been detected for a predetermined period and the bat is no longer considered to be in danger. A substantial review of this smart curtailment system is provided in papers in Hein and Straw (Hein & Straw 2021). This type of system is undergoing substantial current development.

Acoustic detection is now increasingly being used to determine the presence of birds by their calls and it is possible that this could see the development of call-detection as a technique for curtailment of turbines for some species of birds. This approach is reliant on animals vocalising in the vicinity of a turbine. While many microbats call almost constantly to echolocate, it is not likely that this will prove to be a reliable method for birds.

Possible applications for KGPH

A system employing acoustic bat-call detection as a trigger for turbine curtailment could have application for the two threatened species of microbats, Southern Bent-wing Bat and Yellow-bellied Sheathtail Bat. This type of system has not yet been demonstrated to function for any species in Australia, but the method is undergoing substantial current development. The relatively short detection distance of ultrasonic bat calls, and the time taken for turbines to stop rotating may limit the applicability of this approach.

If acoustic detection of birds can be developed as a trigger for turbine curtailment, such a system might be applicable to a variety of species such as Orange-bellied and Blue-winged Parrots, with the caveat that they may not be consistently vocalising in the vicinity of a turbine.

7.1.2 Low wind-speed turbine curtailment for Southern Bent-wing Bat

A number of investigations overseas have demonstrated that flight activity of small species of bats is concentrated on periods when wind-speeds are relatively low (i.e. at wind speeds of between approximately 0 and 7 metres per second) (Arnett et al. 2011, Arnett 2017, Martin et al. 2017). More recent refinements have taken into account additional factors such as humidity and rainfall and time of night (Hein & Straw 2021).

In recent years various studies have investigated whether a reduction in bat fatalities due to turbine collision can be achieved by programming the turbines to alter their night-time operation so that their rotors do not turn during periods of specified low wind-speed when many species of bats are most active (Arnett et al. 2011, Arnett 2017). This is termed 'low wind-speed turbine curtailment'.

A wind turbine will not operate under zero wind conditions, but as the wind-speed increases, the rotational speed of the rotor will also increase until it reaches a point where it is effective to generate electricity, this point is known as the 'cut-in' wind-speed. The manufacturer's rated cut-in speed for turbines planned to be used at KGPH Project is approximately 3.0 metres per second (m/s). The rotors of some turbines turn at wind speeds of between 0 metres per second and their rated cut-in speed. In this mode they present a collision risk even when not generating electricity. It will be important, subject to confirmation of technical requirements, that turbine rotor blades will remain feathered to minimise rotation during periods of the night when wind speeds are below the rated cut-in wind-speed.

Other conditions are known to inhibit flight activity of microbats including rainfall (Kerns et al. 2005) and low ambient temperature. Studies at the project site (see below) indicate that these conditions applied to SBWB.

The majority of published studies of low wind-speed curtailment have been undertaken in North America and the species primarily involved have been migratory, tree roosting bat species with relatively high incidences of collisions. Low wind-speed curtailment has been demonstrated to be an effective operational measure to reduce fatalities of these bats by up to 50% when turbine cut-in speed was increased from manufacturers' rated cut-in speed by at least 1.5 m/s. Importantly, a recent study in Victoria (Bennett et al. 2022) has also demonstrated that a significant reduction in microbat collisions was achieved by a targeted regime of low wind-speed turbine curtailment (raised cut-in wind speed to 4.5m/s), although the sample size of Southern Bent-wing Bats was too small (total of 3 mortalities detected) to provide a valid result for that species. A substantially larger experiment for low wind-speed curtailment is close to completion at Mount Emerald Wind Farm in north Queensland, but results are not yet available. Reports describing the Mount Emerald Wind Farm study are provided on the wind farm's website (https://mtemeraldwindfarm.com.au/compliance/).

While there is no empirical data about flight activity of Southern Bent-wing Bats, there is potential that low wind-speed turbine curtailment might reduce the incidence of turbine collisions by this species.

Possible applications for KGPH

Subject to refinements in other methods to minimise collisions that may prove to be of greater efficacy by the time of construction of the KGPH Project (see below), the Project plans to adopt a low wind-speed turbine curtailment strategy as a mitigation measure. This will include consideration of temporal factors (seasonal and daily) and climatic factors (temperature, rainfall and wind-speed).

Recommended parameters for curtailment timing include:

- **Seasons of highest activity: September to November and February to March (5 months in total).** 76% of confirmed, probable or complex calls assigned to the Southern Bent-wing Bat were recorded during this time.
- **Daily timing: Curtailment to commence 30 minutes following sunset and extend until three hours before sunrise.** 86% of confirmed, probable or complex calls were recorded during this time.
- **Cut-in wind speed of 4.5 m/s^{-1}.**
- **Climatic conditions: recommended curtailment parameters for temperature and rainfall to be developed during finalisation of the BBAMP.** 91% of confirmed, probable or complex calls were recorded at temperatures above 10ºC, so 10 ºC is proposed as a lower limit, under which curtailment would not be applied.

Low wind-speed curtailment is a 'blanket' measure that limits turbine operation on the basis of wind-speed regardless of whether or not threatened bats are present and at risk. Smart curtailment (see above) that is responsive to the presence of threatened bat species will be considered if evidence indicates its functionality as a more effective option for relevant species that use the KGPH site.

7.2 Deterrence of bats from proximity of turbines

Some species of bats are attracted to concentrations of insect prey that can occur near artificial lights. As currently proposed, turbines at KGPH will not be lit and they will not have aviation warning lighting. Artificial lighting will thus not be a cause of attraction of bats to turbines at the wind farm.

Some techniques intended to deter bats from approaching wind turbines have been tried overseas. They include methods using ultrasonic noise and ultraviolet light. Available information indicates they have been experimental and they have not been widely applied to commercial wind energy facilities and there is no body of peer-reviewed rigorous evidence for their performance.

7.2.1 Deterrence using ultrasonic noise

Arnett et al. (2013) undertook experiments at an operational wind farm to evaluate the effectiveness broadcasting ultrasound noise with the intent of deterring bats that rely on their own emission of ultrasound for navigation and foraging.

Some commercially available systems to deter bats from the proximity of wind turbines use ultrasonic noise to 'jam' the frequencies of echo-locating bat calls. Overall, the effectiveness of the use of ultrasound has not been well demonstrated and the largely experimental nature of this approach does not yet indicate that it is likely to provide a suitable method for use at KGPH Project.

This method may also involve unknown detrimental effects on target species, such as alienation from otherwise suitable habitat.

Possible applications for KGPH

The use of ultrasonic noise is not a proven reliable deterrent of microbats and is not considered to be suitable to reduce the risk of turbine collisions for SBWB at KGPH Project.

7.2.2 Ultraviolet lighting

Gorresen et al. (2015) carried out a trial in which they illuminated trees with dim flickering ultraviolet light in areas frequented by Hawaiian Hoary Bats *Lasiurus cinereus semotus*, an endangered subspecies affected by wind turbines, to ascertain whether this would reduce their flights in proximity to the illuminated trees. They used a repeated-measures design to quantify bat activity near trees with acoustic detectors and thermal video cameras in the presence and absence of ultraviolet illumination, while concurrently monitoring insect numbers. Results indicated that dim UV did reduce bat activity despite an increase in insect numbers. However, the experimental treatment did not completely inhibit bat activity. This method is not known to have been tried on operational wind turbines and for the present this method can be considered to be purely experimental. There is no known information about the possible response of SBWBs to ultraviolet light.

Possible applications for KGPH

The effects of ultraviolet lighting on SBWB is not known, and it is not a proven reliable deterrent of microbats and is not considered to be suitable to reduce the risk of turbine collisions for Southern Bent-wing Bat at KGPH Project.

7.3 Collision monitoring systems

A number of commercially available systems function to detect and record turbine collisions by flying animals and we note this category of method simply for completeness. These generally use a combination of acoustic sensors installed within rotor blades and on the turbine tower to detect a collision and trigger active infrared video cameras to record the event.

Possible applications for KGPH

These systems are designed to record collisions but do not control turbine shut-down and re-start and thus they do not have capacity to reduce collisions for any species.

7.4 Large animal carcass removal

The timely removal of carcasses of livestock and other larger animals, such as destroyed feral species or road kill, from the wind farm may help reduce the incidence of collision with turbines by raptors and ravens that routinely feed on carrion and may be attracted to carcasses. Note that carcasses of birds and bats that may have resulted from collisions with turbines are to be left in place for the purposes of collision monitoring and are not to be removed as part of this process.

A carcass removal program will be implemented for the life of the wind farm and will apply to any carcass other than those of birds and bats, found anywhere within the wind farm site. All site personnel (staff and contractors) will be inducted into a reporting procedure that will apply during all wind farm operations, including collision carcass searches (see below). The wind farm will implement a routine for removal and burial of any carcass within 48 hours of its discovery. Any program of feral animal control on the wind farm will include the removal of all carcasses from the wind farm site. The wind farm operator will make all efforts to work collaboratively with land managers, including, where achievable, entry into formal agreements to provide for co-operative and coordinated detection and removal of large animal carcasses from within a zone around each turbine. The radius of the zone will be at least 200 metres of all turbine towers, with the actual distance to be determined in consideration of the dimensions of turbines when those specifications for the Project are finalised.

7.5 Pest animal control

Pest animal control will be undertaken as part of routine environmental management of the wind farm and land managed by the wind farm operator.

Control of rabbits around wind turbines is a specific action that may minimise collision risk because rabbits are primary prey for large raptors. A pest animal control program will be implemented for the life of the wind farm. All site personnel (staff and contractors) will be inducted into a procedure for reporting the location of any rabbit warren or other site of high rabbit density. The wind farm operator will make all efforts to work collaboratively with land managers, including, where achievable, entry into formal agreements to provide for co-operative and coordinated detection and control of pest animals from the area within at least 200 metres of all turbine towers, with the actual distance to be determined in consideration of the dimensions of turbines when those specifications for the Project are finalised.

8 Monitoring strikes & effectiveness of impact minimisation

8.1 Objectives of monitoring turbine collisions

The monitoring program set out here is designed to:

- Detect and document mortality of all species of birds and bats resulting from collisions with wind turbines.

The results will be used to:

- Determine if or when prescribed trigger levels for threatened, migratory and specified non-threatened species are reached (see section 10.2). This information will trigger notification to relevant authorities and responsive actions (see section 11).
- Contribute to informed estimates of total annual numbers of collisions, with associated confidence intervals, for all bird and bat species of concern.

Section 11.1 sets out response actions that will be taken in the event that a trigger level of collision fatalities is detected. These include review and potential adjustment of the collision monitoring regime.

8.2 Basic principles

Assessment against trigger levels will require a program for monitoring collisions in a sample of years. This will entail a regime of searches for dead birds and bats under turbines.

The following important principles have guided the design of studies described here:

- To the extent possible, they should be simple and minimise influences of extraneous variables.
- In order to maximise their potential to meet stated objectives, they should obtain the largest sample sizes that are practicable.
- They must be able to be implemented without significantly compromising the routine operation and management of the wind farm.

8.3 Monitoring of turbine collisions

Several of the species listed in Table 1 are known to exhibit increased seasonal activity, particularly during autumn and spring, due to migration, dispersal or seasonal foraging activity.

These include species such as:

- Australasian Bittern
- White-throated Needletail
- Brolga
- Orange-bellied Parrot
- migratory shorebirds
- Southern Bent-winged Bat
- Grey-headed Flying-fox

The draft BBAMP proposes regular monthly monitoring for turbine collisions. During the development and finalisation of the plan, however, the option of increased monitoring frequency during particular seasons or periods will be considered in consultation with DEECA and DCCEEW.

8.3.1 Carcass search method

Purpose-trained dogs have been shown to be highly efficient at detecting carcasses (Mathews et al. 2013) and are now routinely used for this purpose at onshore wind farms in Australia. Using purpose-trained dogs obviates the need for formal transects to be established in search zones as dogs use scent to detect carcasses and are permitted to roam to do so. Every dog will be fitted with a GPS tracking device while undertaking searches. GPS tracks will be downloaded and maintained for future reference and used for analyses of search effort and coverage. GIS maps showing routes taken by dogs will be made available to DEECA on request. **The use of trained dogs is the preferred method for searches and will be used, provided appropriately trained dogs and handlers are available.** Dog handler(s) must have demonstrated capacity to identify bird and bat species of western Victoria.

However, if the use of dogs is not practicable at the KGPH site the alternative is to use people. Human observers will search by walking transects through the search zones. Searches by people will be undertaken by ecologists with demonstrated capacity to identify bird and bat species of western Victoria. Transects will be spaced a maximum distance of 6 metres apart, or as near to 6 metres as is practical and observers will thus search the ground for 3 metres on either side of each transect. Transect spacing will be reduced in areas where visibility does not extend for three metres, such as locations with a dense grassy or shrubby understorey, or in young dense plantations. Each observer will carry a hand-held GPS unit and record transects they walk. GPS tracks will be downloaded and maintained for future reference and used for analyses of search effort and coverage. GIS maps showing transects walked will be made available to DEECA on request.

The selection of search method using either dogs or human observers will be determined before the monitoring regime commences and whichever is chosen will be used throughout the entire monitoring regime. Prescriptive details for the selected search method will be developed and provided in the final BBAMP.

8.3.2 Fall zone and estimation for unsearchable zones

Hull and Muir (Hull & Muir 2010) provide the sizes of likely fall zones for different turbines and sizes of birds and bats based on ballistics theory. They note that distance from the base of a turbine is an important factor in dispersion of carcasses and that with increased distance the density of carcasses decreases. They provide modelled fall zones and radii for percentages of expected distribution for two size classes of birds and one for small bats. Huso and Dalthorp (2014) compared five estimators for the relationship of carcass density to distance from wind turbines. For all five estimators tested they found that density approached zero at about 70 metres horizontal distance from the turbine base. Prakash & Markfort (2021) have undertaken further modelling for the effects of carcass size, weight, drag and wind drift on carcass fall trajectories. Their study found that for turbines with an 80 metre hub height and rotor diameter of 108 metres small bat carcasses were found within the range of 40 and 51 metres from the base of turbine towers.

At the time of preparing this draft BBAMP, the Project proposes to operate turbines with a hub height of up to 174 metres and rotors of up to 190 metres diameter. It is anticipated that searches encompassing a radius of 100 metres from the base of turbine towers will appropriately cover the fall zone for these turbines. The actual radial distance to be searched will be determined and included in the final BBAMP on the basis of current science as it applies to the dimensions of turbines when final specifications of turbines for the KGPH Project are available.

The greatest capacity to detect carcasses is obtained from intensive searches of defined areas of the potential fall zones and the most valid estimates of mortality come from distance-based carcass-density models (Huso & Dalthorp 2014). Because the densities of carcasses diminish with horizontal distance from a turbine, searching of large areas including the outer extremities of potential fall zones were shown by those authors to add little to detection rates but to add very substantially and disproportionally to search effort. Hence, intensive searches of the portion of the fall zone in which the majority of carcasses will be found are the most effective and appropriate.

Searching of an entire prescribed radius area will be possible for turbines located in cleared sites (farmland). At present there is no known operational wind farm in Australia within a large pine plantation and searches have not found relevant information from overseas where wind farms operate within forested environments. In part, the latter appears to be because there is limited requirement for carcass monitoring in many of the relevant jurisdictions. Trained scent dogs are in use for carcass searches in at least one wind farm in Australia with sections in Blue Gum plantations (T. Lyten pers. comm. 2024). Carcass detection rates from that work are not currently available, but dogs are proving to be effective at locating carcasses there. Overall, there is no available empirical basis for certainty about the likely efficacy of carcass searches within pine plantations in the Project area.

It is possible that some carcasses may fall into trees and not immediately reach the ground, however substantial first-hand experience (T. Lyten pers. comm. 2024) is that bird and bat carcasses rapidly dehydrate and are likely to fall to the ground soon after a collision.

Due to the cycle of rotation, thinning and clear-felling of plantation trees, at any given time the structure of treed areas is substantially varied. The height ranges of plantation trees across the site, along with the portion of turbines within various tree height ranges as proposed as at the time of writing, are set out in Table 3. A portion of the overall site routinely supports trees less than 5 metres in height. Plantation pine trees are the most dense during the age range of approximately 5 – 10 years, after which thinning creates a more open structure.

Table 3 Height ranges of treed portions of the KGPH site as at 2024

GTFP plantation height range (m)		Turbine count	Percent of turbines
0	5	18	17%
5	10		0%
10	15	4	4%
15	25	32	30%
25	35	40	38%
Other plantation, trees to approx. 35 m		9	9%
No Plantation		2	2%
Total		105	100%

A study in Arizona, USA, investigated the efficacy of scent-detection dogs for locating natural bat roosts and bat guano in areas dominated by Poderosa pines *Pinus ponderosa* (Chambers et al. 2015). Overall, dogs detected 79% of 20 g guano samples in trees and 29% of roosts in trees. Dogs correctly identified 69% of guano samples at 2 metres high and 40% of samples at 6 metres high. While this study was not attempting to locate bat carcasses, it demonstrates that trained dogs have ability to located signs of microbats at height in pine trees.

Trained scent dogs have substantial capacity to locate carcasses in structurally complex environments and are considered to be capable of doing so throughout the majority of the Project site. It is expected that effective searches will be feasible in treed portions of the KGPH Project wind farm area.

Searcher efficiency trials will be undertaken and a minimum detection rate has been set for the Project (section 8.3.7).

Some areas may not be readily searchable but limitations on searchable areas are common to many wind farms internationally and in Australia, typically due to occupational health and safety risks on steep or rocky terrain. For example, at Crowlands Wind Farm in western Victoria, areas under many turbines are extremely steep, rocky and dissected and sometimes precipitous; and there are exposed vertical abandoned mine shafts within a short distance of some turbines. In addition, zones under a number of turbines there are quite densely treed. For these reasons the approved Bat and Avifauna Management Plan for Crowlands Wind Farm (Biosis 2019) stipulates that turbine searches will cover the hardstand and sections of roads out to a radius of 120 metres from the tower base of each turbine. A science has been developed and is used internationally to account for these situations. Huso and Dalthorp (2014) and Huso *et al.* (2017) provide sound methodology for using the results from areas under turbines that are able to be searched effectively to extrapolate out to the entire fall zone..

Thus, if necessary due to safety or low efficiency, searches at the Project wind farm may be limited to cleared hard stand areas and any adjacent cleared areas that are implemented for blade/tree clearance, which will typically consist of a minimum 50 m radius around the turbine base. If that approach is required any limitations in searchable area will be compensated for by increased monitoring frequency and/or number of turbines included in the monitoring. The methods of Huso and Dalthorp (2014) and Huso *et al.* (2017) (or any updates on those methods) will be used to calculate estimates of collisions for the entire fall zone under relevant turbines.

Further modelling of fall zones and any unsearchable areas will be conducted in the development and finalisation of the BBAMP. This modelling will be based on the specific turbines proposed to be used, and the body dimensions of key species of interest. As noted above, existing theory for the size of fall zones is provided in Hull and Muir (2010) and Prakash and Markford (2021).

8.3.3 Turbines to be searched

Searches will be undertaken under a selection of turbines during the entire period prescribed by planning permit conditions for the KGPH Project, from commencement of routine electricity generation by turbines (see Search duration and frequency, below). Searches will be undertaken around half of the turbines within each stratified area of:

- pine plantation
- Blue gum plantation and
- cleared agricultural land.

The selection of turbines to be searched will ensure that searches cover a complete representation of turbine-location variables but will otherwise be chosen at random. Results of the first year will be used to ascertain whether there are distributional patterns in collisions. If there are, the results will be used to select turbines to be searched thereafter. The selection of individual turbines to be monitored will be determined during further development and finalisation of the BBAMP, including after undertaking modelling of fall zones and effective carcass search areas.

8.3.4 Search duration and frequency

The regime of carcass searching will run for the entire period prescribed by planning permit conditions for the KGPH Project and will commence when turbines are commissioned and become operational at the wind farm. If the facility is constructed in stages or turbines become operational in a staged manner, the timing of monitoring and reporting will be determined in consultation with the responsible authority and DEECA.

At the completion of each year of the monitoring program results will be collated and an interim report will be prepared. The results will be provided to DEECA and in collaboration with DEECA a determination will be made about any changes to search duration and/or frequency that might be made to improve effectiveness of the monitoring program. At the conclusion of the final year of the program (as prescribed by the planning permit conditions for the KGPH Project) and after analyses of results, a review will be undertaken in collaboration with DEECA to determine whether any further monitoring is warranted.

It is likely (but uncertain at present) that carcasses of bats and small birds will be scavenged quickly at the site. Carcass persistence trials will be undertaken during the course of the study (see below), particularly to inform analyses required to extrapolate from numbers of carcasses detected to estimate total number of collisions. In order for the search regime to accommodate the likelihood of rapid scavenging, a short period between initial searches is important.

A primary purpose of the search regime is to ascertain the frequency at which collisions occur. This is necessary for use in extrapolation to estimate total fatality rates. A three-day interval between two searches in each monthly search cycle is designed to provide good capacity to determine frequency of collisions, because there is a high probability that a carcass found on day four must have collided in the preceding three days.

In each month when a turbine is to be searched, one search will be undertaken followed by a second search three days later. The frequency of carcass searches may be altered from the regime set out here if results of carcass persistence trials (see Section 5.1.6, below) indicate the value of doing so. The regime may be altered only if approval is first obtained from DEECA.

8.3.5 Carcass & data collection & management

During all searches, all species of birds and bats detected as carcasses or as bird featherspots, will be recorded on a data pro forma designed for the purpose (Appendix 1). Ideally, data will be collected on-site using electronic tablets which will maximize efficiency in data management. A featherspot is any collection of five or more feathers found grouped together in a manner that suggests a bird has died at the location. All information, including metadata for each turbine search will also be recorded irrespective of whether a carcass is found during a given search. All data will be entered into a database to be maintained by the wind farm operator. Raw data will be available to relevant regulatory authorities on request.

On finding a carcass, it will be photographed in situ and its location will be logged using a portable GPS device. Carcasses of all taxa, whether species of concern or not, will be collected, labelled with relevant data details and frozen to permit any necessary investigations of cause of death and/or for use in future searcher efficiency or persistence trials. A freezer for this purpose will be available on-site. At the conclusion of the overall investigation, all specimens will be made available to the Museum of Victoria.

A DNA sample from the remains of any bird or bat found during searches that cannot be identified with certainty will be collected and stored in ethanol. It will be forwarded to a laboratory with appropriate capacity to determine its taxonomic identity. When it has been identified, a collision record for the relevant species will be added to the collision database for the relevant month.

Retrieved carcasses may pose health risks and carcasses of common species may be used later for scavenger trials. To avoid risks and the potential for human scent on carcasses to influence scavenging rates gloves will be worn when handling all bird and bat carcasses.

8.3.6 Carcass persistence trials

Carcasses of bird and bats that collide with turbines may be removed by scavengers or will ultimately disappear due to decomposition. Carcass persistence affects the detection of birds and bats killed as a result of collision with turbines and consequently influences estimation of the total number of fatalities for each species.

Trials to determine persistence time of carcasses are required to derive correction factors necessary to estimate total fatalities from the results of the carcass searches. Two persistence trials will be undertaken in each year of the monitoring regime, one in each of spring and autumn. Carcass persistence trials have been undertaken in these seasons widely in south-eastern Australia as they generally coincide with annual cycles of both prey and predator species in which their populations are increasing due to breeding in spring and are declining in autumn.

Remote cameras will be used to record persistence of carcasses placed on-site for the purpose. Carcasses for the trials will be sourced from bird and bat carcasses found at the site or from other local sources, such as roadkills. It is vital that species used are representation of the bird and bat fauna of the local area. Carcasses used for trials will be individually marked to ensure they are not confused with collision carcasses. Individual marking allows trial carcasses to be identified if they are simply moved by scavengers. Radio-frequency identification (RFID) microchips inserted into carcasses will be used to provide individual identification. Cameras used for the purpose will be set to take a photograph every hour (day and night) and also when triggered by movement and infrared. This method has been demonstrated in Victoria to be highly efficient and substantially reduces potential influence on scavengers as may occur when human observers visit frequently to check carcasses. Cameras are installed to operate for the duration of the trial and this entails substantially less effort than having people check carcasses daily. Cameras have the additional advantage of recording the precise time of carcass removal and the species of scavenger that removes a carcass. As a result of the precise documentation of the time of carcass removal there is no need to estimate the period of carcass persistence which is required when carcasses are checked only at an intervals of several days. Censored analysis will be required when carcasses persist beyond the trial period (Klein & Moeschberger 2010).

The field of view of cameras is limited and scavengers can simply move a carcass out of that view. In order to check for this, each trial will commence approximately one week before the next routine search for carcasses and, if required, a carcass that has been moved will be placed back into the view of the camera.

In each trial, a total of 10 carcasses of birds and 10 carcasses of bats will be distributed under 20 randomly-chosen turbines across the wind farm. Each trial will be run for up to one month, but cameras will be checked after two weeks to check on their operation and at that point the trial may be terminated if the carcass has been removed or a second carcass may be placed to increase the sample size of the trial.

The results of these trials will permit average carcass persistence times to be determined. The resulting persistence rates will be used in analyses to estimate total numbers of collisions.

8.3.7 Searcher efficiency trials

Searchers do not routinely find all carcasses, so it is necessary to ascertain the efficiency of searches in order to determine and apply appropriate correction factors for carcasses missed to inform estimation of total collision mortality for species of concern.

The efficiency of each dog or person undertaking searches will be determined by the use of trials. Searcher efficiency trials determine the likelihood of a survey team detecting a carcass during formal surveys if one is present. Carcasses are randomly distributed by an independent individual throughout the survey area at least one hour prior to search team (handler and dog) arrival. To ensure dogs are not tracking human footsteps, carcasses are thrown from a randomly designated point and allowed to land naturally. GPS coordinates of the throw location and direction of throw are recorded, and an indirect path is walked back to the vehicle. Whilst handlers are aware of the trial being undertaken, the trial is still considered to be as 'blind' as is practicable as handlers are unaware of carcass number and type and which turbines are and are not baited, thus providing sufficient blinding to validate the testing. GPS tracking of both dogs and handlers allows survey duration to be compared to standard non-trial surveys to ensure additional effort is not made by search teams in light of trials being conducted.

Without the prior knowledge of searchers, a known number of bat carcasses will be placed within search plots prior to routine searches. Carcasses will be placed in sufficient numbers, at a range of turbines and over sufficient time to permit the rate of carcass detection to be adequately determined. After the trial the person who placed the carcasses will collect any that has not been detected and document whether any have been scavenged to ensure accuracy of the searcher efficiency trial. The number and type of carcasses found during the searcher efficiency trials will be compared with the known number of and type of carcasses placed under the turbines.

Reviews of large numbers of searcher efficiency trials at multiple wind farms in Victoria (Moloney et al. 2019, Symbolix 2020) are consistent in finding that humans and dogs detect similar percentages of bird carcasses but that dogs are substantially better than humans at detecting carcasses of bats. Dogs detected between 73% and 84% of birds and bats carcasses used in trials.

Two searcher efficiency trials will be undertaken for each searcher in each year of the monitoring regime, one in each of spring and autumn. Symbolix (2020) found there was no discernable seasonal effect in rates at which bird and bat carcasses are detected in trials.

Carcasses for the trials will be sourced from bird and bat carcasses found at the site or from other local sources such as road kills. It is vital that species used are representative of the bird and bat fauna of the local area. Carcasses used for the purpose should be marked to ensure they are not confused with previously undetected collision carcasses, but in a manner that does not draw the attention of the searcher. This may be in the form of clipping feathers of bird carcasses and notching ears of bat carcasses.

At any time that new search personnel or dogs are employed to undertake searches the rate of their detection ability must also evaluated by a searcher efficiency trail as detailed here.

The KGPH Project will operate to achieve a minimum 80% searcher efficiency rate for detection of bird and bat carcasses. If that rate is not achieved, measures to increase the overall number of carcasses detected will be implemented. These may entail demonstrably improved efficiency on the part of searchers or increases to the number of turbines searched or the frequency of searches.

8.3.8 Incidental finds of bird and bat carcasses

During the life of the wind farm, birds and bat carcasses may be discovered incidentally by site personnel. This includes carcasses found outside of turbine fall zones during carcass searches. All site personnel will be trained on procedures for the event in which they encounter dead or injured birds and bats. Upon incidental discovery, carcasses and featherspots must be photographed *in situ*. However, the carcass or featherspot must be left where it was found in order not to introduce bias to detection rates of the official search regime. Any member of the site personnel who finds a carcass of a bird or bat must complete the relevant carcass data sheet (see Appendices). Copies of carcass data sheets must be available on site for use by all site staff.

Where possible, these carcasses will be assessed to determine whether the cause of death is likely to have been collision with a turbine. This may require autopsy.

The results of the assessment of cause of death and the location of the remains relative to the potential fall zone (section 5.1.2) will be used to determine whether an incidental find will be included in the data for turbine collisions. In the event of doubt, it will be assumed that the carcass is the result of a turbine collision.

8.4 Injured birds and bats

Injured birds and bats may be encountered during carcass searches or incidentally. Handling injured birds and bats requires specialist skill as there is the risk of injury to both animals and people and there is potential for disease transmission in some cases. Injured birds and bats will only be handled by person(s) authorised under the *Wildlife Act 1975*. To reduce the risk associated with Australian Bat Lyssavirus, any injured bats must be handled only by people who have up-to-date rabies vaccination (an appropriate level of antibodies for the rabies virus, based on vaccination, is considered to offer the best available protection against Australian Bat Lyssavirus). The details of any injured birds and bats found will be recorded on a dead or injured bird and bat data sheet (see Appendices).

Prior to implementation of this plan, arrangements must be made with a conveniently located veterinary surgery to ensure that arrangements are in place for acceptance and treatment of any injured birds or bats. As options for treatment of injured wildlife may change over the life of the wind farm, an arrangement must be kept current and current telephone numbers for the surgery must be readily available to all site personnel (e.g. on their mobile phones). Where an injured animal can be readily captured it should be placed into a tied calico bag or a box and kept in a quiet and dark location while it is transported to a veterinarian for treatment. In the event that an injured animal cannot be readily captured site personnel should telephone a local wildlife rescue organisation for assistance.

A data sheet must be completed as per Section 5.1.8 *Incidental finds of bird or bat carcasses* for any injured bird or bat suspected to have collided with a wind turbine (see Appendices).

9 Monitoring site utilisation by species of concern

There are a number of threatened species and/or species of concern that are either resident onsite or present in adjacent habitat. It will be important to determine whether their presence, abundance and flight behaviours alter, relative to pre-construction levels, in response to the presence and operation of the wind farm. At a finer scale, monitoring may also provide insight into their temporal and spatial usage of the site, which may be of use to inform management of the facility to further minimise effects on particular species. Species for which this monitoring is recommended are listed in Table 4 along with key monitoring objectives and potential monitoring methods. Important overarching aims of monitoring of all relevant species will be to further inform adaptive management measures and potential compensation plan(s).

The monitoring program for these species will be further developed and detailed during finalisation of the BBAMP in response to permit conditions.

The design of this utilisation monitoring program will ensure that, at a minimum, it meets the post-commissioning requirements of *Onshore Windfarms – Interim Guidance on Bird and Bat Management* (DAWE 2022).

Table 4 Bird and bat utilisation monitoring objectives

Focal species	Monitoring objectives	Potential methods
Southern Bent-wing Bat	Understanding activity levels and seasonal and weather-related movement patterns. Understanding frequency of movements through the wind farm. Improved understanding of flight height.	Acoustic monitoring. GPS tracking.
Grey-headed Flying Fox	Detecting presence of new camps near the wind farm. Monitoring movement patterns to and from any detected camps to assess potential movements into or through the wind farm. Improved understanding of flight height.	Undertake regional investigation (including available tracking data) to identify local roost camps. GPS tracking from known camps. Monitoring of flight directions from known camps to or into project site.
Brolga	Detecting any new or unknown breeding sites within 3.2 kilometres of the wind farm and any overhead sections of the transmission line. Monitoring breeding success and juvenile dispersal of known breeding sites. Understanding frequency and seasonality of movements through the wind farm. Improved understanding of flight height.	Regular monitoring of known historic breeding sites during the breeding season. Roaming surveys during the breeding season. Intensive monitoring if breeding behaviour is observed within 3.2 km of wind farm infrastructure.

Focal species	Monitoring objectives	Potential methods
Australasian Bittern	Assessing local population size and trends over time. Improving understanding of timing of migratory movements Understanding range of local movements around key wetlands. Improved understanding of flight height.	Regular monitoring of wetlands where Bitterns are known to occur. Acoustic monitoring. GPS tracking.
Latham's Snipe	Assessing local population size and trends over time. Improving understanding of timing of migratory movements Understanding range of local movements.	Observational surveys of wetlands and areas of other potential habitat during the seasonal period in which the species is annually present in SE Australia.
Orange Bellied Parrot **Blue-winged Parrot**	Assessing local population size and trends over time. Improving understanding timing of presence and migratory movements.	Seasonal searches of specific habitats in proximity with the wind farm. Acoustic monitoring.
White-throated Needletail	Understanding local population size, seasonal movement patterns and influence of weather conditions on presence of birds within the wind farm. Improved understanding of flight height.	Observational surveys throughout project area during the seasonal period in which the species is annually present in SE Australia.
Powerful Owl	Detecting presence and distribution within 2 km of the wind farm.	Listening and call playback surveys within the breeding season to assess local population size. Acoustic monitoring.
South-eastern Red-tailed Black-cockatoo **Gang-gang Cockatoo**	South-eastern Red-tailed Black Cockatoo – detecting presence of groups within 2 km of the wind farm. Studies focused on north-west and eastern sections of the wind farm, where stringybark habitats are present. Gang-gang Cockatoo – understanding presence and movements in the far eastern and far western sections of the wind farm, where the birds may move through the wind farm between habitat areas. Improved understanding of flight height.	Roaming surveys in potential habitat around the pine plantation/wind farm margins particularly in response to information from wider surveys undertaken under auspices of the recovery program that indicate the species is present in the region of the Project.

10 Significant impact & response trigger levels

10.1 Guiding principles for determining significance of impacts

While the most desirable outcome for the KGPH Project is that it will operate without any negative effect on birds and bats and multiple aspects of the siting and design of the Project are intentionally aimed at minimizing the potential for such impacts, it is recognised that some residual impact is likely to occur. The following is intended as a conceptual framework in which significance of residual effects might be evaluated relative to the size and demographic functions of particular taxa.

The overarching objective is that the wind farm does not have a significant impact on the viability of the population of any species. It is worth noting that density dependence is an important ecological concept of relevance for consideration of effects on viability of wildlife populations. In essence, the size of any natural population is regulated by availability of resources to support it. This includes food, breeding sites, roost sites, mating opportunities, etc. all of which in combination represent 'habitat' for the species in question. Where an impact removes habitat, the population will be reduced as a direct consequence. However, where the key resources for the species are not reduced and the population is otherwise stable, the mortality of one individual makes resources available to another whose survival prospects can be expected to improve so that the net result is that the size of the population is not altered. Wind energy facilities generally have little impact on the availability of habitat for wildlife populations and may thus have little effect on populations that are stable, but they may exacerbate the situation for populations that are in decline as a result of other factors causing habitat loss.

Construction and operation of the KGPH will have little impact on resource availability for most species of birds and bats and mortalities due to turbine collisions can be expected to function in accordance with density dependence. This is particularly relevant to the Radiata Pine plantation which occupies the majority of the site and has low intrinsic value to the majority, but not necessarily all species of threatened and migratory birds and bats.

Various guidelines published by the Commonwealth for application of the EPBC Act offer some principles of value in consideration of impacts on populations. Significant impact guidelines for threatened and migratory species listed under the EPBC Act are contained in *Matters of National Environmental Significance: Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999* (CoA 2009), which also provides criteria for what might constitute a 'significant impact'. However, the criteria are not quantifiable in numbers of individual animals and not all of the species of concern for the KGPH Project are listed under the EPBC Act.

The *EPBC Act Policy Statement 2.3 Wind Farm Industry* (DEWHA 2009) provides some further explanation and examples relative to potential effects of the wind industry. The following excerpt indicates that the risk should be considered as proportional to the population size of particular species:

> *"An activity that affects, or is likely to affect, a small number of individuals usually would not be expected to have a significant impact on the species as a whole. However, when a species or community is in small numbers nationally, or its distribution or habitat is limited, or if the habitat has particular importance for the species, the activity could have a significant impact. In general, this would apply to species or communities that are most at risk of extinction and are, as such, listed as critically endangered or endangered.*
>
> *An action is likely to have a significant impact on a species listed as vulnerable where it significantly affects an important population of that species. An example might be where a wind farm is proposed on an island or*

headland, or near a wetland, that has a key breeding population of a bird species listed as vulnerable. The breeding frequency and success rate for that species would also be relevant considerations."

The *Draft referral guideline for 14 birds listed as migratory species under the EPBC Act* (DoE 2015), while of little direct relevance to threatened species using the Kentbruck site, considers that a significant impact would entail annual mortalities equalling or exceeding 1% of the population of a species and that further investigation would be required if it equals or exceeds 0.1% of the population.

The Victoria *Ministerial guidelines for assessment of environmental effects under the Environment Effects Act 1978* note that individual types of potential effects on the environment that might be of regional or State significance include:

"potential long-term loss of a significant proportion (e.g. 1 to 5 percent depending on the conservation status of the species) of known remaining habitat or population of a threatened species within Victoria".

These government guidance documents clearly indicate that the level of impact that may be significant is based on the measure of change that may be experienced by the population of a threatened or migratory species. This 'population' approach is ecologically meaningful as it responds appropriately to the population sizes and variables of different species. Ideally, it would be possible to consider a number of turbine collision mortalities for a particular species as a proportion of its entire population and determine numbers and frequency of collisions that would warrant management response(s) according to whether they represent an ecologically important influence on the population's viability (Smales 2017). Population Viability Analyses have been undertaken for the purposes of the KGPH Project impact assessment for Brolga and Southern Bent-wing Bat. That approach requires well founded estimates for the population sizes of relevant species and a variety of other demographic values. Precise population estimates are not available for many of the species of concern for KGPH, although approximate estimates for the Australian populations of all nationally threatened bird taxa are available from sources such as *The Action Plan for Australian Birds 2020* (Garnett & Baker 2021) and BirdLife International (2023) (see Section 5.2). Estimates based on strategic counts, and thus with a likely high level of precision, are available for Brolga, Orange-bellied Parrot, Red-tailed Black Cockatoo, Grey-headed Flying-fox and Southern Bent-wing Bat. Estimates of the Australian population sizes of relevant taxa are shown in Table 1, Section 5.2.

In light of the principles discussed above it is necessary to determine levels of collision mortality that will represent triggers for management responses measured by numbers of detected bird and bat collisions with turbines. As outlined above, the significance of any collision mortalities that may occur will differ according to the abundance and population dynamics, as well as the level of threat, for various taxa. Since categories of threat status under relevant legislation are applied to taxa on the basis of IUCN criteria, threat status provides a standardised measure of the overall risk faced by particular species. The categories of threat address a range of aspects that encompass much more than the simple size of the population in question including other demographic characters like generation length that are of relevance. Hence, it is appropriate to assign trigger levels according to the threat status of each species and that approach has been adopted for the KGPH Project. The threat status of species of volant fauna likely to occur at the KGPH wind farm are shown in Table 1.

Diurnal raptors and owls that occur at the KGPH site are principally resident species and, due to their high trophic levels, occur at naturally low densities and abundance. For these reasons they are assigned trigger levels different from other non-threatened taxa.

Baseline and post-construction studies of birds and bats at the KGPH Project are aimed at detecting changes in distribution, abundance and activity (collectively termed 'utilisation') of these groups. Multiple variables external to operation of the wind farm, including land management practices, weather and climate are all likely to affect the local utilisation by birds and bats and the levels of collision mortalities of this fauna at other large wind energy facilities in Australia suggests that they are routinely too low and rare to be detectable by utilisation studies. For that reason, the discussion below about trigger levels for management response(s) at the KGPH are defined by numbers of mortalities that may be actually detected by carcass searches, rather than by indirect measures obtainable from utilisation studies.

Trigger levels are for numbers of bird and bat fatalities detected during carcass searches (see Section 10.2). It is important to note that the number of fatalities detected by searches will almost certainly not represent the total number of animals killed because searches rarely detect all carcasses and because some carcasses will be removed by scavengers before they can be found during a search regime. These effects are well known and there is an existing science for determining estimates of total mortalities from numbers of mortalities detected during searches (e.g. Huso *et al.* 2017). While estimation of total numbers of collision fatalities is important and will be undertaken for the KGPH Project, the statistically small numbers of collisions that generally occur at wind farms in Australia most often result in a median estimates of total mortality with associated very large confidence (or 'credible') intervals (usually using 95% C I). The lower bound of the 95% C I is necessarily below the number of carcasses detected (and is most frequently 0.0), while the upper bound may be several times the median estimated value (Moloney et al. 2019). For that reason, extrapolated estimates of total mortality may not provide a sound basis for use as trigger levels. This is addressed here by intentionally setting trigger levels for detected mortalities at low levels and triggers for responsive management actions are considered to be precautionary because they will be implemented at levels substantially below numbers of fatalities that are likely to represent a significant impact on the viability of the overall population of all but the most critically endangered species.

Defined trigger levels are set out below. The levels will be used, if required, as triggers for implementation of adaptive management aimed at reducing impacts to a level below the defined trigger levels.

10.2 Trigger levels for management responses to bird & bat collisions at KGPH site

Trigger levels are set here for taxa according to their differing conservation status and their relative natural abundance. The trigger levels will apply for all taxa that may use the site, other than introduced species, regardless of whether they are included in Table 1, and for any species whose threat status is altered in future. For the purposes of this plan the following trigger levels will apply:

10.2.1 Listed threatened taxa

A trigger-level impact will occur where one or more carcasses; feather spots; or injured individuals of a species listed as critically endangered, endangered or vulnerable under either the EPBC Act or the FFG Act is found during any rolling 12 month period in the course of formal mortality searches or incidentally and the cause of death or injury is deemed to have been due to collision with a wind turbine.

10.2.2 Non-threatened migratory taxa and raptors

A trigger-level impact will occur where five or more carcasses; featherspots; or injured individuals of a species listed as migratory under the EPBC Act but not as threatened under the EPBC Act or the FFG Act, or is a species of raptor or owl, is found during any rolling 12 month period in the course of formal mortality searches or incidentally and the cause of death or injury is deemed to have been due to collision with a wind turbine.

10.2.3 Other non-threatened species

A trigger-level impact will occur where eight or more carcasses; featherspots; or injured individuals of any one species of another non-threatened species is found during any rolling 12 month period in the course of formal mortality searches or incidentally and the cause of death or injury is deemed to have been due to collision with a wind turbine.

Trigger levels will not apply to any introduced species.

10.3 Calculation of trigger levels

An assessment of whether trigger levels are reached will be performed for all species, using the results of collision mortality searches.

Calculation of whether trigger levels have been reached will be based on the number of collisions detected during a rolling 12 month period which will permit immediate response.

11 Response in the event of reaching a trigger level

Trigger levels for the KGPH Project are defined in Section 10.2. Regardless of any measures in place to reduce bird and bat collisions at the time of reaching a trigger level, further responsive measures or actions will be implemented with the primary objective of limiting the potential for further collisions by relevant species.

11.1 Incident investigation & additional survey activity

The detection of a mortality of any species listed as threatened or migratory and/or the reaching of any trigger level, will be reported to DEECA within 2 business days of the detection.

If a trigger level is reached an investigation will commence and be concluded at the earliest opportunity. The investigation will seek to assess and document any relevant attributes associated with the particular mortality. For example, it will address (but may not be limited to):

- Date/time/season of mortality
- Likely wind speed at the time of the mortality
- Other weather variables at the time of the mortality
- Landscape and seasonal factors (dry, wet)
- Proximity to habitat type and foraging resource availability for the taxon involved
- Proximity and history of other mortalities on the project site
- Proximity and history of wind turbine curtailments

For trigger levels that entail the cumulative collisions of two or more individuals of a particular taxon, the investigation will incorporate information from all the preceding mortality events that contributed to reaching the trigger.

To gain a greater understanding of collisions, and, if possible, the circumstances of trigger-level collisions of threatened or migratory species, the following actions will be undertaken with a view to understanding the likely actual number of individuals impacted and to understand the population level consequences, if any:

- Review the mortality monitoring program and mortality estimation methods to establish if the current methodology provides an accurate mortality estimate for the given species.
- If species-specific modifications to the program are needed, modify the on-ground mortality program for the given listed species, where it is possible and feasible, to:
  - increase detection probability (this may entail review of the number and frequency of turbine searches (sections 8.3.3 and 8.3.4))
  - estimate the species' specific carcass persistence rate (section 8.3.6)
- Review and investigate if the statistical methodology for estimating the specific species' mortality requires updating, and update it as needed.

Additional carcass surveys will be conducted commencing within two business days of the detection of a mortality of any species listed as threatened or migratory and/or the reaching of any trigger level. The search team will conduct searches at the 10 wind turbines nearest to the one at which the trigger level of mortality was recorded (any turbines defined in the nearest 10 that have already been surveyed will not be surveyed again). The purpose of the additional surveys is to identify if there are any adjacent turbines where mortalities of the same taxon have occurred. The mortality surveys will be completed in a manner consistent with the secondary/pulse survey' approach. Outcomes of the surveys will help to inform the investigation process.

The investigation will assess all available evidence, as outlined above, and based on the conclusions of the investigation, will prepare a short report that will, as applicable, make recommendations regarding future actions consistent with the stated aim of the KGPH BBAMP. For example:

- Retention, removal, increase or decrease of the curtailment applied to particular wind turbine(s) to determine the efficacy of curtailment measures.
- Other measures to monitor or modify operation of the wind farm including implementation of proactive measures such automated systems to further reduce the potential for collisions and / or use of deterrents.

The report will be provided to the Responsible Authority and DEECA and consultation with DEECA will be undertaken to determine the appropriate course of action to be implemented to reduce the potential for further impacts on the taxon involved.

11.2 Adaptive mitigations for Southern Bent-wing Bat

11.2.1 Project commitment to routine turbine curtailment

As outlined in Section 7.1, there is evidence that low wind speed turbine curtailment is likely to be a suitable mitigation of wind turbine associated mortalities of Southern Bent-wing Bat and the Project is committed to routine implementation of low wind speed curtailment of all turbines with the specific aim of reducing such collisions (see section 7.1.2).

Routine curtailment will function at two levels, as follows.

1. Blades of all turbines will be feathered (turned out of the wind to prevent rotors from turning) at all times when wind speed is between 0 ms^{-1} and the rated cut-in wind speed (expected to be at 3.0 ms^{-1}).
2. During the periods from September to November and February to March (all months inclusive) blades of all turbines will be feathered for 30 minutes after sunset and for 3 hours before sunrise when wind speed is between 0 ms^{-1} and 4.5 ms^{-1} when ambient air temperature is 10°C or higher and it is not raining (relative humidity is less than 95%).

The periods and weather conditions set out for curtailment level 2 correspond with periods and conditions in which the great majority (greater than 75% for all parameters) of SBWB calls were recorded at the site (see section 7.1.2 for specifics). The routine curtailment program is summarised in Table 5.

Table 5 Summary of routine low wind speed turbine curtailment to which the Project is committed

Time period	Climate parameter	Environmental conditions in which turbines are to be curtailed
Year-round	Time	At all times
	Wind speed	Below rated cut-in wind speed (expected to be 3.0 ms^{-1})
September to November	Time	30 minutes after sunset until 3 hours before sunrise; and
	Wind speed	Below 4.5 ms^{-1}; and
	Temperature	10ºC or higher; and
	Humidity	Not raining (relative humidity < 95%).
February to March	Time	30 minutes after sunset until 3 hours before sunrise; and
	Wind speed	Below 4.5 ms^{-1}; and
	Temperature	10ºC or higher; and
	Humidity	Not raining (relative humidity < 95%).

11.2.2 Additional measures in the event of reaching trigger levels of Southern Bent-wing Bat collisions

On reaching a trigger level of fatalities for Southern Bent-wing Bat, additional low wind speed curtailment will be immediately imposed at the wind turbine where the trigger level of collisions occurred, such that its blades will be feathered between wind speeds between 0 ms^{-1} and 6.0 ms^{-1} from sunset until sunrise for the entire subsequent 12 months, or for another period based on empirical science and determined in consultation with DEECA.

During the life of the BBAMP, if an additional trigger level mortality event is identified at a wind turbine where the cut-in wind speed has already been raised in response to an initial trigger, the cut-in wind speed will be raised further such that its blades will be feathered between wind speeds of 0 ms^{-1} and 7.5 ms^{-1} from sunset until sunrise for the entire subsequent 12 months, or for another period based on empirical science and determined in consultation with DEECA.

If trigger level of fatalities (section 10) occur or are exceeded twice at a single turbine, in addition to the continual application of low wind speed mitigation measures, an additional one off contribution of $50,000 dollars will be made to the offset fund (Section 14). Adaptive management phases will be applied where possible to ensure offsets provide a genuine contribution to the species conservation and recovery. If carcasses or injured individuals of 10 or more Southern Bent-wing Bats are found during the course of formal mortality searches or incidentally across the wind farm in any rolling 12 month period, or that the number of trigger levels at a single turbine exceed two and a one off contribution of $50,000 dollars has already been made, DEECA will be informed within 2 business days of the event occurring. The wind farm operator will collaborate with DEECA to determine an appropriate further course of action. Table 6 provides a summary of additional measures to be implemented in the event of reaching trigger levels of bat collisions.

Table 6 Additional measures to be implemented in the event of reaching trigger levels of Southern Bent-wing Bat collisions

Event	Response measure	Period of response
Trigger level 1	Curtail turbine responsible for collision(s) at wind speeds between 0 ms^{-1} and 6.0 ms^{-1}	From sunset until sunrise for the subsequent 12 months, or for another period based on empirical science and determined in consultation with DEECA.
Trigger level 2	Curtail turbine responsible for collision(s) at wind speeds between 0 ms^{-1} and 7.5 ms^{-1}	From sunset until sunrise for the subsequent 12 months, or for another period based on empirical science and determined in consultation with DEECA.
Collisions in excess of trigger level 2	Continue curtail turbine responsible for collision(s) at wind speeds between 0 ms^{-1} and 7.5 ms^{-1}	From sunset until sunrise for the subsequent 12 months, or for another period based on empirical science and determined in consultation with DEECA.
	Contribution of $50,000 to offset fund; application of adaptive management to ensure offsets provide a genuine contribution to the species conservation and recovery	One-off contribution; adaptive management for period relevant to specified contribution to the species conservation and recovery

A flow chart outlining the adaptive management approach proposed to be adopted for Southern Bent-winged Bat is provided as an appendix to this plan (Appendix 5).

12 Reporting

Requirements for reporting of results and actions pertaining to this BBAMP are as set out in relevant sections above. The KGPH operator will be responsible for submission of all relevant reports.

12.1 Incident reporting

The Responsible Authority and DEECA will be notified within seven business days of determination by the KGPH operator or the contracted qualified ecologist that a defined trigger level for any species has been detected.

12.2 Annual Reporting

An annual review will be undertaken regardless of whether trigger levels of collisions have been detected. A report will be prepared and submitted to the Responsible Authority and DEECA within three months of conclusion of each year of monitoring.

12.2.1 Scope of annual report

The annual report will provide results of all investigations and studies related to effects of KGPH on bird and bat species. The report will address the following:

- Details of surveys, mitigations, analyses and methods employed.
- Results and analyses.
- Update and comparison of the rates of mortalities and trigger levels between years.
- Observations and trends of bird utilisation data, mortalities and curtailments to establish patterns and cause-effect. This component of the annual report will consider any annual trends or variances in the seasonality of any detected mortalities and any applied low wind speed curtailment and make recommendations to extend or restrict either or both of surveys and low wind speed curtailments.
- Results and progress of all programs, research, analyses and activities.
- Recommendations for modification, continuation, cessation and prioritisation of all programs, research and activities.
- Appraisal of the mortality data and any conclusion or recommendations discussed with the Responsible Authority and other subject matter experts.
- Recommendations aimed at refinement or improvements for the subsequent years.

12.2.2 Estimation of total collision fatalities

In addition to reporting of numbers of carcasses detected, estimates of total numbers of collisions for all taxa will be calculated and reported. Estimates of the annual total number of collision mortalities for all species of concern will be undertaken using current best-practice science. They will use internationally defined and published methods that account for:

- the total number of carcasses of each taxon found;
- the proportion of turbines that are searched;
- the size of fall zones for various taxa;
- the site-specific efficiency of searches;
- the site-specific persistence of carcasses of various types;
- the frequency of searches; and,
- any other quantifiable variables that may be of relevance.

Along with the estimates, 95% confidence intervals will be determined as a measure of variance around the estimates. Current best-practice for these analyses are provided by Huso et al. (2017) (see also Huso and Dalthorp (2014); and Dalthorp et al. (2017). The analyses will be undertaken by a biometrician with a thorough understanding of the relevant science. Specifics of analytical approaches will be developed during finalization of the BBAMP and will be documented in the final BBAMP.

A report, including results and analyses, for each year of the study will be prepared and provided to DEECA.

Collision rates will be quantified and reported as:

(1) the mean number of detected strikes per species per turbine per annum and

(2) the total estimated number of strikes per species per turbine per annum, with 95% confidence interval.

Values for (2) will be calculated using all the necessary factors as detailed in the list of dot points above.

12.2.3 Review and implementation of report results

In collaboration with the Responsible Authority and DEECA, the results of annual reports will be considered to determine whether any changes to processes or management actions are required. Any such changes will be focussed on improvements to reduce impacts on bird and bats, specifically, in the event that detected collisions with turbines by any such species have reached or exceeded trigger levels set out here.

Any mitigation strategy will be tailored to the needs of the particular species affected and will be formulated if and when the nature and cause(s) of the impact are known. It will be submitted to the Responsible Authority and DEECA and will be implemented when approved.

13 Managing contingencies and new information

It is very likely that changes in bird and bat populations and their local distribution or behaviours may occur during the life of the KGPH Project. New information is also likely to come from monitoring programs set out in this plan and from external sources. Section 3 of this draft BBAMP describes a flexible and adaptive approach that will be vital to delivery of the objectives of the Plan.

It is not possible to accurately predict changes in natural systems that may occur in the future, however during preparation of the draft BBAMP some potential aspects have been raised and are considered here. The following are provided as examples and it is recognised that changed situations and new information may occur for any taxon.

13.1 Grey-headed Flying-fox

Grey-headed Flying-foxes have been expanding their distribution across Victoria in recent decades with roost-camps increasingly appearing from the east of the state to sites in the west. The species established a camp in Geelong in 2003 and has a year-round occupation. Further west, at Warrnambool Botanic Gardens Grey-headed Flying-foxes were first recorded in 2003 and at Colac Botanic Gardens the species was first seen in 2016. Grey-headed Flying-fox roosts have also been observed at Lower Gellibrand in 2016, and at Bacchus Marsh and Merrimu. In very recent years new roosts have been found near Hexham and Lismore and in Adelaide. Grey-headed Flying-foxes have also been recently (March 2024) observed in the Ballarat botanic gardens, and it is as yet unclear if this colony will be temporary or permanent.

No survey was undertaken for this species as at the time of carrying out targeted surveys as there were limited records in the region. Victorian Biodiversity Atlas records include observations of one or two individuals near Portland between 1998 and 2013. Recently records from a national satellite tracking study have been added to public databases and there are several records of Grey-headed Flying-fox to the north and west of the Project Area. One of the satellite tracked individuals appears to have followed the Glenelg River while moving between the Adelaide-based colony camp and areas in south-western Victoria. DEECA has also reported that a temporary Grey-headed Flying-fox camp was established recently in pine plantations to the north of the Glenelg River. Grey-headed Flying-fox have also recently established temporary camps in pine plantations elsewhere in south-west Victoria and have been recorded as wind farm collision mortalities at nearby wind farms. In the past several years Grey-headed Flying-fox has established temporary camps in many locations across western Victoria as the species expands its range into areas not previously known to have been occupied.

At the time of preparing this draft BBAMP, there is no indication that Grey-headed Flying-foxes utilise the KGPH Project area routinely, but given the dynamic and recent spread of the population into south-western Victoria it is plausible that the species may begin to fly through the site more frequently and that new roost camps could be established nearby or within the Project area.

The monitoring for Grey-headed Flying-foxes set out in the draft Plan is intended to ensure that any such changes are evident and that resulting data can be used to inform altered management that may be required in response.

Currently recommended measures

Low wind speed curtailment of turbines, as recommended here to minimise impacts upon microbats (section 7.1.2) will have capacity to reduce the incidence of collisions by Grey-headed Flying-foxes if they occur at the site because it will function during the hours from 30 minutes after sunset to 3 hours before sunrise when the species is active. Its use during the period from February to March also coincides with the peak period in which Grey-headed Flying-fox collisions have occurred at Salt Creek Wind Farm in western Victoria.

Potential measures

As noted in sections 7.1.1.2 and 7.1.1.3, if Grey-headed Flying-foxes are found to occur at the site, smart-curtailment technologies that incorporate capacity to detect flights of nocturnal animals are likely to have application to reduction of Grey-headed Flying-fox collisions.

13.2 Australasian Bittern

Australasian Bittern occurs at wetlands within the site and the adjacent Glenelg Estuary and Discovery Bay Ramsar site. Of particular importance and relevance to the Project is the series of wetlands including Lake Mombeong, Dead Horse Swamp, Black Swamp, McFarlanes Swamp and Long Swamp and the associated wetlands along the southern boundary of the Kentbruck pine plantation near Lake Mombeong and Nobles Rocks.

Satellite tracking of Australasian Bitterns has relatively recently demonstrated that the species appears to be a partial migrant with resident and seasonally migrating individuals within the Australian population. That study recorded juveniles and adult males moving from the Riverina rice-growing areas inland, to coastal wetlands in South Australia, Victoria and New South Wales post-breeding season (Bitterns in Rice Project 2024). The species is also likely to be resident and sedentary in permanent wetlands and other waterbodies. Whether individuals fly between breeding and non-breeding areas as single birds, in pairs or groups, is unknown, however one juvenile male has been tracked moving at night from the Riverina rice fields to Long Swamp and Picaninny Swamp close to the Project site.

It is evident that further information about local and long-distance movements by Australasian Bitterns will assist in refining management aimed at minimising effects on the species and monitoring recommended here is aimed at providing relevant additional information.

Currently recommended measures

While the flight heights of Australasian Bitterns are not known with certainty, tracking in New Zealand has shown the species flies at rotor swept height, with one individual spending 61% of its time at 20–200 metres (E. Williams pers. comm.).

Low wind speed curtailment of turbines, as recommended here to minimise impacts upon microbats (section 7.1.2) may have capacity to reduce the incidence of collisions by Australasian Bitterns if they occur at the site because it will function during the hours from sunset to sunrise when the species is thought to fly most actively.

Offset strategy

The *Kentbruck Green Power Hub Environmental Effects Statement Technical Report: Flora and Fauna Existing Conditions and Impact Assessment* (Biosis 2024a) indicates the project might result in significant impacts on the Australasian Bittern (as defined under relevant EPBC Act Significant Impact criteria). The Australasian Bittern is the only species with that assessment. If that level of impact was to occur after application of turbine curtailment measures outlined above, then EPBC offsets may be applicable and may entail preparation of compensatory measures as set out in DSEWPC (2012). In consultation with DCCEEW, an offset strategy will be prepared in accordance with the principles of the EPBC Act Environmental Offsets Policy and provided as part of the hearing process for the Inquiry and Minister's consideration. A process for compensation designed to achieve a zero net impact on the Victorian population of the Brolga has been in effect since 2012 and broadly offers some precedents for appropriate compensatory mechanisms, which primarily include rehabilitation and protection of former habitat that has been drained or otherwise degraded.

Potential additional measures

As noted in Sections 7.1.1.2 and 7.1.1.3, if improved information about Australasian Bitterns indicates they are at substantial risk of turbine collision, smart-curtailment technologies that incorporate capacity to detect flights of nocturnal animals are likely to have application to reduction of collisions by the species. Combined radar and camera systems discussed in Section 7.1.1.3 are also likely to avoid and minimise turbine collisions.

13.3 Orange-bellied Parrot

The recovery program for the Orange-bellied Parrot has recently achieved an increase in its critically endangered population through successful reintroductions of captive-bred birds into the wild population. As a consequence, the numbers of Orange-bellied Parrots in the wild has grown and sightings during the period of their annual sojourn on the mainland indicate that at least some individuals have travelled long distances to reach parts of the species former range where they have not been documented for many years. This includes a record by Biosis from near the Project area near Swan Lake in May 2020.

In addition to the increased number and distribution of the species, the recovery program is undertaking telemetry studies of significant numbers of juvenile birds (M. McGrath, S. Troy per. comm.). This study commenced in 2023 and is likely to yield new information about distribution of the species.

At present the KGPH Project is not considered likely to have a direct significant impact on the Orange-bellied Parrot population. However, new information about the species may require specific adjustments to operation of the Project and it is imperative that the Project remains well informed and ready to respond to relevant new information.

Currently recommended measures

Flight heights of Orange-bellied Parrot during their day to day activities are generally substantially below 60 metres (I. Smales pers. obs.). Higher flights may occur at times and during long distance flights. It is likely that the 60 metre high ground clearance of turbine rotors will function to reduce collision risk for the species.

Potential measures

Detection of an Orange-bellied Parrot within the vicinity of a wind turbine, by a confirmed observation or data from tracking studies, could be used as a trigger for intensive monitoring and targeted curtailment.

The details of any such adaptive curtailment for the Orange-bellied Parrot will be outlined in the final BBAMP to be prepared for the Project. These details will include the detection radius (distance from the turbine to a detection) to trigger the curtailment action, the turbines to be included in the monitoring and/or curtailment, and the duration of curtailment or triggers for returning to normal turbine function.

As noted in sections 7.1.1.2 and 7.1.1.3, regardless of potential for collision risk for Orange-bellied Parrots the Project will explore the capacity of smart curtailment technologies to be applied to small birds of concern including the Orange-bellied Parrot.

14 Threatened species offset & research and projects fund

Neoen Australia is committed to provision of one million dollars (AU$1,000,000) annually of funding during operations to implement conservation measures for species that may be affected by the KGPH Project regardless of whether or not any impacts are demonstrated to occur.

At the time of preparing this draft BBAMP details of how the funding will be allocated and accounted have not been developed. It is anticipated that allocation of funds will be adaptive, particularly if it becomes apparent that priority should be given to any taxon or habitat that is affected by the KGPH Project.

The fund will operate in a complimentary and compensatory manner to measures set out in the BBAMP and is not intended to replace them or to limit or reduce any obligations incumbent on the KGPH Project in respect of the BBAMP.

It is currently planned that priority for species to be funded will be determined in consultation with DCCEEW and DEECA. For a given species it is anticipated that priority for conservation measures to be funded will be drawn from priority actions set out in official recovery plans or conservation advice documents and/ or through collaborative consultation with recovery teams. If those sources indicate that key research is required to reduce uncertainty to inform conservation efforts, then relevant research may be funded.

References

Arnett E, Schirmacher W, & Hayes J 2011. 'Altering turbine speed reduced bat mortality at wind-energy facilities.', *Frontiers in Ecology and the Environment*, 9, 4: 209–214.

Arnett EB 2017. *Wildlife and Wind Farms, Conflicts and Solutions. Onshore: Monitoring and Mitigation. // Chapter: Mitigating bat collision*, Perrow M (ed.), Pelagic Publishing, Exeter, UK.

Arnett EB, Hein CD, Schirmacher MR, Huso MM, & Szewczak JM 2013. 'Evaluating the Effectiveness of an Ultrasonic Acoustic Deterrent for Reducing Bat Fatalities at Wind Turbines', *PLoS ONE*, 8, 6.

Baerwald EF, D'Amours GH, Klug BJ, & Barclay RMR 2008. 'Barotrauma is a significant cause of bat fatalities at wind turbines', *Current Biology*, 18, 16: 695–696.

Bennett E, Florent SN, Venosta M, Gibson M, Jackson A, & Stark E 2022. 'Curtailment as a successful method for reducing bat mortality at a southern Australian wind farm', *Austral Ecology*, 47, 6: 1329–1339.

Biosis 2024a. *Kentbruck Green Power Hub Environmental Effects Statement Technical Report: Flora and Fauna Existing Conditions and Impact Assessment*, Report prepared for Neoen Australia Pty Ltd. Authors: Smales. I, Gibson. M, Venosta. M, Biosis Pty Ltd, Melbourne, VIC. Project no. 35014.

Biosis 2024b. *Kentbruck Green Power Hub: Southern Bent-wing Bat Impact Assessment*, Report prepared for Neoen Australia Pty Ltd. Authors: Smales. I, Gibson, M. & Venosta, M. Biosis Pty Ltd, Melbourne, VIC. Project no. 35014.

Biosis 2024c. *Kentbruck Green Power Hub Environmental Effects Statement Technical Report: Brolga Impact Assessment.*, Report prepared for Neoen Australia Pty Ltd. Authors: Smales. I, Gibson. M, Venosta. M, Biosis Pty Ltd, Melbourne, VIC. Project no. 35014.

BirdLife International 2023. *State of the world's Birds - 2023 Update*, *Data Zone*, accessed 23 April 2021, http://datazone.birdlife.org/2023-annual-update.

Bitterns in Rice Project 2024., accessed 5 October 2024, http://www.bitternsinrice.com.au/tracking-bunyip-birds/.

CoA 2009. *Significant impact guidelines for 36 migratory shorebird species: Migratory species*, Australian Government Department of the Environment, Water, Heritage and the Arts, Canberra, ACT, Draft EPBC Act policy statement 3.21.

Dalthorp D, Huso M, & Dail D 2017. 'Evidence of absence (v2.0) software user guide: U.S', *Geological Survey Data Series*, 1055: 109.

DAWE 2022. 'Onshore Wind Farms - interim guidance on bird and bat management',.

DCCEEW 2024. *Environmental Management Plan Guidelines*, Australian Government Department of Climate Change, Energy, the Environment and Water. Canberra, Canberra, https://www.dcceew.gov.au/environment/epbc/publications/environmental-management-plan-guidelines.

DELWP 2017. *Ecological Character Description for Glenelg Estuary and Discovery Bay Ramsar Site*, Department of Environment, Land, Water and Planning, East Melbourne, Victoria.

DELWP 2021. *Policy and Planning Guidelines for Development of Wind Energy Facilities in Victoria*, Report prepared for Victorian State Government. Department of Environment, Land, Water and Planning, Melbourne, VIC.

DEWHA 2009. 'EPBC Act Policy Statement 2.3 Wind Farm Industry', Department of Environment, Water, Heritage and the Arts. Barton, ACT. https://www.environment.gov.au/system/files/resources/c707cc9d-8e11-4d15-a2cb-dabc070f716e/files/wind-farm-industry.pdf.

DEWHA 2010a. *Survey Guidelines for Australia's Threatened Birds: Guidelines for detecting birds listed as threatened under Environment Protection and Biodiversity Conservation Act 1999*, Australian Government Department of the Environment Water Heritage and the Arts. Canberra, Australian Capital Territory.

DEWHA 2010b. *Survey Guidelines for Australia's Threatened Bats: Guidelines for detecting bats listed as threatened under Environment Protection and Biodiversity Conservation Act 1999*, Department of the Environment Water Heritage and the Arts.

DoE 2015. 'Referral guideline for 14 birds listed as migratory species under the EPBC Act', http://www.environment.gov.au/system/files/resources/c05f5b87-0a99-4998-897e-7072c236cf83/files/migratory-birds-draft-referral-guideline.pdf.

DSEWPaC 2012. *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy*, Department of Sustainability, Environment, Water, Population and Communities, Canberra, ACT.https://www.dcceew.gov.au/sites/default/files/documents/offsets-policy_2.pdf.

Garnett S & Baker GB 2021. *The action plan for Australian Birds*, 1st edn, CSIRO Publishing.

Gorresen MP, Cryan PM, Dalton DC, Wolf S, Johnson JA, Todd CM, & Bonaccorso FJ 2015. 'Dim ultraviolet light as a means of deterring activity by the Hawaiian hoary bat Lasiurus cinereus semotus', *Endangered Species Research*, 28, 3: 249–257.

Hein C & Straw B 2021. 'Proceedings from the State of the Science and Technology for Minimizing Impacts to Bats from Wind Energy', https://www.nrel.gov/docs/fy21osti/78557.pdf.

Hull C & Cawthen L 2013. 'Bat fatalities at two wind farms in Tasmania, Australia: bat characteristics, and spatial and temporal patterns', *New Zealand Journal of Zoology*, 40: 5–15.

Hull C & Muir S 2010. 'Search areas for monitoring bird and bat carcasses at wind farms using a Monte-Carlo model', *Australasian Journal of Environmental Management*, 17, 2: 77–87.

Hull CL, Stark EM, Peruzzo S, & Sims CC 2013. 'Avian collisions at two wind farms in Tasmania, Australia: taxonomic and ecological characteristics of colliders versus non-colliders', *New Zealand Journal of Zoology*, 40, 1: 47–62.

Huso M & Dalthorp D 2014. 'Accounting for Unsearched Areas in Estimating Wind Turbine-Caused Fatality', *The Journal of Wildlife Management*, 78, 2: 347–358.

Huso M, Dalthorp D, & Korner-Nieverglt F 2017. *in* Perrow MR (ed.), *Wildlife and Wind Farms, Conflicts and Solutions. Onshore: Monitoring and Mitigation*, Pelagic Publishing, Exeter, UK.

Kerns J, Erickson WP, & Arnett EB 2005. 'Bat and bird fatality at wind energy facilities in Pennsylvania and West Virginia: an assessment of bat fatality search protocols, patterns of fataility, and behavioural interactions with wind turbines. A final report submitted to the Bats and Wind Energy Cooperative.', *Bat Conservation International, Austin, Texas, USA.*

Klein JP & Moeschberger ML 2010. *Survival analysis: techniques for censored and truncated data*, 2. ed., corr. 3. print, Springer, New York, NY, Statistics for biology and health.

Lumsden LF, Moloney PD, & Smales I 2019. *Developing a science-based approach to defining key species of birds and bats of concern for wind farm developments in Victoria*, Report prepared for Department of Environment, Land, Water and Planning. Authors: Lumsden. LF, Moloney. PD, Smales. I, Arthur Rylah Institute for Environmental Research, Heidelberg, VIC. Report Series No. 301.

Martin CM, Arnett EB, Stevens RD, & Wallace MC 2017. 'Reducing bat fatalities at wind facilities while improving the economic efficiency of operational mitigation', *Journal of Mammalogy*, 98, 2: 378–385.

Mathews F, Swindells M, Goodhead R, August TA, Hardman P, Linton DM, & Hosken DJ 2013. 'Effectiveness of search dogs compared with human observers in locating bat carcasses at wind-turbine sites: a blinded randomized trial', *Wildlife Society Bulletin*, 37, 1: 34–40.

Moloney P, Lumsden L, & Smales I 2019. *Investigation of existing post-construction mortality monitoring at Victorian wind farms to assess its utility in estimating mortality rates*, Report prepared for Department of Environment, Land, Water and Planning, Authors: Molony. P, Lumsden. L, Smales. I, Arthur Rylah Institute for Environmental Research Heidelberg, VIC. Report no. 302.

Nicholls AJ, Barker M, Armitage M, & Votier S 2022. *Review of seabird monitoring technologies for offshore wind farms*, Report prepared forOffshore Renewables Joint Industry Programme (ORJIP). Nicholls, A. Barker,M. Armitage, M. Votier, S. RPS group.

Prakash S & Markfort CD 2021. 'Development and testing of a three-dimensional ballistics model for bat strikes on wind turbines', *Wind Energy*, 24, 12: 1407–1425.

Rogers D 2022. *Assessment of Effectiveness of the IdentiFlight Avian Detection System*, Goldwind Australia, Sydney, NSW. Report no. CH-PM-REP-0125.

Rollins KE, Meyerholz DK, Johnson GD, Capparella AP, & Loew SS 2012. 'A Forensic Investigation Into the Etiology of Bat Mortality at a Wind Farm: Barotrauma or Traumatic Injury?', *Veterinary Pathology*, 49, 2: 362–371.

Smales I 2017. *Wildlife and Wind Farms, Conflicts and Solutions. Onshore: Monitoring and Mitigation. | Chapter: Modelling collision risk and populations*, Perrow M (ed.), Pelagic Publishing, Exeter, UK.

Threatened Species Scientific Committee 2021. 'Conservation Advice Miniopterus orianae bassanii Southern Bent-wing Bat',.

Westcott DA, Heersink DK, McKeown A, & Caley P 2015. 'The status and trends of Australia's EPBC-Listed flying-foxes.', https://www.dcceew.gov.au/sites/default/files/documents/status-trends-australias-epbc-listed-flying-foxes.pdf.

Appendices

Appendix 1: Turbine mortality survey data sheet

Survey details:	
Date:	Observers:
Start time:	Finish time:
Turbine ID:	

Survey methodology (please tick):
Dog ID
Human observers
Incidental (Any bird or bat turbine mortality observed outside a routine survey)
Ground visibility (circle): *High* *Moderate* *Poor*

Was entire search area covered? *Yes / No*	NOTE: If not, estimate area covered as a percentage (%) of total search area:

Survey limitations (e.g. long grass, any areas that were inaccessible/not surveyed and why):

Weather details (please circle):				
Temperature:				
Precipitation:	*Fine*	*Showers*	*Rain*	
Wind strength:	*Calm*	*Breeze*	*Moderate*	*Strong*
Wind direction:			Cloud cover (%):	

Turbine bird and bat mortality record:			
Dead/injured bird or bat recorded? *Yes / No*	If yes, record total number:	Bird and Bat carcass / injury datasheet completed? *Yes / No*	Photographs taken? *Yes / No*

Additional notes

Appendix 2: Dead or injured bird / bat data sheet

This datasheet must be completed for every dead / injured bird or bat found during high- and general-intensity turbine mortality surveys. This datasheet should also be completed for any dead /injured bird or bar recorded incidentally (i.e. not during routine surveys).

Each dead bird or bat (including feather spots) must be removed upon discovery and placed into a clearly labelled plastic bag with the date, time, location (GPS coordinates) and turbine number, as required for species identification.

Date and location:				
Date:		Observer/s:		
Time animal was found:				
Turbine ID:		Easting/Northing of carcass:		
Detection:				
Survey method (circle):	*Dog search*	*Human search intensity*	*Incidental*	NOTE: turbine survey datasheet must also be completed.
Distance of carcass / injured animal from observer when first detected:				
Describe ground visibility within a 1 m radius of where carcass / injured animal was found:				
Carcass / injured animal photographed? *Yes / No*		Photo and camera details (e.g. camera number, photo numbers, location of saved photos):		
Weather details at time of detection (please circle):				
Temperature:				
Precipitation:	*Fine*	*Showers*	*Rain*	
Wind strength:	*Calm*	*Breeze*	*Moderate*	*Strong*
Wind direction:		Cloud cover (%):		
Carcass / injured animal information and condition:				
Species (if unknown closest taxonomic group, e.g. raptor, bat):				
Age (circle):	*Unknown*	*Adult*	*Juvenile*	
Sex (circle):	*Unknown*	*Male*	*Female*	
Condition (circle):	*Dead (carcass)*	*Injured but alive*	*Feather spot (≥ 10 feathers)*	
Degree of decay (circle):	*Fresh*	*More than a week old*	*Very old or highly decayed*	
Describe location and type of any injuries evident:				

Describe evidence of scavenging, if any:
Notes / additional information:

Appendix 3. Carcass persistence trial: carcass deployment data sheet

This carcass deployment sheet must be completed for each turbine used in the scavenger trial.

Survey and turbine details:	
Date:	Observers:
Time:	
Turbine ID:	
Ground visibility (circle): *High* *Moderate* *Poor*	
Description of ground visibility (e.g. grass height, rock cover):	

Carcass deployment record:

Carcass type	Unique carcass identifier:	Direction from turbine base:	Distance from turbine base:	Easting / northing:	Notes:

Additional notes:

Appendix 4. Bird and bat utilisation monitoring plans

Details of specific plans for monitoring utilisation by birds and bats will be prepared and included in the final BBAMP. As a general rule, they will at the least, replicate utilisation surveys that were undertaken in the prior to construction of the Project. Those investigations obtained data from treatment and control sites with the intention that pre- and post-construction utilisation rates will be able to be compared.

Appendix 5. Southern Bent-wing Bat Adaptive Management Approach

The following flow chart provides an overview of the proposed SBWB adaptive management approach.

Kentbruck Green Power Hub SBWB Adaptive Management Approach

Key issue

Potential for SBWF impacts - collisions with turbines. Management approach - Avoid, Mitigate, Offset

Adaptive management process phases'

Plan, Do, Learn and Evaluate, Adjust

Plan and Do

Baseline studies, risk assessment, planning for minimising impact (avoidance)

1. Turbine selection for monitoring should consider stratification by habitat type (Plantation and Farmland), distribution throughout the site and proximity to known caves.
2. Micrositing based on several years of targeted site surveys.
3. Develop a curtailment strategy, which will include consideration of temporal factors (seasonal and daily) and climatic factors (temperature, rainfall and windspeed)

Monitoring Program

1. SBWB Monitoring Program designed to detect bat collisions with turbines. SBWB Monitoring Program will include monthly monitoring during operation. Pulse surveys are conducted during peak activity periods, including autumn and spring.

Evaluate and learn

Collision impacts detected (one or more) at turbine Investigation / Mitigation:

- ASAP (within 2 days to align with carcass persistence) survey approximately 18 turbines to determine if there is larger event
- Investigation - single or multiple
- Evaluate turbine siting to see if that is a possibly contributing factors.
- Are there any key findings (season, wind speed, other factors) that provide potential inputs to other management strategies.
- Apply any learnings that can be operationally implemented.
- Review - Are there any other mitigation techniques applicable (from annual appraisal) that could reduce any detected impacts?
  If yes - commence trial ASAP.
  If no - continue to monitor.
- Annual commitment - Mitigation readiness: Ongoing action it to review and report on (annually) available mitigation options in the event they are required.

Adjust / Mitigate

- Turbines (1 or more) where first mortality event identified raise cut in speed by 1.5m/s (6.0 m/s).

Evaluate and learn

Turbines with subsequent mortality event

- Complete same investigation.
- Apply any learnings that can be operationally implemented.
- Conduct turbine specific study to determine wind speed limit (RSA) where risk of further mortalities can be eliminated?

Adjust / Mitigate

- Raise cut in by a further 1.5m/s (7.5 m/s).
- Based on results of turbine specific study apply wind speed limit to turbines where multiple mortalities have been identified.

Offset commitment operates independently but is adjusted based on Adaptive Management approach outcomes

Offset

If the Significant Impact Trigger (section 6.2) is exceeded, in addition to the continual application of mitigation techniques, a trigger contribution of $50,000 dollars will be made to the offset fund. Apply Adaptive Management Phases where possible to ensure offsets provide a genuine contribution to the species (and its recovery).

If carcasses or injured individuals of 10 or more Southern Bent-wing Bats are found across the wind farm in any rolling 12 month period, or that the number of trigger levels at a single turbine exceed two and a one off contribution of $50,000 dollars has already been made, DEECA will be informed within 2 business days of the event occurring. The wind farm operator will collaborate with DEECA to determine an appropriate further course of action.