Hexham Wind Farm

Chapter 9

Bats

WIND PROSPECT

9.1 Overview

This chapter describes the assessment of potential impacts from the construction, operation and eventual decommissioning of the project on bat species, and measures taken to avoid and minimise these impacts in consultation with the Victorian Department of Energy, Environment and Climate Action (DEECA) and the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW).

This chapter is based on the findings of the ***Bat Assessment*** (Appendix C2) prepared by Nature Advisory. Specific bat species assessed by Nature Advisory were Southern Bent-wing Bat (*Miniopterus orianae bassanii*), Grey-headed Flying-fox (*Pteropus poliocephalus*) and Yellow-bellied Sheath-tailed Bat (*Saccolaimus flaviventris*), which are protected under Commonwealth and Victorian legislation. Potential impacts on bat species have been presented separately from the broader flora and fauna impact assessment (Chapter 8 – ***Biodiversity and habitat***) to capture the significant survey effort, design mitigations and management controls that have been proposed.

Over the last decade, there has been significant effort to assess the presence and activity of threatened bat species within the project site. This included numerous bat detector surveys, undertaken across various seasons between Spring 2010 and Autumn 2023. In total, 4,418 bat detector nights were surveyed at over 80 unique sites across the project site and the surrounding area, recording vocalisations at ground level and at height. These vocalisations were analysed to identify unique call sequences and the presence of different bat species. Calls from nine bat species were recorded during bat detector surveys, including two listed threatened species: the Southern Bent-wing Bat (listed as Critically Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *Flora and Fauna Guarantee Act 1988* (FFG Act)) and the Yellow-bellied Sheath-tailed Bat (listed as Vulnerable under the FFG Act).

Out of tens of thousands of recording files from the surveys, 218 were assigned to the Southern Bent-wing Bat and 2,244 calls were assigned to a Southern Bent-wing Bat species complex (i.e., calls with characteristics that could have been produced by Southern Bent-wing Bat, Little Forest Bat, or Chocolate Wattled Bat). Most confirmed Southern Bent-wing Bat calls were from treed and wetland habitats, specifically along Mustons Creek. A total of 610 Yellow-bellied Sheath-tailed bat calls were recorded. Other bat species recorded within the project site, accounting for most of the activity, are common and widely distributed.

Widely distributed refers to species whose distribution is not restricted to a small portion of Australia, and that are recorded commonly throughout their distribution.

Targeted surveys were also undertaken to understand the movement of Grey-headed Flying fox (listed as Vulnerable under the EPBC Act and FFG Act) from a temporary camp at a pine plantation to the east of the project site. During the survey period, no flights towards to the project site were observed, likely due to a lack of significant food sources within the project site.

To minimise the impact of the project on threatened bat species, proactive avoidance and minimisation strategies were developed during the design development process in consultation with DEECA and DCCEEW. This includes turbine design and micro-siting to avoid impacts to threatened Southern Bent-wing Bat and Yellow-bellied Sheath-tailed Bat populations. A mitigation hierarchy was developed to preferentially avoid high-quality habitat and areas where high levels of Southern Bent-wing Bat activity were recorded.

Attachment V - ***Bat and Avifauna Management Plan*** will be implemented during project operation to minimise bat collisions with wind turbines. Mitigation measures outlined in this plan include increasing the wind turbine cut-in windspeed as informed by modelling and site observations, which is the windspeed at which turbines start operating, and implementing blade feathering at designated times and seasons as informed by further acoustic bat surveys and additional Grey-headed Flying-fox monitoring during first two years of project operation.

Blade feathering refers to the act of preventing the turbine blades from free-spinning below the cut-in speed, which is achieved by locking turbine blades or angling the blades to be parallel to the wind.

While the likelihood of bat collisions with project wind turbines has been minimised as far as practical, a low- to very low-level of bat mortality is anticipated.

9.2 EES objectives and key issues

The EES scoping requirements specify the following evaluation objective and key issues, outlined in Table 9.1, relevant to bat species that have guided this assessment.

Table 9.1 EES evaluation objective and key issues

Evaluation objective	
Biodiversity and habitat: *To avoid, and where avoidance is not possible, minimise potential adverse effects on biodiversity values within and near the site including native vegetation, listed threatened species and ecological communities, and habitat for these species. Where relevant, offset requirements are to be addressed consistent with state and Commonwealth policies.*	
Key issues	• Direct loss or degradation of habitat for migratory or threatened flora and fauna listed under the EPBC Act and/or the FFG Act. • Disturbance and/or degradation of adjacent or nearby habitat that may support listed threatened or migratory species or other protected flora, fauna or ecological communities • Disturbance and increased mortality risk to flora and fauna species listed under the EPBC Act and/or FFG Act. • Indirect habitat loss or degradation resulting from other effects, such as edge effects, surface hydrological changes, groundwater drawdown, noise, vibration, light or the introduction of weeds/ pathogens. • Disruption to the movement of fauna between areas of habitat across the broader landscape, including between roosting, breeding and potential foraging sites for the **Southern Bent-wing Bat** and **Grey-headed Flying-fox**. • Potential collision risk for protected bird and bat species with project infrastructure, including with wind turbine blades. • Potential cumulative effects on relevant listed threatened and migratory species and communities of flora and/or fauna, in particular, but not limited to, Brolga, **Southern Bent-wing Bat**, **Grey-headed Flying-fox**, White-throated Needletail and Black Falcon from the project in combination with the construction and operations of other energy facilities.

9.3 Legislation, policy and guidelines

Legislation, policies and guidelines relevant to the ***Bat Assessment*** (Appendix C2) are summarised in Table 9.2 below.

Table 9.2 Relevant legislation, policies and guidelines

Legislation, policy and guidelines	**Description**	**Relevance to project**
Commonwealth		
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	The EPBC Act provides a framework for the protection and management of defined matters of national environmental significant (MNES), including nationally threatened species.	Two bat species listed under the EPBC Act are present within the investigation area: • Southern Bent-wing Bat (Critically Endangered) • Grey-headed Flying-fox (Vulnerable). Impacts to this species require formal approval under the EPBC Act and may require specific offsets.

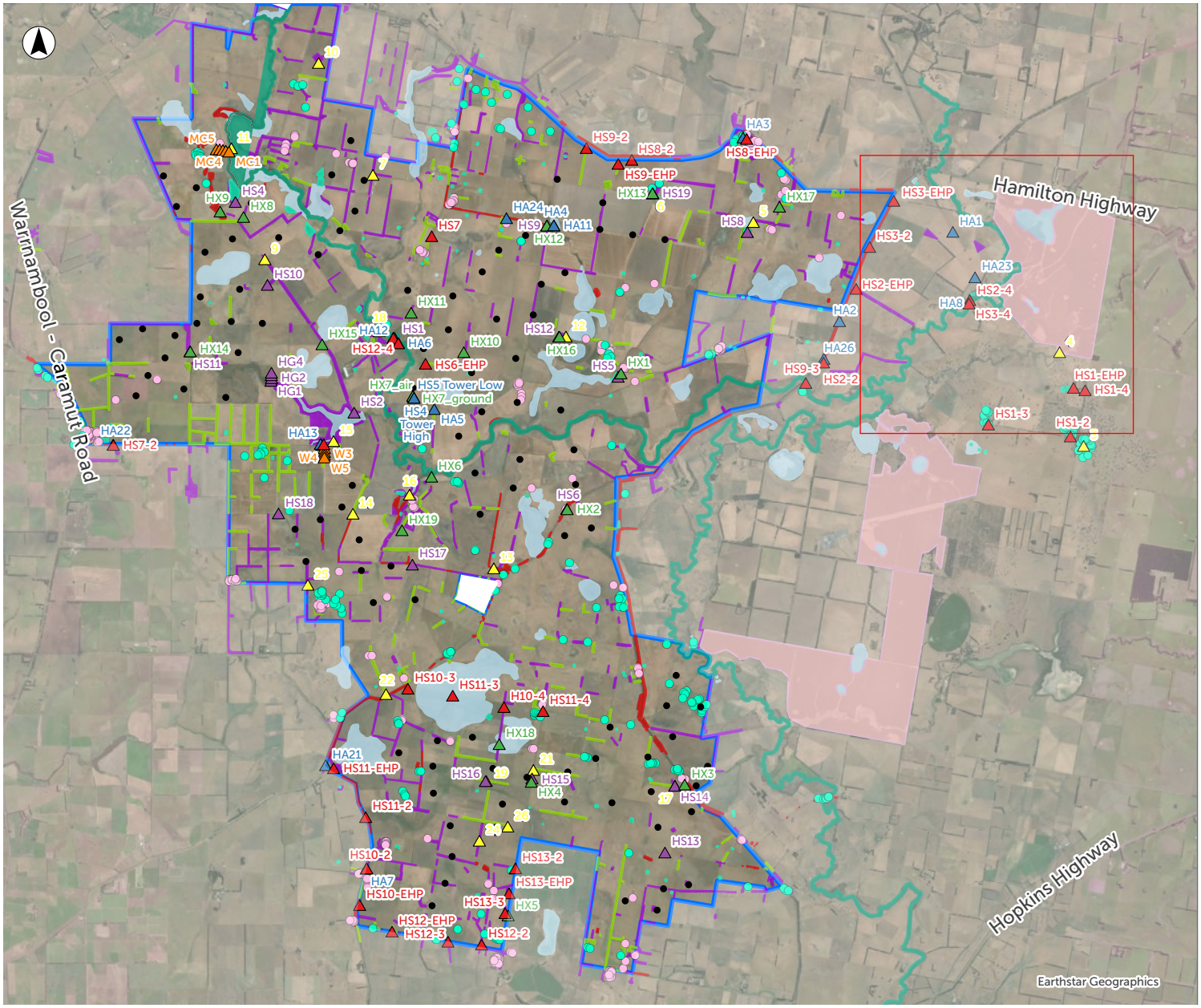
Legislation, policy and guidelines	Description	Relevance to project
Onshore wind farm guidance - best practice approaches when seeking approval under Australia's national environment law (DCCEEW, 2024a)	This guidance outlines best practice for planning and assessing onshore wind farm projects under the EPBC Act. It provides advice on survey requirements and management plans for nationally threatened bird and bat species.	Attachment V - ***Bat and Avifauna Management Plan*** has been prepared in accordance with the Onshore Wind Farm Guidance (DCCEEW, 2024a).
Survey Guidelines for Australia's Threatened Bats: Guidelines for Detecting Bats Listed as Threatened Under the *Environment Protection and Biodiversity Conservation Act 1999* (DEWHA, 2010)	These guidelines provide recommended methods for conducting presence/absence surveys for threatened bat species listed under the EPBC Act.	The project has the potential to impact two EPBC Act listed bat species present within the investigation area. Surveys for these species were conducted in accordance with these guidelines.
State		
Flora and Fauna Guarantee Act 1988 (FFG Act)	The FFG Act lists threatened and protected species in the State of Victoria.	Three bat species listed under the FFG Act are present, or can potentially be present within the investigation area: • Southern Bent-wing Bat (Critically Endangered) • Yellow-bellied Sheath-tailed Bat (Vulnerable) • Grey-headed Flying-fox (Vulnerable). A permit may be required under the FFG Act if project activities are likely to impact these species or their habitat.
Southern Bent-wing Bat (Miniopterus orianae bassanii) Action Statement (DEECA, 2023b)	Under the FFG Act, Action Statements are statutory documents prepared for every listed threatened species, ecological community, or potentially threatening process.	This statement is used to inform identified threats and conservation approaches for the recovery of the species.
Handbook for the development of renewable energy in Victoria (the Handbook) (DEECA, 2025a)	The Handbook for the development of renewable energy in Victoria (the Handbook), published by DEECA in May 2025, recommends and includes guidance on a risk-based approach to identify, assess and manage impacts on threatened bat species.	Under the transitional arrangements the Handbook does not apply to a project that was referred to the Minister for Planning for assessment under the *Environment Effects Act 1978* or where an assessment under the *Environment Effects Act 1978* commenced prior to the commencement of the Handbook. These transitional arrangements apply to the project, however a risk-based approach has still been utilised.

Legislation, policy and guidelines	Description	Relevance to project
Planning and Environment Act 1987	The purpose of the *Planning and Environment Act 1987* is to establish a framework for planning the use, development and protection of land in Victoria. This Act sets out the process for obtaining permits under schemes, settling disputes, enforcing compliance with planning schemes and permits, and other administrative procedures.	The Moyne Planning Scheme is relevant to the project and is administered by the Moyne Shire Council.
	Planning Policy Framework and Municipal Strategic Statement	The following clauses of the Planning Policy Framework and Municipal Strategic Statement contained within the Moyne Planning Scheme are relevant to biodiversity for the project: • 02.03-2 Environmental and landscape values strategic directions include *"Protect and enhance land that supports ecological communities hosting native flora and fauna"* • 12.01-1S Protection of biodiversity objective is *"to assist the protection and conservation of Victoria's biodiversity."* • 12.01-2S Native vegetation management objective is *"to ensure that there is no net loss to biodiversity as a result of the removal, destruction or lopping of native vegetation."*
	Particular provisions	Clause 52.32 Wind Energy Facility facilitates the establishment and expansion of wind energy projects, in appropriate locations, with minimal impact on amenity of the area. It requires that impacts of wind energy projects on FFG Act listed species are assessed.
National Recovery Plan for the Southern Bent-wing Bat Miniopterus orianae bassanii (National Recovery Plan) (DELWP, 2020a)	The National Recovery Plan outlines the biology, threats, and recovery actions required to support the long-term survival of the Southern Bent-wing Bat.	The Southern Bent-wing Bat is present within the investigation area for the project. As such, the project considered the objectives, actions, and conservation advice listed in the Recovery Plan and associated Conservation Advice.
Wildlife Act 1975	This Act provides legal protection for all native wildlife in Victoria, including bats, and includes enforcement provisions.	Relevant where project activities may result in harm to native bats, for example through collision with wind turbines. This Act may also apply to mortality monitoring activities.

9.4 Investigation area

The bat species investigation area primarily includes the project site, however surrounding areas were included in some bat detector surveys (Spring 2010, Autumn 2011, Spring 2018, Summer-Autumn 2019, Summer-Autumn 2022) as they were within the site boundary for previous project design layouts. The development of the project site and the previous designs are discussed in Chapter 5 – ***Project alternatives and design development.***

The location of bat detectors for all surveys in relation to the project site are shown in Figure 9.1. Targeted Grey-headed Flying fox survey locations, to the east of the project site, are shown in Figure 9.2.



Legend

- Wind farm boundary
- Turbine

Bat survey

- Spring 2010
- Autumn 2011
- Spring 2018
- Autumn 2019
- Autumn 2020
- Autumn 2023
- Grey-headed Flying Fox survey area - See figure 9.2

Habitat features

- Farm dam
- Forestry plantation
- Permanent creeks
- Pine tree row
- Planted Eucalypts
- Remnant native woodland
- Wetland
- Planted tree
- Remnant tree

Scale

km

0 1 2 3 4 5

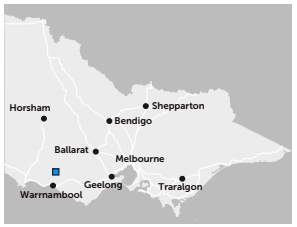


Figure 9.1 Investigation area and survey locations

Figure 9.2 Grey-headed Flying fox survey locations

9.5 Method

The potential impact of wind farms on bat species is recognised as a key environmental issue for the wind energy industry. This is due to the potential for collision with turbine blades and disturbance to foraging and roosting habitats.

The assessment method used was informed by the guidelines described in Section 9.3 and included a general bat detector survey, as well as targeted Grey-Headed Flying Fox surveys. These surveys are described in the following sections.

The risk of collisions with wind turbines was assessed using the impact definitions provided in Table 9.3.

Table 9.3 Collision risk impact definitions

Impact level	Definition
Very low	The impact is localised (immediate vicinity) and/or short-term, and changes to the receptor are unlikely to be detectable above natural conditions. Having negligible effect on the known population or range of the receptor
Low	The impact is at the site scale and/or is medium-term, and results in reversible changes (i.e. to conservation status / population viability / genetic resource etc.) to the receptor once the activity has ceased. Having a minor effect on the known population or range of a receptor.
Medium	The impact is local scale and / or is medium term, and results in reversible changes to the receptor once the activity has ceased. Loss of a moderate proportion of the known population or range of a receptor.
High	The impact is regional scale and long-term, and results in reversible changes to the receptor once the activity has ceased. Loss of a high proportion of the known population or range of the receptor.
Very high	The impact is regional (or up to international) scale, and/or long-term, and results in substantial and possibly irreversible change (permanent), or total loss, to the receptor. Loss of a very high proportion of the known population or range of the receptor.

9.5.1 Bat detector surveys

A series of bat detector surveys were undertaken to record bat activity across the investigation area. These surveys were designed to capture seasonal variation and reflect best-practice survey methodologies that evolved over time.

Bat detector nights are monitoring sessions (typically dusk to dawn) where acoustic recorders are deployed to capture the vocalisations of bats during their active periods.

The bat detector surveys used ultrasonic microphones to record bat calls at different locations and heights throughout the investigation area, as individuals navigated the area are using echolocation (interpreting the echoes of their calls). The survey recordings were filtered and analysed to identify unique call sequences and the presence of specific bat species. This data identifies the presence and activity of unique bat species over time and at specific locations, however it cannot indicate population size as one individual can be responsible for multiple calls.

A summary of the bat detector surveys, including the number of detectors deployed, survey duration and total bat detector nights undertaken, is provided in Table 9.4. Further detail on each survey period is provided in the following sections.

Table 9.4 Summary of bat detector surveys undertaken

Survey	Number of nights	Number of sites	Total bat detector nights
Spring 2010	7-21	36	298
Autumn 2011	7-66	18	413
Spring 2018	14-53	19	438
Summer-Autumn 2019	7-79	23	1462
Summer-Autumn 2020	74-92	10	930
Autumn 2023	18-61	21	877
Total	**7-91**	**127**	**4,418**

Spring 2010 and Autumn 2011 Surveys

These surveys were undertaken based on the initial project design site and predominantly involved ground-level detectors, with one detector positioned at ground level and on an anemometer tower at a height of 42 metres (referred to as a 'paired' detector). These detectors were deployed for a period of five weeks in both Spring and Autumn, targeting seasonal movements of Southern Bent-wing Bats as they departed from or returned to maternity caves. The initial project design site, which has now been superseded, included areas outside the current project boundary. As such, six detector sites in the Spring 2010 survey and two sites in the Autumn 2011 survey are located outside of the current project site.

The detectors were placed in a range of habitat types, including areas near remnant trees, dams, watercourses and ridge-tops. Detectors were maintained at each survey site for approximately one to two weeks. A total of 706 bat detector nights were recorded.

Spring 2018 and Summer-Autumn 2019 Surveys

Additional surveys were conducted in spring 2018 and Summer-Autumn 2019 to reflect current and evolving best practice survey methodology outlined in the Survey Guidelines for Australia's Threatened Bats (DEWHA, 2010) and advice provided by DEECA based on surveys at other proposed wind farm sites in south-west Victoria.

Similar to previous studies, this methodology involved ground-level and paired detectors positioned at ground level and a raised height of 50 metres (as opposed to 42 metres) on an anemometer tower. The detectors were again located in a range of habitat types but sought to survey a wider range of habitats than previously surveyed across the project site. Detectors were maintained at each survey site for approximately one to eleven weeks, with a total of 1,900 bat detector nights recorded over this period.

Summer-Autumn 2020 Surveys

Specific surveys were undertaken in Summer-Autumn 2020 to characterise the height distribution of bat species and trends in activity of the Southern Bent-wing Bat in relation to the distance to key habitat features. These surveys involved five paired detectors placed at 60-metre intervals from Mustons Creek and a large wetland within the project site (Wetland ID: 220382) to determine whether the Southern Bent-wing Bat preferred habitat adjacent to water sources and inform the development of design mitigations including buffer instances for water sources. However, the relationship between Southern Bent-wing Bat activity and distance to these habitats was not able to be statistically modelled due to low levels of recorded activity.

Detectors were maintained at each survey site for approximately 10 to 13 weeks. A total of 930 bat detector nights were recorded.

Autumn 2023 Survey

The 2023 Autumn surveys included locations that had been surveyed previously but also captured new sites, which were chosen at similar habitat features across the investigation area in an attempt to identify patterns of Southern Bent-wing Bat activity at these habitat features. This survey also targeted a wide range of habitats across the investigation area, rather than locations of anticipated or known suitable habitat for the Southern Bent-wing Bat.

Ground-level detectors were maintained at each survey site for approximately two to eight weeks. A total of 877 bat detector nights were recorded.

9.5.2 Grey-headed Flying-fox surveys

A temporary Grey-Headed Flying-fox camp was established and used seasonally in a pine plantation to the east of the investigation area throughout 2022 and 2023, located within three kilometres of the project site. Twelve targeted field surveys for Grey-headed Flying-fox were undertaken while the camp was present to determine their presence, number and typical flight paths. These included evening surveys (commencing 30 minutes prior to sunset and continuing for two hours after sunset) and morning surveys (commencing at least one hour prior to sunrise and continuing for ten minutes following sunrise) utilising thermal binoculars as needed to improve vision. The survey sites, shown in Figure 9.2. were selected as they provided an unobstructed view of the landscape.

Following the completion of targeted surveys, acoustic recorders were used to monitor the presence of the Grey-headed Flying-fox camp between March and April 2023. This data was analysed to identify call sequences of Grey-headed Flying-fox and determine when the bats left the temporary camp. Detection of Grey-headed Flying-fox through acoustic analysis became more difficult as activity at the camp reduced. As such, it is possible that a small number of individuals remaining at the site may not have been detectable due to infrequent calling.

A single incidental observation was made in September 2023 of Grey-headed Flying-fox at the temporary camp.

9.6 Existing conditions

Project surveys identified two threatened bat species within the project site: Southern Bent-wing Bat and Yellow-bellied Sheath-tailed Bat. No Grey-headed Flying-fox were observed within the project site.

The occurrence of these species, and other non-threatened bat species, within the project site are discussed in the Sections 9.6.1 to 9.6.4.

There is limited or no information on flight heights for most Australian bats, primarily due to technical limitations in recording bat activity across a vertical gradient (Adams et al., 2009). Noise interference at height also limits the ability to accurately determine species calls. As such, where bat species were recorded at ground level they were also assumed to also fly within the Rotor Swept Area.

Complex calls

Calls with characteristics that could be attributed to the Southern Bent-wing Bat, Little Forest Bat or Chocolate Wattled Bat are referred to as 'complex calls' as they are difficult to attribute to an individual species. An unknown portion of these calls were made by the Southern Bent-wing Bat.

Confirmed calls are those which can be directly attributed to a single species.

9.6.1 Southern Bent-wing Bat

The Southern Bent-wing Bat is a cave-roosting species with a restricted distribution in south-eastern Australia that spans from Robe, Naracoorte and Port MacDonnell in south-east South Australia, to Lorne and Pomborneit in south-west Victoria (Churchill, 2008; Threatened Species Scientific Committee, 2021). They are classified as a microbat species, with an average weight of approximately 16 grams and length of 52-58 millimetres.

Across Australia, the Southern Bent-wing Bat has undergone significant population decline since the 1960s (DELWP, 2020a). Consequently, it was listed as Critically Endangered under the EPBC Act and FFG Act. Recent population modelling predicts an 84% to 97% reduction in population size from 2020-2056 (van Harten et al., 2022b), with continued population decline suspected to be driven primarily by historical and ongoing loss of foraging habitat due to agricultural practices, drought and disease introduction.

There were 218 Southern Bent-wing Bat calls recorded from 33 of the 128 survey locations (i.e., 25% of survey locations) across the investigation area from 2010 to 2023 (shown in Table 9.5), averaging 0.05 calls per night, which indicates a very low level of activity. As such, it is unlikely that high numbers of individuals would be on site regularly or for extended periods. The survey location with the highest Southern Bent-wing Bat activity was HS1-2 (Spring 2010), which recorded 69 calls over seven bat detector nights. This location is no longer within the project site, following revision of the site boundary to avoid or limit impacts to the species and other environmental and social values. Design measures to avoid bat habitat are discussed in Section 9.7.2, and the development of the project to avoid other environmental and social values is discussed in Chapter 5 – ***Project alternatives and design development***.

In addition, 2,244 calls were attributed to the Southern Bent-wing Bat species complex across all survey periods. These calls could be an indication of additional Southern Bent-wing Bat activity, or non-threatened bat species activity including the Little Forest Bat and Chocolate Wattled Bat. These calls included:

- 1,474 calls in Spring 2010
- 282 calls in Autumn 2011
- 29 calls in Spring 2018
- 254 calls in Summer-Autumn 2019
- 50 calls in Summer-Autumn 2020
- 155 calls in Autumn 2023.

Calls from non-threatened bat species which are included in this species complex are discussed in Section 9.6.4.

Foraging and habitat usage

The Southern Bent-wing Bat forages for insects across a variety of habitats, including forests, farmland and wetlands. It is known to travel long distances from its roosting caves to reach preferred foraging areas and shows a strong preference for seasonally inundated wetlands with diverse vegetation. There are two major maternity caves with a long history of use that support the reproduction of the Southern Bent-wing Bat:

- Starlight Cave in Warrnambool, approximately 40 kilometres south of the project site
- Portland Cave, approximately 100 kilometres west-south-west of the project site.

These caves are used in late Spring and early Summer.

Non-breeding caves are relied on for roosting outside of active periods throughout cooler seasons. Two non-breeding caves are located within 30 kilometres of the project site:

- Panmure Cave, approximately 30 kilometres south-south-east of the project site
- Grassmere Cave, approximately 25 kilometres south-south-west of the project site.

There are no known roosting areas within the project site.

Bat detector surveys showed that Southern Bent-wing Bat activity (measured as calls per night) tended to be greater close to wetlands and wooded vegetation such as planted eucalypts and forestry plantations, particularly in the centre and north-east of the project site. When considering complex calls, activity was mostly recorded from wooded vegetation such as remnant native woodland (roadside) vegetation, planted eucalypts and pine tree rows. However, there is considerable variability in the spatial distribution of recorded calls, demonstrating that Southern Bent-wing Bat can utilise a range of habitats across the landscape. Figure 9.3 shows the location of Southern Bent-wing Bat activity during each survey season (shown in different colours) and rate of calls per night (shown as the size of circles), including complex calls that may be attributed to the Southern Bent-wing Bat.

Flight behaviour and movements

The Southern Bent-wing Bat has a fast, direct flight pattern and is capable of travelling long distances between roost caves and foraging areas. With average nightly movements of up to 35 kilometres and longer nightly inter-cave flights ranging from 70 to 85 kilometres (Bush et al., 2022; van Harten et al., 2022a), the species is likely to be present across, and forage within, the project site on an ongoing basis as it moves between caves or other foraging areas.

Preliminary research (which has not yet been peer reviewed) using GPS tracking found the Southern Bent-wing Bat primarily flies at lower heights (between 0 and 30 metres). However, flights up to 80 metres in height were observed, increasing the risk of mortalities due to wind turbine collision (Bush et al., 2025). Modelled data shows that they are capable of flying to heights of more than 70 metres. Southern Bent-wing Bat activity was only recorded at ground level during the bat detector surveys.

Southern Bent-wing Bat (and Southern Bent-wing Bat complex) activity was analysed in relation to weather and proximity to habitat to inform the development of management controls. Results of this analysis indicated that activity increases with temperature, decreases with wind speed, and is slightly reduced with greater distance to treed habitat, with significant variation across sites and dates.

Table 9.5 Confirmed Southern Bent-wing Bat calls

Survey location	Habitat description	Bat detector nights	Total number of calls	Average calls per night
Spring 2010				
HS1*	Creek	7	1	0.14
HS3	Remnant native woodland	7	2	0.14
HS1-2*	Remnant tree	7	69	9.85
HS2-2*	Remnant native vegetation	7	3	0.42
HS3-2*	Remnant native woodland	7	1	0.14
HS1-4	Planted eucalypts	12	1	0.08

Survey location	Habitat description	Bat detector nights	Total number of calls	Average calls per night
HS1-3	Remnant tree	7	1	0.14
Autumn 2011				
HA13	Planted eucalypts	35	13	0.97
HA12	Creek	35	2	0.06
Spring 2018				
HX7-ground	Cleared open land (non-treed)	53	1	0.02
HX11	Planted eucalypts	21	1	0.05
HX13	Planted eucalypts	21	1	0.05
HX15	Cleared open land (non-treed)	20	1	0.05
HX17	Planted eucalypts	20	1	0.05
Summer-Autumn 2019				
HS8	Remnant tree	59	25	0.42
HS12	Planted eucalypts	58	22	0.38
HS14	Planted eucalypts	59	10	0.17
HS3	Remnant native woodland	79	6	0.08
HS16	Pine tree row	59	3	0.05
HG1	Cleared open land (non-treed)	58	1	0.02
HG2	Cleared open land (non-treed)	58	1	0.02
HG3	Cleared open land (non-treed)	58	1	0.02
HS5	Farm dam	79	1	0.01
HS6	Remnant native woodland	78	1	0.01
HS7-ground	Cleared open land (non-treed)	53	1	0.02
Summer-Autumn 2020				
W2	Cleared open land (non-treed)	92	2	0.02
W3	Cleared open land (non-treed)	92	6	0.07
Autumn 2023				
4	Forestry plantation	34	10	0.29
5	Wetland	59	18	0.31
7	Planted eucalypts	33	2	0.06
12	Planted eucalypts	59	2	0.03
15	Wetland	61	1	0.02
16	Wetland	58	7	0.12
Total		**4,418**	**218**	**0.05**

* Denotes survey locations that are no longer within the project site

Total and average number of calls

The average number of calls per night (also referred to as relative activity) is a more representative measure of species occurrence than activity per site, as the number of bat detector nights varied between survey sites.

However, the limitation of 'calls per night' is that it does not take into account conditions when bat activity may be lower, such as lower temperatures and higher wind or rainfall.

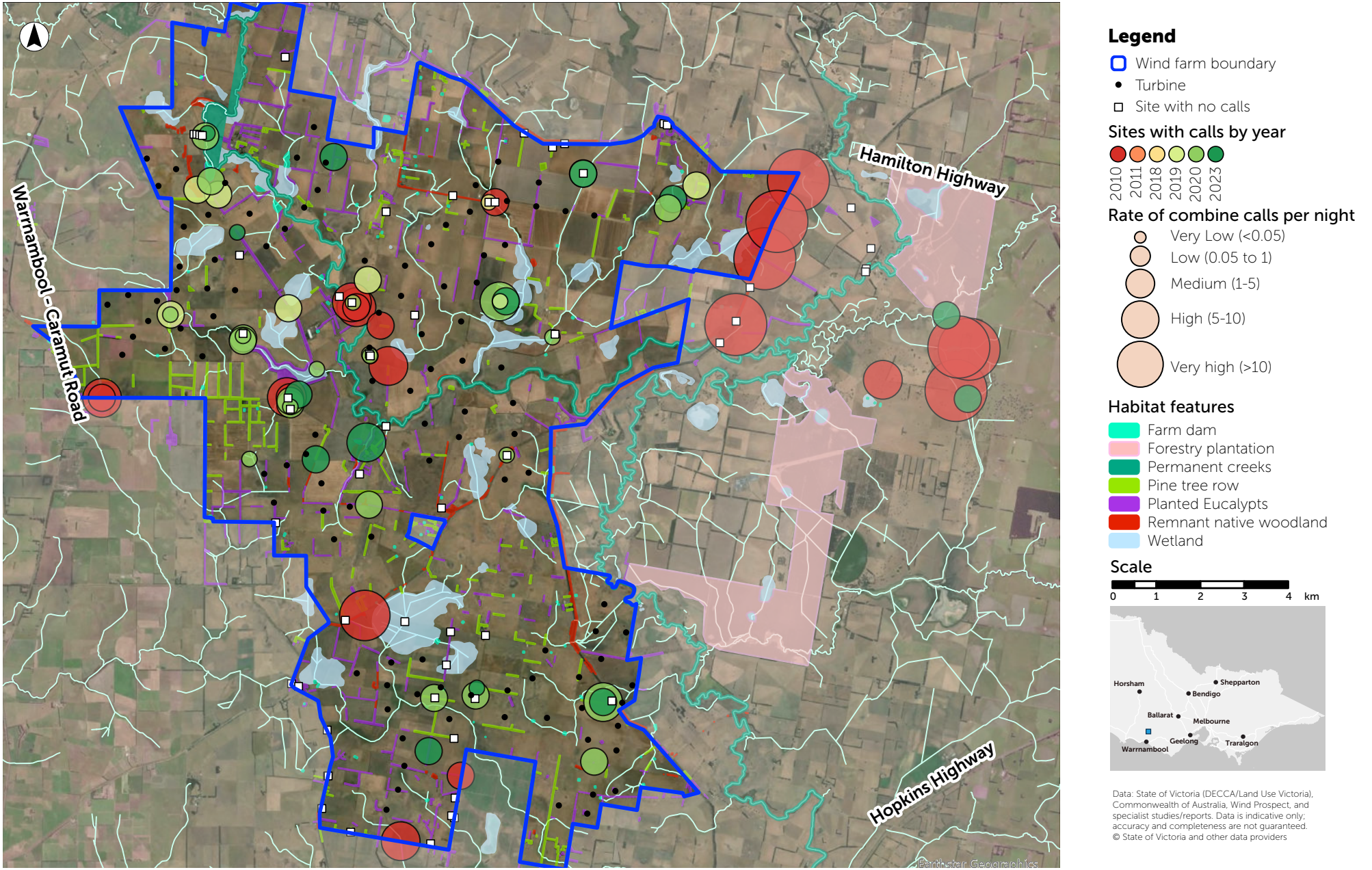


Figure 9.3. Confirmed and complex calls attributed to the Southern Bent-wing Bat

9.6.2 Yellow-bellied Sheath-tailed Bat

The Yellow-bellied Sheath-tailed Bat is a wide-ranging species found throughout tropical and sub-tropical Australia. Rare occurrences have been recorded in southern regions such as Victoria, predominantly in late Summer and Autumn, with some individuals likely displaced southward by adverse wind conditions. They are a large microbat species, with an average weight of 30-60 grams and length of 76-87 millimetres.

The number of Yellow-bellied Sheath-tailed Bats in Victoria is unknown. Due to a decline in recordings in Victoria, the species has been listed as Threatened under the FFG Act. It has also been listed as 'least concern' on the International Union for Conservation of Nature (IUCN) Red List. The IUCN notes its wide distribution, large population size and use of varied habitats, but acknowledges uncertainty regarding its status in south-eastern Australia, where it is rarely recorded. Declines in population size are largely attributed to disturbance of roosting and breeding sites, habitat clearance and modification, the use of pesticides and impacts to food sources.

The **ICUN Red List of Threatened Species** is the world's most comprehensive inventory of the global conservation status of plant and animal species. It assesses extinction risk based on scientific data and helps guide conservation actions and policy decisions.

There were 610 Yellow-bellied Sheath-tailed Bat calls recorded from 25 of the 128 survey locations (i.e., 20% of survey locations) across the investigation area from 2010 to 2019 (shown in Table 9.5), averaging 1.13 calls per night. Unusually high activity was recorded in the Spring 2010 and Autumn 2011 surveys, suggesting there may be a resident population that does not migrate north during Spring, contrary to available literature. The 2018 and 2019 surveys indicated much lower levels of activity than previously recorded and at fewer locations, however they confirmed a continued presence of the Yellow-bellied Sheath-tailed Bat within the project site. Over the past 10 years, bat call analysts have realised that calls which were previously attributed to the Yellow-bellied Sheath-tailed Bat in Victoria are more likely to be calls at the lower end of the Gould's Wattled bat call range, and therefore a number of the calls recorded in 2010 and 2011 are possibly incorrectly identified (R. Gration, pers. comm.).

Foraging and habitat usage

The Yellow-bellied Sheath-tailed Bat forages for insects across a wide range of habitats, including wet and dry sclerophyll forests, open woodlands and modified landscapes. Typically roosting in large tree hollows, it has also been observed roosting in buildings.

Within the project site, bat detector surveys recorded activity (measured as calls per night) near windbreaks, wetlands, a farm dam and remnant native woodland in linear roadside vegetation. However, no specific habitat preference was determined. An extensive study in the Cadia Valley, New South Wales, found that Yellow-bellied Sheath-tailed Bat activity was strongly correlated with the size of remnant vegetation patches, with higher activity observed in areas over 500 hectares (Richards, 2008). This suggests that large, continuous habitat areas may be important for supporting the species.

Flight behaviour and movements

The Yellow-bellied Sheath-tailed Bat is an open-space adapted species that typically flies high and fast above the canopy, although it may also forage at lower altitudes over open areas and forest edges. At the project site, the species was recorded at ground level and flying at a height of 42 metres during the 2011 surveys, which indicates that there is potential for wind turbine collisions. However, no detections at height were recorded during the 2018–2019 surveys with all recordings located at ground level.

Table 9.6 Confirmed Yellow-bellied Sheath-tailed Bat calls

Survey location	Habitat description	Bat detector nights	Total number of calls	Average calls per night
Spring 2010				
HS8	Large scattered tree	8	105	13.13
HS9	Remnant native woodland	8	19	2.38
HS12	Planted eucalyptus	8	1	0.13
HS13	Cleared open land (non-treed)	8	48	6.00
HS3-2*	Remnant native vegetation	8	3	0.38
HS10-2	Roadside native vegetation	8	6	0.75
HS11-2	Pine windrow	8	22	2.75
HS12-2	Pine windrow	8	3	0.38
HS13-2	Eucalypt windrow	8	109	13.63
HS9-3	Mustons Creek	8	32	4.00
HS10-3	Native plantings	8	4	0.50
HS13-3	Cluster of pines	8	17	2.13
HS9-4	Large scattered tree	8	100	12.50
HS10-4	Pine windrow	8	27	3.38
HS8-4	Remnant native woodland	6	10	1.67
HS12-4	Mustons Creek	6	3	0.50
HS13-4	Mustons Creek	6	52	8.67
Autumn 2011				
HA8	Large pool, Hopkins River	9	26	2.89
HA10	*No habitat description supplied*	9	4	0.44
HA21	Small dam	21	5	0.24
Spring 2018				
HX3	Cleared open land (non-treed)	21	2	0.10
HX11	Planted eucalyptus	21	2	0.10
Summer-Autumn 2019				
HG1	Cleared open land (non-treed)	58	1	0.02
HS5	Farm dam	79	1	0.01
HS12	Planted eucalyptus	58	6	0.10
HS14	Planted eucalyptus	59	2	0.03
Total		465	610	1.13

** Denotes survey locations that are no longer within the project site*

9.6.3 Grey-headed Flying-fox

The Grey-headed Flying-fox is distributed along the east coast of Australia from Bundaberg, Queensland to Melbourne, Victoria, extending inland to the western slopes of New South Wales. They roost in large groups, known as camps, that can support up to tens of thousands of bats. They are classified as a megabat species, with an average weight of approximately 600-1,000 grams and length of 230-290 millimetres (NSW National Parks and Wildlife Service, 2001).

Population decline of the Grey-headed Flying-fox across Australia has been significant, estimated to be in the order of 30% between 1998 and 2001 (DAWE, 2021). As such, it has been listed as 'vulnerable' under the EPBC Act and FFG Act. Notable threats to the population include the habitat clearing, disturbance at roosting sites, human interference, electrocution on power lines and competition with other species.

Grey-headed Flying-fox camps are determined to be **nationally-important** if they have contained more than 10,000 individuals in more than one year in the last 10 years, or have been occupied by more than 2,5000 individuals permanently or seasonally every year for the last ten years.

No Grey-headed Flying-fox calls were recorded at the survey locations between 2010 and 2023. However, a temporary camp was observed in the pine plantation to the east of the project site, within three kilometres of the project site. Targeted surveys identified that this camp was active from late-Summer to mid-Autumn in 2022 and 2023, with audio recordings demonstrating that the colony left during April 2023. However, it is possible that a small number of individuals remaining at the temporary camp may not have been detectable due to infrequent calling following this date. A single incidental observation of the camp was also made in September 2023 by Nature Advisory. This temporary camp has not been classified as a known camp by DEECA on their Flying Fox Locations map (DEECA, 2025b) and is not of national importance.

Foraging and habitat usage

The Grey-headed Flying-fox forages for blossoms and fruit in canopy vegetation, supplementing their diet with leaves. Major sources of food include blossoms of Eucalyptus, Corymbia, Melaleuca and Banksia. Foraging needs often dictate the movements of Grey-headed Flying-fox, which are influenced by the flowering of different species. Within the project site food sources are limited to blossoms of remnant Eucalyptus and planted Sugar Gums, and seasonal fruit trees that may be planted around farmhouses.

Other than the temporary camp surveyed to the east of the project site, there are known camps in:

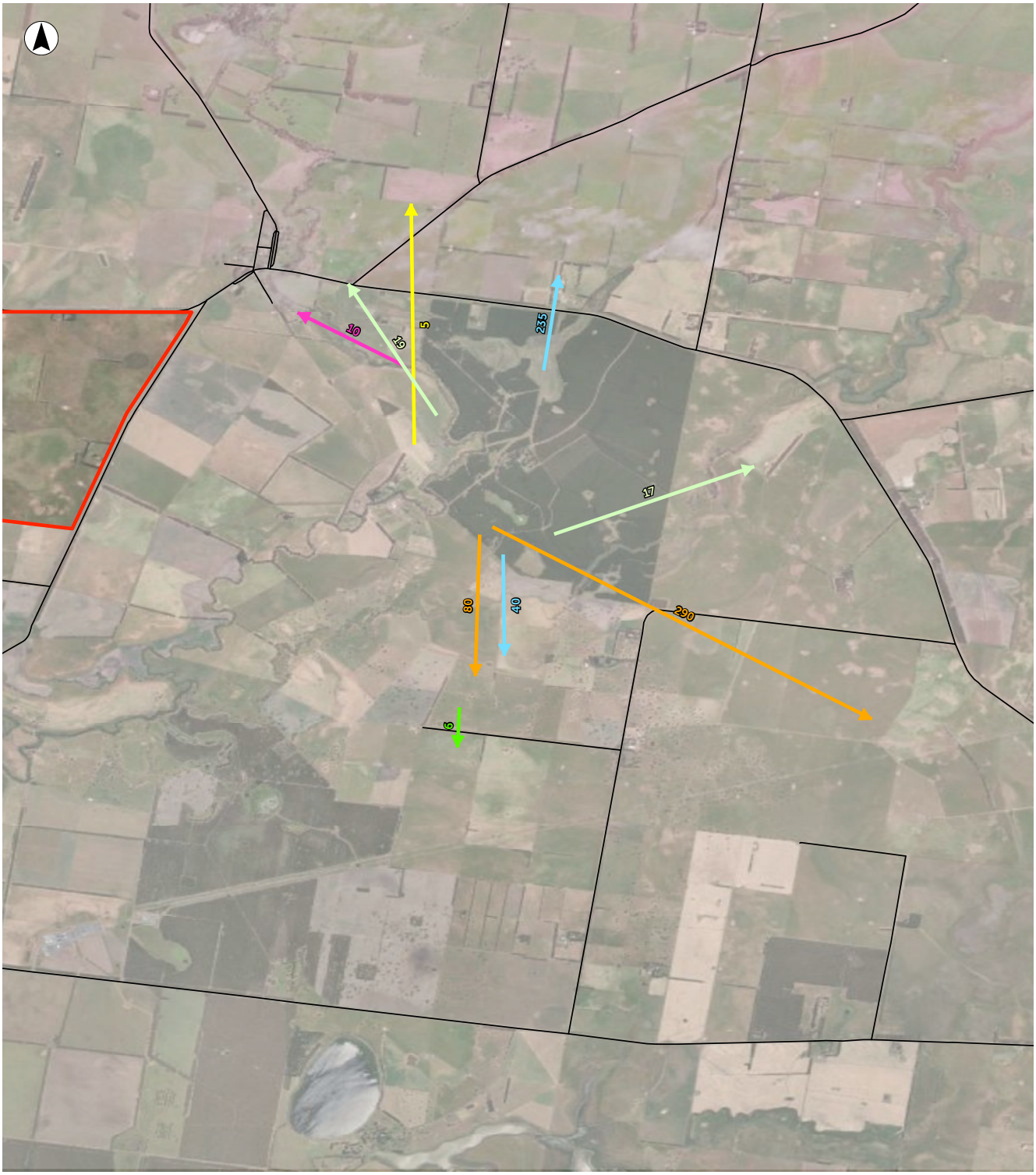
- Warrnambool (permanent, 30 kilometres from the project site)
- Lismore (new, 55 kilometres from the project site)
- Colac (temporary, 85 kilometres from the project site).

There is the potential for Grey-headed Flying-fox to be present across the project site as it moves between camps and foraging areas.

Flight behaviour and movements

A total of 702 Grey-headed Flying-fox were observed during targeted field studies flying out the pine plantation camp, predominantly moving towards the south-east and north as shown in Figure 9.4. Initial observations suggest that the colony arrived from the known permanent camp in Warrnambool.

The Grey-headed Flying-fox typically exhibits strong directional flight over extensive areas and is known to fly up to 40 kilometres to reach foraging areas. They typically fly at altitudes ranging from just above the canopy to over 100 metres, depending on landscape features and wind conditions. Their high, sustained flight and preference for open airspace make them particularly vulnerable to collision with wind turbines.



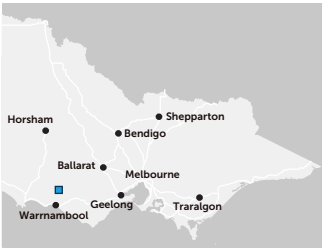
Legend

Wind farm boundary

Observation date and direction

14/02/2022
15/02/2022
01/03/2023
07/03/2023
08/03/2023
16/03/2023

370 Number of GHFF observed



Scale

800 m

Data: State of Victoria (DECCA/Land Use Victoria), Commonwealth of Australia, Wind Prospect, and specialist studies/reports. Data is indicative only; accuracy and completeness are not guaranteed.
© State of Victoria and other data providers

Figure 9.4. Grey-headed Flying fox flight paths and observations

9.6.4 Other (non-threatened) bat species

A number of non-threatened bat species were also recorded within the project site. The total number of calls by these species recorded in the Spring 2010 and Autumn 2011 surveys, and the presence of these species in Spring 2018 is detailed in Table 9.7 below. This includes a number of complex calls, that are difficult to attribute to a single species. One of these complex call sequences includes the Southern Bent-wing Bat, as discussed in Section 9.6.1.

Further studies undertaken from 2019 to 2023 focused specifically on threatened bat species (Southern Bent-wing Bat, Yellow-bellied Sheath-tailed Bat and Grey-headed Flying-fox) and did not include identification of non-threatened species.

General key bat habitat features within and surrounding the project site include remnant native woodland, scattered trees, planted tree rows, pine plantations, wetlands and waterways.

Table 9.7 **Confirmed and complex calls attributed to non-threatened bat species**

Common name	Scientific name	Total number of calls		
		Spring 2010	Autumn 2011	Spring 2018
Chocolate Wattled Bat	*Chalinolobus morio*	86	2	**Present**
Eastern Falsistrelle	*Falsistrellus tasmaniensis*	27	1	**Present**
Gould's Wattled Bat	*Chalinolobus gouldii*	528	16	**Present**
Large Forest Bat	*Vespadelus darlingtoni*	1,286	46	**Present**
Little Forest Bat	*Vespadelus vulturnus*	61	0	**Present**
Southern Free-tailed Bat	*Ozimops planiceps*	3	0	**Present**
White-striped Freetail Bat	*Austronomus australis*	240	33	**Present**
Complex calls				
Forest Bat species complex	*V.darlingtoni / V. regulus / V. vulturnus*	196	32	**Present**
Gould's Wattled Bat / Freetail Bat species complex multi-species complex	*C. gouldi/O. planiceps / O. ridei*	24	0	Not recorded
Southern Bent-wing Bat / Chocolate Wattled Bat / Little Forest Bat multi-species complex	*M. orianae bassanii / C. morio/V. vulturnus*	1,474	282	**Present**
Long-eared Bat species complex	*Nyctophilus geoffroyi / N. gouldi*	173	1	**Present**
Freetail Bat species complex	*Ozimops. Planiceps / O. ridei*	1	0	**Present**

9.7 Impact assessment

9.7.1 Impact pathways

During construction, human presence and construction noise from project activities may result in temporary disturbance of local bat populations. Construction may also result in foraging habitat being removed.

The main impact pathway for bats relevant to the project is direct collisions with operating wind turbine blades, leading to bat mortality.

Disturbance from construction activities

Declines in Yellow-bellied Sheath-tailed Bat populations may be due to factors such as loss of hollow-bearing trees and clearing and fragmentation of forest and woodland habitat.

Impacts on foraging habitat are also considered a potential threat to Southern Bent-wing Bat, with the National Recovery Plan noting that "*Changes to foraging habitat in the foraging range (e.g. within approximately 35 km) of important roosting sites could impact on food availability or diversity, and hence the longterm survival of these populations. Such changes could include draining or modifying wetlands…(or) clearing native vegetation, including paddock trees…*" (DELWP, 2020a).

The project will require up to 8.190 hectares of native vegetation patches, including up to nine large trees in patches, and up to six scattered trees to be removed to transport and construct project infrastructure. However, the loss of native vegetation is unlikely to have a material effect on the availability of foraging habitat for bat populations, with design mitigations developed to avoid areas Southern Bent-wing Bat habitat as discussed in Section 9.7.2. In total, 8.168 hectares of native vegetation and six scattered trees to be removed has been identified as suitable bat habitat. During project construction noise will be generated from heavy vehicle movements and human activity on the site, as well as blasting from the on-site quarry.

Collisions with wind turbines

The National Recovery Plan (DELWP, 2020a) lists wind farm developments as one of the nine potential threats to Southern Bent-wing Bat, noting that "*it is possible that any wind farm built close to a significant roosting site could have a major impact on that population*".

Once the wind farm is operating, the impacts to bats are primarily associated with collisions with turning blades. Post-construction monitoring of bat deaths from turbine collisions at 15 wind farms in Victoria between 2003 to 2018 observed that three bat species accounted for 83% of all recorded deaths, with most bat deaths being the White-striped Freetail Bat (at 67%) (Moloney et al., 2019). This species typically flies higher above the ground than most other species of bats in Victoria.

Collision mortality modelled by Stark and Muir (2020) based on post-construction monitoring predicted between seven and 10.8 bat mortalities per turbine per year in Western Victoria. As such, it is expected that the project will result in some bat mortality from collisions with wind turbines. Pre-construction collision risk modelling for the project has not been undertaken due to limitations associated with the application of Collision Risk Models (CRMs) to microbats. Specifically, acoustic monitoring data only captures the presence or absence of species, not abundance, making it an unreliable indicator of collision risk for microbat species. Even if abundance estimates were available, the volume of Southern Bent-wing Bat data currently available is unlikely to meet the minimum requirements for CRM applications.

9.7.2 Design mitigation

To minimise potential impacts to threatened bat species, the mitigation hierarchy was adopted whereby key avoidance and risk minimisation measures were applied during the design of the project in consultation with DEECA and DCCEEW. This approach also accounted for the known ecology and behaviour of Southern Bent-wing Bat and Yellow-bellied Sheath-tailed Bat, site features relating to available habitat and foraging opportunities, and the influence of weather and season on bat activity.

Turbine specifications

The proposed minimum blade tip height (i.e., minimum Rotor Swept Area) is 40 metres.

Preliminary analysis of existing monitoring data from post-commissioning monitoring conducted at operational wind farms in Victoria, ACT and NSW was undertaken by Nature Advisory to investigate the influence of turbine model specifications on mortality rates for Australian bat species. The results from this analysis indicate a trend of decreasing mortality rate with an increase of the minimum Rotor Swept Area height above 40 metres above ground level. Additionally, as turbine blades are raised higher above the ground, the number of microbat species impacted decreases, with taxa adapted for open-space accounting for most mortalities (Nature Advisory, 2024). These findings are similar to those reported from research in the Northern Hemisphere.

Avoidance of habitat

Concept design process

Higher quality habitat for Southern Bent-wing Bat within the project site includes woodland and wetland areas, and rivers and creeks with permanent water sources.

During the concept design phase, 100-metre buffers were applied around wetlands (mapped on the DEECA Victorian wetland inventory) and watercourses to limit potential impacts to these areas. Watercourse crossings were also minimised through the siting of access tracks and cable routes. These design measures are further described in Chapter 5 – ***Project alternatives and design development***.

Turbine-habitat buffers

For most insectivorous bats, activity increases closer to important habitat features such as treed areas and waterbodies and decreases in more open areas with less tree cover.

There are currently no Australian State or Commonwealth guidelines that outline appropriate buffer distances between turbine blade edges and preferred bat habitat to reduce collision risks to an acceptable level. As such, turbine-habitat buffer distances contained within the Guidelines for consideration of bats in wind farm projects (EUROBATS guidelines) have been adopted for the project – i.e., a minimum 200-metre separation from the nearest habitat feature (e.g., woodland, tree lines, wetlands, waterbodies and watercourses) to blade-tips (Rodrigues et al., 2015).

With a proposed project turbine hub height of 150 metres, blade length of 95 metres and minimum Rotor Swept Area height of 40 metres above ground level, using the EUROBATS guidelines method to calculate the distance from the edge of the Rotor Swept Area to the edge of the nearest habitat feature (in this case presumed to be a 30-metre tall tree[1]) the buffer distance would be 269 metres from the base of the turbine to the nearest habitat edge (Figure 9.5). It should be noted that the formula uses the maximum blade length and the proposed hub height that may apply to the final turbine model selected. The buffer required would be calculated using this formula and the final turbine model specifications.

1 Note, most trees within the project site are significantly less than 30 metres tall. As such, the distance between the blade tip and habitat features less than 30 metres tall would be greater than 269 metres.

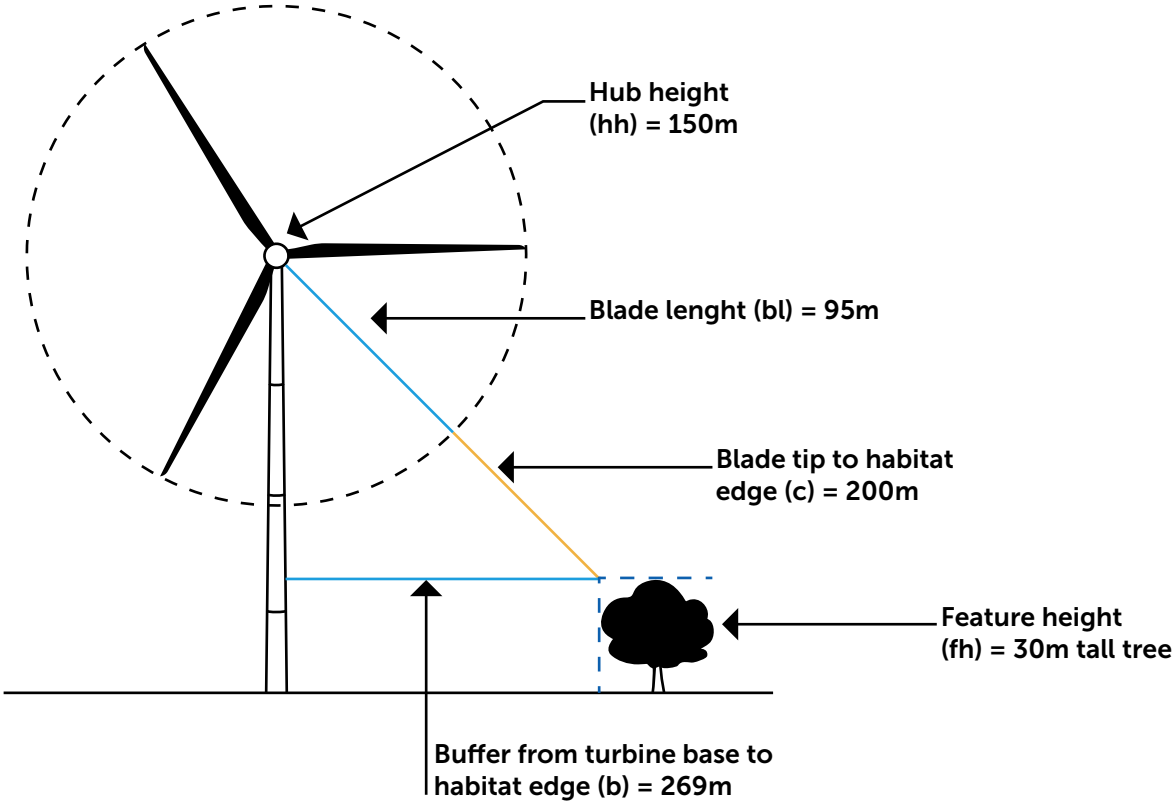


Figure 9.5 Schematic showing 269-metre turbine-habitat buffer based on Rodrigues et al. (2015) EUROBATS guidelines

It is not feasible to avoid all potential Southern Bent-wing Bat habitat throughout south-east Victoria using a 269-metre buffer. As such, in consultation with DEECA, a mitigation hierarchy (outlined in the below text box) was adopted based on an overlap of a 269-metre buffer around turbines, presence of habitat and recorded Southern Bent-wing Bat activity areas to:

- Avoid high quality habitat
- Avoid areas with higher Southern Bent-wing Bat and Southern Bent-wing Bat-complex calls (i.e., observed echolocation calls with characteristics that could have been produced by Southern Bent-wing Bat, Little Forest Bat or Chocolate Wattled Bat)
- Minimise turbine buffer overlays with medium and low quality Southern Bent-wing Bat habitat.

Categories of avoidance

High priority avoidance: Creeks, wetlands, remnant native woodland, forestry plantations, and higher number of Southern Bent-wing Bat-definite or complex calls per night relative to other sites.

Medium priority avoidance: Planted windrows and eucalypts, farm dams, and medium number of Southern Bent-wing Bat-definite or complex calls per night relative to other sites.

Low priority avoidance: Scattered trees, isolated windrows (100 metres from other trees), and low/very low number of Southern Bent-wing Bat-definite or complex calls per night.

To reduce the area of Southern Bent-wing Bat habitat within 269 metres of proposed turbines, turbines were micro-sited relative to higher- and medium-priority avoidance areas based on habitat and known Southern Bent-wing Bat activity (Figure 9.6).

In total, 33 turbines were micro-sited. All turbines where the 269-metre buffer originally overlapped with permanent creek habitat were relocated to avoid overlap, and in total there was a 93.6% reduction in the area where the buffer overlapped with any wetland habitat.

Turbine risk categories

Higher risk: Turbine buffers overlap with high-priority avoidance habitat and/or have medium, high or very high numbers of Southern Bent-wing Bat or Southern Bent-wing Bat complex calls per night

Moderate risk: More than 2.5% of the turbine buffer covers medium-priority habitat

Lower risk: Less than 2.5% of the turbine buffer overlaps with medium or low-priority avoidance habitat. Buffers overlap with areas of very low or no Southern Bent-wing Bat activity.

The 2.5% habitat overlap limit was chosen to enable a small portion of overlap with habitat to occur, as it was difficult to avoid medium- and low-priority habitat completely. At present, there are no specific guidelines to inform this approach. However, it was developed to be consistent with a precautionary yet pragmatic interpretation of the avoid and minimise principle, noting the conservation status of the species, and ensures 97.5% of the mapped habitat is outside of the nominated turbine buffer.

With the implementation of the micro-siting design measures, five proposed wind turbines are categorised as 'higher risk', while 41 proposed wind turbines are categorised as 'moderate risk'. Turbine risk categories are shown in Figure 9.7.

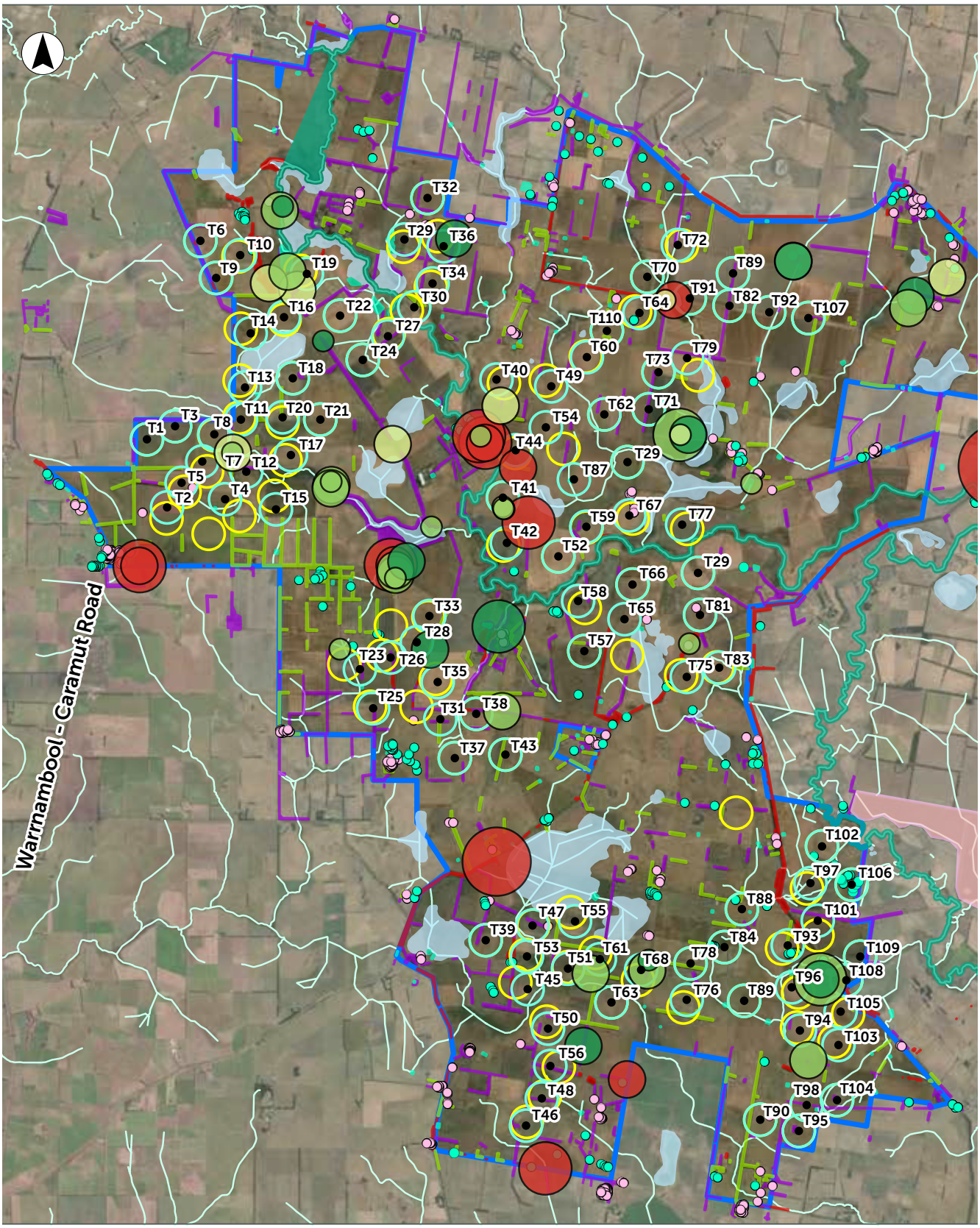
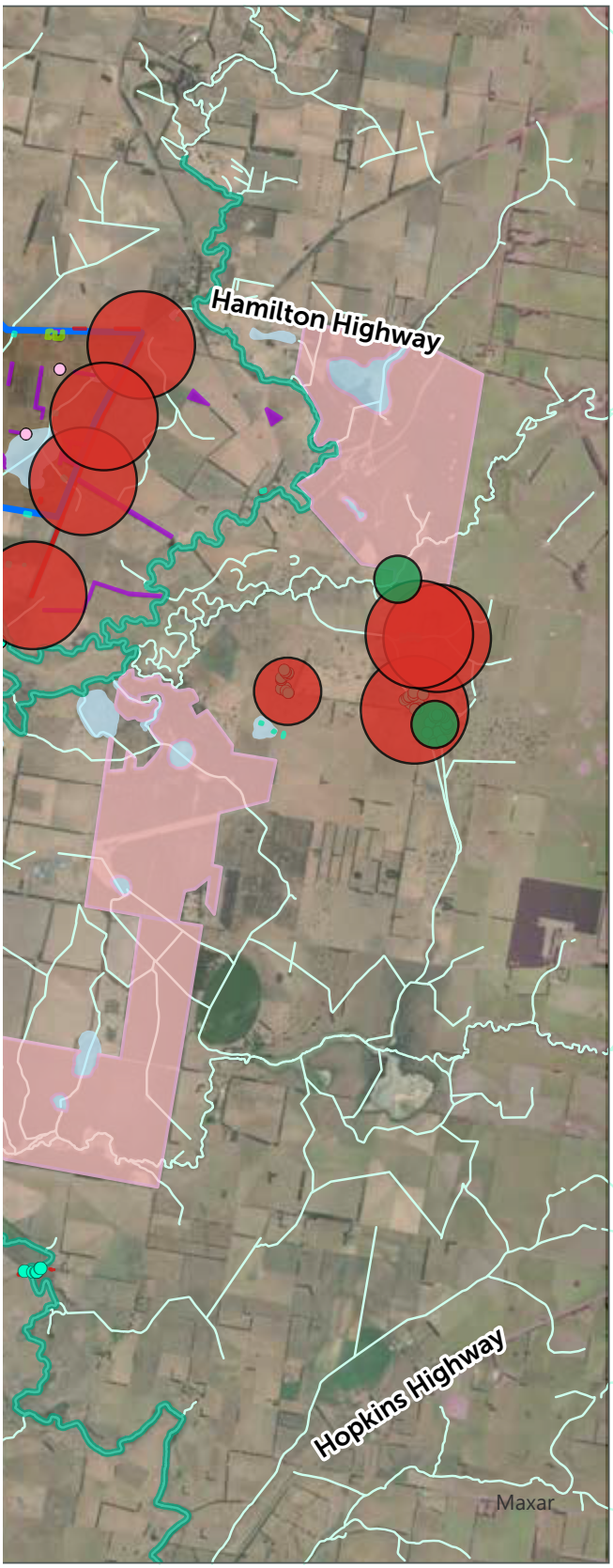


Figure 9.6 Bat turbine-habitat buffer *(continued on the next page)*



Legend

- Hexham wind farm boundary
- Turbine
- Turbine buffer (269m)_Original
- Turbine buffer (269m)_Updated

Sites with calls by year

2010 2018 2020
2011 2019 2023

Rate of combine calls per night

- Very Low (<0.05)
- Low (0.05 to 1)
- Medium (1-5)
- High (5-10)
- Very high (>10)

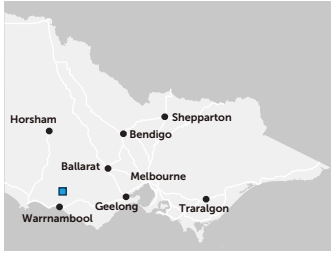
Habitat features

- Farm dam
- Forestry plantation
- Permanent creeks
- Pine tree row
- Planted Eucalypts
- Remnant native woodland
- Wetland
- Planted tree
- Remnant tree

Scale

km

0 1 2 3 4 5



Data: State of Victoria (DECCA/Land Use Victoria), Commonwealth of Australia, Wind Prospect, and specialist studies/reports. Data is indicative only; accuracy and completeness are not guaranteed.

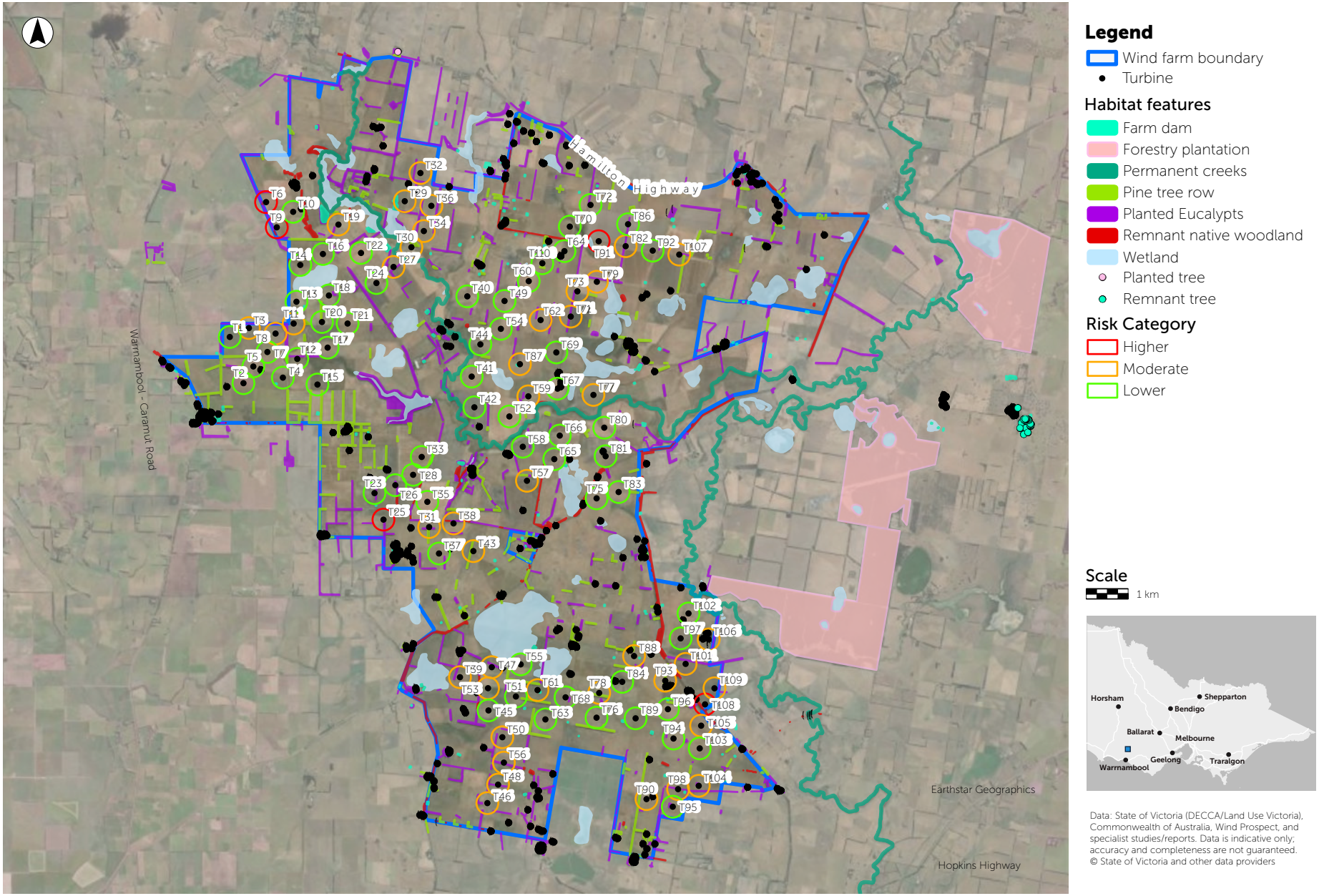


Figure 9.7 Turbine risk categories

9.7.3 Environmental management measures

The management measures outlined in Table 9.8 have been proposed to further mitigate potential impacts of the project operation on threatened bat species. Attachment V - ***Bat and Avifauna Management Plan*** [EMM BA01] is available as part of the documentation exhibited with this EES.

Table 9.8 Measures to manage adverse impacts to bats

Bat impact	Project phase	Management measures	Number
Disturbance from construction activities	Construction	**Construction Noise and Vibration Management Plan** 1. Prior to the commencement of construction, a Construction Noise and Vibration Management Plan (CNVMP) will be prepared as a sub-plan to the Construction Environmental Management Plan (EMM01) to address the effects of construction noise related to on- site activities and off-site traffic movements, and construction vibration associated with any activities expected to occur at less than 100 m from a receiver. 2. The CNVMP will include the following: a. *a clear description of the proposed construction program including the expected timing and duration of key elements of the works* b. *details of all reasonably practicable measures proposed to fulfil the general environmental duty under the Environment Protection Act 2017 (EP Act), accounting for guidance under EPA Publication 1834.2: Civil construction, building and demolition guide. The measures will include (but not be limited to):* i. *restriction of construction activities to normal working hours wherever practical* ii. *selection of major construction plant to achieve low noise emissions and minimise any distinctive undesirable characteristics* iii. *maintenance of site equipment and infrastructure to minimise noise emissions* iv. *planning for the most efficient way to complete the works and minimise duration of the noise* v. *processes and governance for addressing the general environmental duty (GED), with particular reference to any out of hours work.* c. *a schedule of noise emission data for the major plant items to be used for construction of the project, including the source reference for this data.* d. *definitions and justifications for all anticipated unavoidable works, low-noise works and managed- impact works which may occur outside of normal working hours, such as out of hours deliveries or wind turbine installation activities that are subject to weather constraints.* e. *details relating to proposed routing and timing of construction traffic, including protocols to minimise noise along local roads and within Mortlake to the extent reasonably practicable. This will establish a restriction to avoid heavy vehicle movements related to construction aggregate sourcing from local quarries (if required) prior to 7am on the local road network around the project or within local townships.* f. *management measures relating to off-site vehicle movements including education of drivers about the general environmental duty under the EP Act and considerate driving practices.* g. *details of the measures to be implemented to address noise characteristics such as tonality, impulsive noise and low frequency noise, including consideration of residential receivers and noise levels in natural areas.* h. *the proposed scheduling of any out of hours works and evidence to support that low-noise or managed-impact works meet the criteria defined in EPA Publication 1834.2.* i. *identify specific activities which warrant notification of neighbouring residents in advance of the work occurring, including unavoidable works outside of normal working hours, peak periods of off-site construction traffic, and activities with potential to cause perceptible vibration.* j. *details of the complaints management procedure as part of the Complaints and Grievance Mechanism (SE02).* k. *requirements for periodic reviews and updates, as necessary, including those informed by complaints and any remedial actions taken in response to the Complaints and Grievance Mechanism (SE02).* 3. The CNVMP will be prepared in consultation with relevant stakeholders.	NV01

Bat impact	Project phase	Management measures	Number
Collision with wind turbines	Operation	**Bat and Avifauna Management Plan** 1. Attachment V - Bat and Avifauna Management Plan has been prepared for the project in accordance with the following guidelines and will be implemented prior to the commencement of operation to minimise impacts to bat and avifauna species: a. Onshore Wind Farm Guidance – interim guidance on bird and bat management (Department of Agriculture, Water and the Environment, 2022) b. Onshore Wind Farm Guidance: Best practice approaches when seeking approval under Australia's national environment law (Department of Climate Change, Energy, the Environment and Water, 2024a). 2. Attachment V - Bat and Avifauna Management Plan outlines monitoring protocols and responsibilities, impact triggers for listed and non-listed bird and bat species, and operational procedures following occurrence of impact triggers including reporting requirements. Adaptive management measures to reduce impacts will be considered as part of the Bat and Avifauna Management Plan. 4. Attachment V - Bat and Avifauna Management Plan include species-specific management strategies for the following species of concern to focus management efforts and improve mitigation effectiveness in response to impact triggers: a. Blue-winged Parrot *(Neophema chrysostoma)* b. White-throated Needletail *(Hirundapus caudacutus)* c. Fork-tailed Swift *(Apus pacificus)* d. Brolga *(Grus rubicunda)* e. Black Falcon *(Falco subniger)* f. Wedge-tailed Eagle *(Aquila audax)* g. Grey-headed Flying-fox *(Pteropus poliocephalus)* h. Southern Bent-wing Bat *(Miniopterus orianae bassanii)* i. Yellow-bellied Sheath-tailed Bat *(Saccolaimus flaviventris)* 3. Attachment V - Bat and Avifauna Management Plan outlines committed financial compensatory measures that would be implemented in response to a significant impact (above the relevant defined impact threshold) to species listed under the *Environment Protection and Biodiversity Conservation Act 1999* during project operation. 4. Key measures of Bat and Avifauna Management Plan are outlined in EMM BA01-1 through BA01-7. 5. Attachment V - Bat and Avifauna Management Plan will be a sub-plan to the Operations Environmental Management Plan [EMM09].	BA01
		Bat and Avifauna Management Plan - Curtailment strategies 1. As detailed in Attachment V - Bat and Avifauna Management Plan [BA01], the minimum required wind speed for night-time operation of moderate and higher-risk turbines (i.e., the night-time low windspeed cut-in) will be increased to 4.5 m/s during periods when Southern Bent-wing Bat are most actively moving across the landscape to reduce the risk of collision between wind turbines and the Southern Bent-wing Bat. 2. Curtailment conditions for each turbine will be outlined in Attachment V - Bat and Avifauna Management Plan (BA01), and updated as required in response to monitoring undertaken as part of Attachment V - Bat and Avifauna Management Plan. This includes temporary daytime curtailment of turbine(s) within a 300-metre buffer of active Black Falcon (*Falcon subniger*) and Wedge-Tailed Eagle (*Aquila audax*) nests identified during operation. 3. The Department of Energy, Environment and Climate Action will be consulted regarding specific parameters for each turbine to confirm adequacy and acceptability of these measures.	BA01-1

Bat impact	Project phase	Management measures	Number
		Blade feathering 4. As detailed in Attachment V - Bat and Avifauna Management Plan (BA01), 'feathering' (i.e., adjusting the angle of the rotor blades to limit rotation, typically to approximately one rotation per minute, when wind speeds are below the manufacturer's or adjusted cut-in speed, to prevent freewheeling) would be applied for all turbines to mitigate impacts to bats.	BA01-2
		Bat and Avifauna Management Plan - Acoustic deterrents 1. The feasibility of acoustic deterrent trials would be investigated, in consultation with the Department of Energy, Environment and Climate Action. This will be documented in the Bat and Avifauna Management Plan (BA01).	BA01-3
		Bat and Avifauna Management Plan - Mortality monitoring 1. As detailed in Attachment V - Bat and Avifauna Management Plan (BA01), ongoing monitoring of blade strike mortality within the project site will be undertaken to inform adaptive management of the collision risk and assess the general mortality of listed and non-listed fauna.	BA01-4
		Bat and Avifauna Management Plan - Post-commissioning acoustic bat surveys 1. As detailed in Attachment V - Bat and Avifauna Management Plan (BA01), bat detector surveys will be undertaken for at least two years post-commissioning to collect further data on temporal activity patterns of Southern Bent-wing Bat and Yellow-bellied Sheath-tail Bat in the project site. 2. Consultation with the Department of Energy, Environment and Climate Action and the Southern Bent-wing Bat Recovery Team will be undertaken to determine the frequency, timing and duration of these surveys.	BA01-5
		Bat and Avifauna Management Plan - Grey-headed Flying-fox monitoring 1. As detailed in Attachment V - Bat and Avifauna Management Plan (BA01), a Grey-headed Flying-fox monitoring program will be undertaken for the first two years post-commissioning. This monitoring program will inform field surveys for this species and be based on: a. annual habitat suitability assessments in and around the project site b. annual reviews of relevant databases for current Grey-headed Flying-fox camp locations and numbers. c. regular discussions with wind farm personnel, landholders, and the Department of Energy, Environment and Climate Action/Department of Climate Change, Energy, the Environment and Water regarding the species presence, and assess its potential increase in prevalence within the site and its surroundings.	BA01-6

9.7.4 Residual impacts

Disturbance from construction activities

Project construction will result in the loss of up to 8.190 hectares of native vegetation patches, including up to nine large trees in patches, and six scattered trees. Through an iterative design process, impacts on native vegetation have largely been avoided. The loss of native vegetation is unlikely to have a material effect on the availability of foraging habitat for bat populations.

Most construction stage activity will occur during daylight hours, and will be temporary and intermittent (estimated to last for short periods at any work site within the longer project construction period). Night-time security lighting will only be used at the terminal station and at temporary construction compounds. Once construction is complete, there will be a lower level of vehicle traffic and human activity associated with operating the completed wind farm During operation, turbines generally only require aviation warning lighting when located within close proximity to airfields. This consists of red flashing lights which are not known to attract bats. As such, lighting and noise during construction and operation is not likely to significantly impact on bats foraging and commuting through the project site.

As the project is located more than 25 kilometres from a known Southern Bent-wing Bat non-breeding cave and 40 kilometres from a maternity cave, impacts due to construction activities and destruction of caves is considered highly unlikely.

Collisions with wind turbines

As supported by research from other studies on bat activity within different habitat types (e.g., Lumsden and Bennett, 2005), the placement of wind turbines to avoid habitats most used by bats will minimise the likelihood of collisions occurring. A critical component of Attachment V - ***Bat and Avifauna Management Plan*** is undertaking post-commissioning bat detector surveys over a two-year period [BA01-5], which will investigate how a range of environmental factors such as wind speed, air temperature and rainfall influence the presence and activity of bat species. Paired with mortality monitoring [BA01-4], this is anticipated to generate sufficient data to inform the development of a smart curtailment algorithm for the project.

An assessment of potential collision risks for Southern Bent-wing Bat, Yellow-bellied Sheath-tailed Bat, Grey-headed Flying-fox and other (non-threatened) bat species is provided in the following sections.

Southern Bent-wing Bat

As Southern Bent-wing Bat were recorded within the project site, there is a risk that individuals may collide with operating wind turbines. While wind turbines were relocated during the design process to avoid or minimise proximity to species habitat, five turbines are proposed within areas considered higher risk.

Most Southern Bent-wing Bat movements are expected to be closer to non-breeding caves, which are located at least 25 kilometres from the project site. As such, it is unlikely that high numbers of individuals would be on site regularly or for extended periods. Noting that Southern Bent-wing Bat primarily flies at lower heights (between zero and 30 metres), the infrequent Southern Bent-wing Bat calls recorded during surveys and the proposed minimum blade tip, if individuals were to cross the project site, the risk of turbine collision is considered likely to be low.

To minimise the risk of collision, the night-time operating windspeed will be increased to 4.5 metres per second for turbines assessed as having moderate to higher risk of Southern Bent-wing Bat collisions during seasons known to have greater Southern Bent-wing Bat activity (i.e., September to April, inclusive) and from half an hour before sunset to half an hour after sunrise [EMM BA01-1]. Post-construction monitoring of Southern Bent-wing Bat activity will be used to refine these curtailment measures, if required.

Trigger actions in response to Southern Bent-wing Bat mortalities during project operation are outlined in Attachment V - ***Bat and Avifauna Management Plan*** [EMM BA01].

Yellow-bellied Sheath-tailed Bat

There is no information on the number of Yellow-bellied Sheath-tailed Bats that visit Victoria as the species is typically recorded rarely and irregularly. Given the number of individuals that occur in Victoria are not known and the low numbers recorded in the investigation area, compared with other, more common bat species, this indicates the Victorian population would be small and unlikely to represent a significant part of the overall larger national population.

In its range where it is more abundant, this species has been recorded colliding with wind turbines (Nature Advisory data), indicating that it is vulnerable to turbine collision.

Given the very small number of calls recorded within the investigation area in recent years, it is considered unlikely that the proposed project would result in levels of mortality sufficient to cause a significant impact on the species. A very low impact on the Yellow-bellied Sheath-tailed Bat is anticipated.

Attachment V - ***Bat and Avifauna Management Plan*** [EMM BA01] outlines actions to be taken in the event of Yellow-bellied Sheath-tailed Bat collisions with project wind turbines.

Grey-headed Flying-fox

The closest known Grey-headed Flying-fox roost is in the pine forest plantation east of the project site. Each night Grey-headed Flying fox leave their roost and spread out across the landscape in search of food resources which include fruit and nectar from blossoms. No Grey-headed Flying-fox were observed flying in a westerly direction from this roost in field surveys, indicating that there are limited food resources within the project site that would attract the Grey-headed Flying-fox to the area. As such, it is considered unlikely that Grey-headed Flying-fox would visit the project site regularly to feed, however they may occasionally fly across the project site which may put the species at risk of collision with turbines.

It is unlikely that the proposed project would result in levels of mortality sufficient to cause a significant impact on the species. Specific measures are included in Attachment V - ***Bat and Avifauna Management Plan*** [EMM BA01-6] to address potential impacts to this species during project operation.

Other (non-threatened) bat species

Based on the results of bat recording within the project site and the results of post-construction bat monitoring undertaken at other wind farms within Victoria (Stark and Muir, 2020), it is likely that White-striped Freetail Bat, Gould's Wattled Bat, Chocolate Wattled Bat, Large Forest Bat and Little Forest Bat will collide with operating project wind turbines. Of these species, White-striped Freetail Bat and Gould's Wattled Bat will likely experience the greatest impacts as they forage high above the tree canopy and open ground and are also one of the most common and widespread species of micro-bat in Australia (Stark and Muir, 2020).

With the placement of wind turbines predominately avoiding treed and forested areas, and a proposed minimum blade tip that is higher than most operating wind farms in Victoria, the overall impact of the project on bats is considered lower than at other operating wind farms in western Victoria. The impact significance is considered low. Attachment V - ***Bat and Avifauna Management Plan*** with specific triggers for non-threatened species will be implemented if impacts during project operation are higher than anticipated [EMM BA01].

9.7.5 Cumulative impacts

While a low to very low level of bat mortality due turbine collision is anticipated for threatened bat species, the cumulative impacts to bat species in general, due to the project and other existing and planned activities in the region, are assessed as low. These cumulative impacts are predominantly associated with the construction and ongoing operation of other wind farms, with modelling predicting between seven and 10.8 bat mortalities occur per turbine per year due to collisions (Stark and Muir, 2020), with the most common bat species found to collide with turbines being the White-striped Freetail Bat and Gould's Wattled Bat. Compared to other wind farms sites in the region, the project site has lower levels of bat activity, lessening its potential cumulative impact.

Potential cumulative impacts of the project on the Southern Bent-wing Bat population are difficult to quantify as there is no central registry of operational monitoring data for Victorian wind farms. Most mortality data remain unpublished, limiting the ability to quantify cumulative effects. However, recent data from DEECA confirmed at least 32 Southern-Bent Wing Bat mortalities at various wind farms in southwest Victoria[2]. These mortalities represent actual carcasses found during searches and the estimated mortality would be higher, considering survey effort, scavenger rates and searcher efficiency. Due to the low activity levels of Southern Bent-wing Bat activity within the project site and limited suitable habitat, cumulative impacts to the species are assessed as low.

Salt Creek Wind Farm (operational), Woolsthorpe Wind Farm (approved), and Swansons Lane Wind Farm (proposed) are identified as potentially resulting in occasional Grey-headed Flying fox collisions. However, it is unlikely that the project will contribute significantly to cumulative impacts.

Potential cumulative impacts to the Victorian bat population are further assessed in Chapter 26 – ***Cumulative effects***.

2 Data as of March 2025, noting that this figure will continue to evolve as collisions continue.

9.8 Conclusions

Over the last decade, there has been a significant effort to assess the presence and activity of threatened bat species within the project site. In total, 4,418 bat detector nights were surveyed at over 80 unique sites across the project site and the surrounding area over various seasons, recording vocalisations at ground level and at height. Calls from nine bat species were recorded during bat detector surveys, including two listed threatened species: the Southern Bent-wing Bat (listed as critically endangered under the EPBC Act and FFG Act) and the Yellow-bellied Sheath-tailed Bat (listed as vulnerable under the FFG Act). All other species recorded within the project site, accounting for most bat activity, are common and widely distributed.

Targeted surveys were also undertaken to understand the movement of Grey-headed Flying-fox (listed as vulnerable under the EPBC Act and FFG Act) from a temporary camp at a pine plantation to the east of the project site. However, no flights towards to the project site were observed.

To minimise the impact of the project on threatened bat species, proactive avoidance and minimisation strategies were developed in consultation with DEECA and DCCEEW. Attachment V - ***Bat and Avifauna Management Plan*** has been developed to respond to impacts to threatened bat species greater higher than anticipated.

While the likelihood of bat collisions with project wind turbines has been minimised, a low to very low level of bat mortality is anticipated.