

# Forest Wind Bird and Bat Management Plan

*Report: FWH-02  
Client: Forest Wind Holdings  
March 2020*



**FOX & CO**  
ENVIRONMENTAL

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<b>DOCUMENT AUTHORISATION</b>					
<b>Revision</b>		<b>Rev. Date</b>		<b>Report Details</b>	
A		10 September 2019		Draft report	
B		8 February 2020		Draft report	
<b>Prepared By</b>		<b>Reviewed By</b>		<b>Authorised By</b>	
P.F		A.F. M.P. J.P.		P. Fox	

# 1 INTRODUCTION

Forest Wind Holdings (FWH) Pty Limited proposes to develop and construct a wind farm called Forest Wind (the Project) located within operational and actively managed exotic pine plantations in Queensland Government owned Toolara, Tuan and Neerdie State Forests, situated between Gympie and Maryborough in the Wide Bay Region of Queensland.

Specifically, the Project comprises a wind farm with up to 226 wind turbines and ancillary infrastructure (herein referred to as the Project Area, Plantation Licence Area (PLA). The Project Area (PLA) will be located within the Gympie Regional Council (GRC) and Fraser Coast Regional Council (FCRC) Local Government Areas (LGAs).

The Project Area (PLA) is located almost entirely within existing operational and actively managed exotic pine plantations. A small portion of the Project Area (PLA) is Native State Forest (NSF). No confirmed infrastructure is proposed within the NSF at this stage. It is within the pine plantation licence area and is therefore included in the Project Area (PLA). The Project Area (PLA) (including ancillary infrastructure) is referred to as the Project Area (PLA).

Bird and bat surveys have been undertaken at the Project Area (PLA) (in addition to other ecological assessments).

Fox & Co Environmental was commissioned by FWH to prepare this Bird and Bat Management Plan (BBMP) for the Project Area (PLA) of the Project. This BBMP has been developed in consideration of:

- State Code 23: Wind Farm Development, Planning Guidelines (Queensland Government, June 2018)
- Wind farms and birds: Interim Standards for Risk Assessment. Report No. 2003.35 (2.2) (AusWEA, 2005)

## 1.1 Objectives

The objective of this BBMP is to provide a plan for monitoring the impacts on birds and bats and from the Project and an overall strategy for managing and mitigating any significant impacts on birds and bats from the operation of the wind farm. To achieve this objective, this BBMP identifies:

- Baseline bird and bat data for the Project
- Proposed mitigation measures and implementation strategies to reduce impacts on birds and bats
- Proposed management and monitoring actions
- Proposed impact triggers for adaptive management
- Proposed reporting requirements

The BBMP uses an adaptive management approach. Monitoring indicates compliance and any non-compliance with approval conditions and management plans. This in turn informs where management measures are effective and where management measures need to be reviewed and altered to achieve their goals.

This BBMP will be updated as per the following Queensland Government Approval Conditions (1912-14632) (*State Development, Manufacturing, Infrastructure and Planning, 21 February 2020*).

- Identification of 'at risk' bird and bat groups (i.e. all threatened and common species), seasons and areas within the project site which may attract high levels of mortality
- Incorporate baseline data, including additional preoperational surveys
- Identification of threshold (trigger) levels for species
- Identification of mitigation measures and implementation strategies in order to reduce impacts on bird and bat groups

- Monitoring requirements
- A decision-making framework, including the trigger for operational shut-down

Management measures will be undertaken in accordance with the following Condition Timing:

- prior to the commencement of the use of each respective stage of the wind farm and at all times.

The revised comprehensive BBMP will include actual turbine monitoring locations, additional monitoring data, statistical thresholds and further details on carcass persistence trials and searcher efficiency trials.

## **1.2 Background**

The Project Area (PLA) is located within exotic pine plantation within the Toolara, Tuan and Neerdie State Forests located in the Wide Bay Area (**Figure 1**). The Project Area (PLA) has a single landowner, being the State (represented by Department of National Parks, Sports and Racing), with land titles on which turbines are proposed, as follows:

- Lot 915 of Crown Plan FTY1775
- Lot 1004 of Crown Plan FTY1659
- Lot 1419 of Crown Plan FTY1697

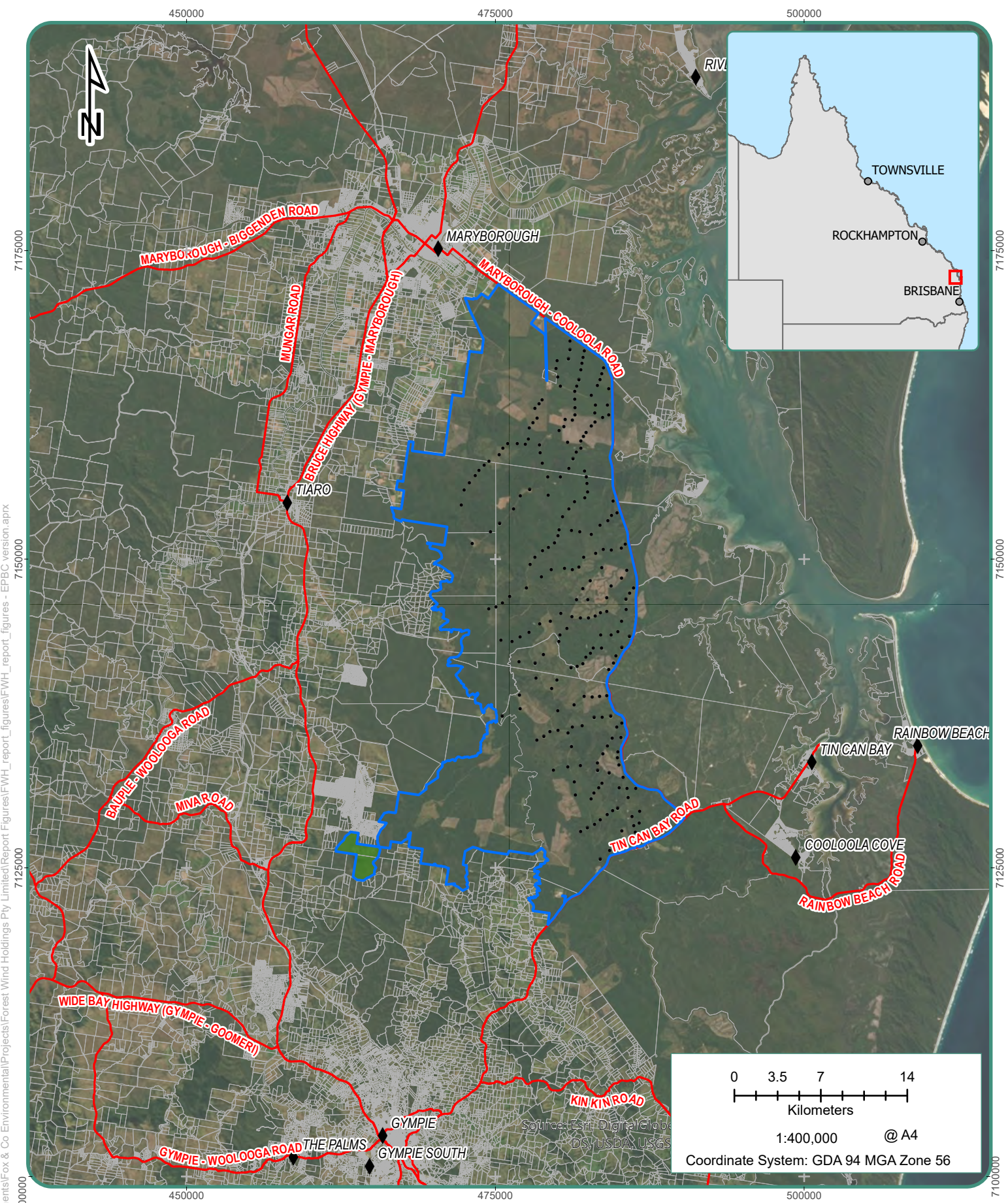
The indicative wind turbine configuration is illustrated in **Figure 2**.

### **1.2.1 Previous Reports**

During the design phases of the Project, investigations were undertaken by Premise Environment Pty Ltd and Fox & Co Environmental Pty Ltd between 2016 and 2019. The methods and results of these investigations are included in the following reports:

- Premise Environment (October 2017). *Forest Wind, Ecological Assessment, Report No. 1701513b*.
- Fox & Co Environmental (February 2020). *Forest Wind Bird and Bat Utilisation Survey, Report FWH-01*
- Fox & Co Environmental (February 2020). *Ecological Assessment Report, Forest Wind Project, FWH-03*
- Fox & Co Environmental (February 2020). *MNES Significant Impact Assessment, Forest Wind Project, FWH-04*

The results are summarized in **Section 2** of this report.



**TITLE:**  
**Project Area and Regional Context**

**MAP NO:** Figure 1

**PROJECT:** Forest Wind Holdings Pty Ltd

**LEGEND**

◆	Populated places	▭ (Blue)	Project Area (PLA)
•	FWH Turbine locations (170m Ø)	▭ (White)	Property boundaries
— (Red)	State controlled roads	▭ (Green)	Native state forest

Date: 10/02/2020

Data Source:  
 © State of Queensland (Department of Natural Resources, Mines and Energy) 2019.

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### 1.3 Wind Turbine Specifications

The Project proposes up to 226 turbines with a blade tip of up to 295m above ground level. Electrical reticulation between wind turbines will mainly be underground within existing forestry tracks.

The turbine to be installed is not yet confirmed, as such a range of impact has been considered based on highest to lowest potential tip height. To be conservative, at the upper limit, a maximum tip height of 295m and a lower tip height of 70m has been considered. The physical area swept by the blades during operation is referred to as the Rotor Swept Area (RSA). In reality, the RSA will not extend across this entire height range but will be somewhere within it depending on final hub height and blade length of the installed turbines.

Figure 2 shows this range and indicative potential RSAs.

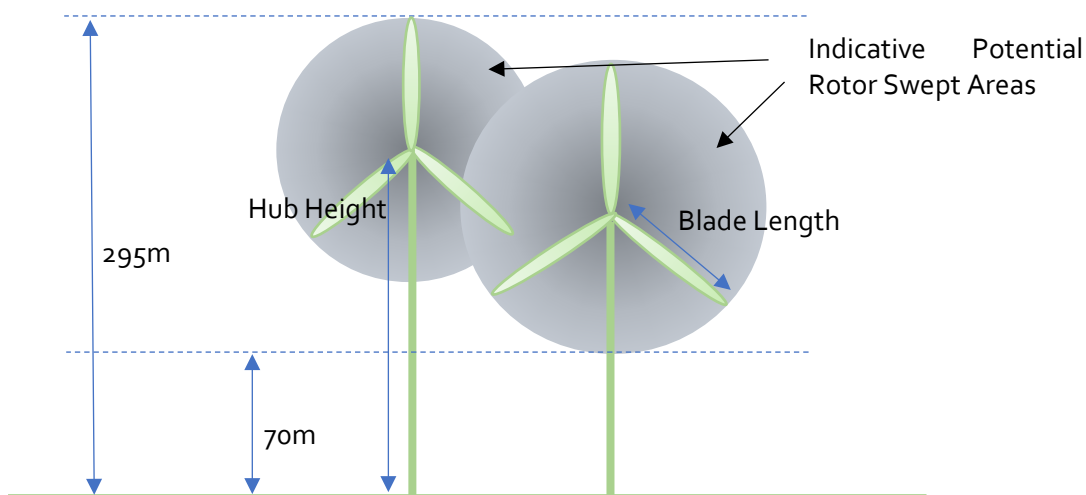


Figure 2 – Indicative Wind Turbine Configuration

## 2 PRE-CONSTRUCTION BIRD AND BAT INFORMATION

The results of previous investigations (refer Section 1.2.1) are summarised below.

### 2.1 Bird Surveys

#### 2.1.1 Bird Survey Methodology

Following desktop assessments, bird surveys were undertaken by Premise Environment and included the following:

- 15 bird surveys (over 16 days) undertaken between December 2016 and April 2019
- A total of 139 diurnal bird utilization surveys (BUS)
- Incidental observations made while traversing the site
- Spotlighting for 16 person hours

#### 2.1.2 Bird Survey Results

Bird surveys recorded 66 bird species across the wind turbine study area. The following five (5) species of conservation significance were recorded:

1. White-throated needletail (*Hirundapus caudacutus*) – V, MT, LM (EPBC Act)
2. Fork-tailed swift (*Apus pacificus*) – MT (EPBC Act)
3. Spectacled monarch (*Monarcha trivirgatus* (syn. *Symposiachrus trivirgatus*)) – LM, MT (EPBC Act)
4. Rainbow bee-eater (*Merops ornatus*) – LM (EPBC Act)
5. Cicadabird (*Coracina tenuirostris*) – LM (EPBC Act)

No migratory shorebirds were observed within the wind turbine study area or flying over the Project Area (PLA) on any of the bird surveys, despite being undertaken during known periods of arrival and dispersal to/from Australia.

Seven (7) Least Concern (NC Act) raptor species (whistling kite (*Haliastur sphenurus*), spotted harrier (*Circus assimilis*), black-shouldered kite (*Elanus axillaris*), brown falcon (*Falco berigora*), Australian hobby (*Falco longipennis*), peregrine falcon (*Falco peregrinus macropus*) and wedge-tailed eagle (*Aquila audax*)) were recorded within the Project Area (PLA). None of the raptors are listed species under the EPBC Act or NC Act.

One (1) large water bird (white-necked heron (*Ardea pacifica*)) was observed flying over the wind turbine area. White-necked herons are not listed under the EPBC Act or NC Act.

### 2.2 Bat Surveys

#### 2.2.1 Bat Survey Methodology

The methods and results of the microbat surveys and flying-fox surveys are outlined in Fox & Co Report FWH-03 (2020). In summary, the following surveys were undertaken:

- December 2016 – review of DoE National Flying-fox Monitoring Viewer (informed by the DoE, National Flying-fox Monitoring Program (NFFMP) – flying-fox census)
- 7 – 8 December 2016 – diurnal flying-fox camp assessment for activity
- 7 December 2016 – nocturnal flying-fox survey on Project Area (PLA) (8 person hours)
- 14 February 2019 - 26 March 2019 - two (2) ultrasonic detectors (SM2BAT, SM4BAT) were deployed across the Project Area (PLA) for micro-bats. Surveys totaled 80 nights of recording.



- 14 February 2019 - 26 March 2019 – one (1) acoustic songmeter (SM4) deployed across the Project Area (PLA) for acoustic flying-fox calls. Surveys totaled 34 nights of recording.
- 17 – 18 June 2019 - nocturnal flying-fox survey on Project Area (PLA) (16 person hours)
- 5 August 2019 - review of DoE National Flying-fox Monitoring Viewer

### **2.2.2 Bat Survey Results**

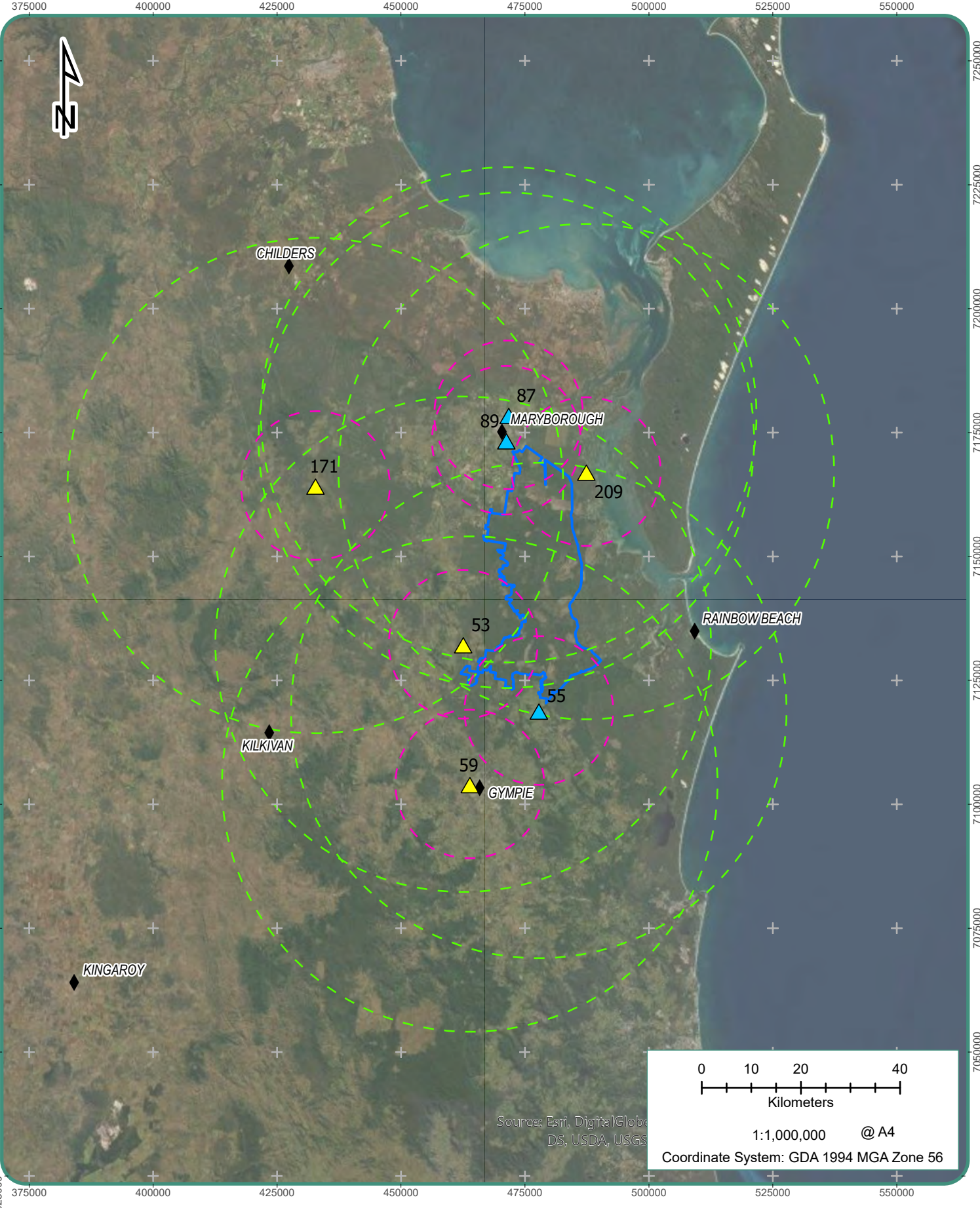
Up to 14 microbat species were recorded during the bat surveys. No threatened microbats were detected. The most common microbat species were *Chalinolobus nigrogriseus* (Hoary wattled bat); *Ozimops ridei* (Ride's free-tailed bat), and *Saccolaimus flaviventris* (yellow-bellied sheath-tail-bat). These 3 species are least concern under the NC Act and not listed under the EPBC Act.


There are seven (7) grey-headed flying-fox (GHFF) camps within 50km of the wind turbine site that have been occupied by GHFF within the past 2 years. Flying-fox camps are sometimes mixed with GHFF and little-red flying-fox (LRFF), and more often with GHFF and black flying-fox (BFF) with numbers and presence varying over time due to the nomadic nature of flying-foxes and food availability

1. Glenwood Varley Road (53)
2. Maaroom, Esplanade (209)
3. Goomboorian, Anderleigh Rd Ginger Creek (55)
4. Maryborough, Kent Street (88)
5. Maryborough, Albion Rd Wetlands (Island Plantation) (87)
6. Gympie (53)
7. Woocoo (171)

The closest Nationally Important GHFF camps are Marrom, Glenwood Varley Road, Gympie and Woocoo, which are 4km, 14km, 30km and 40km away, respectively, from the nearest turbine location, respectively.

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<b>TITLE:</b> <b>Grey headed flying-fox potential foraging distances</b>		<b>LEGEND</b>		
<b>MAP NO:</b> Figure 3	<ul style="list-style-type: none"> <li><span style="color: blue;">▲</span> Grey headed flying-fox camp</li> <li><span style="color: yellow;">▲</span> Nationally important flying-fox camp</li> <li>◆ Populated places</li> </ul>	<ul style="list-style-type: none"> <li><span style="border: 2px solid blue; display: inline-block; width: 15px; height: 10px;"></span> Project Area (PLA)</li> <li><span style="border: 2px dashed pink; display: inline-block; width: 15px; height: 10px;"></span> Flying-fox camp 15km buffer</li> <li><span style="border: 2px dashed green; display: inline-block; width: 15px; height: 10px;"></span> Flying fox camp 50km buffer</li> </ul>		
<b>PROJECT:</b> Forest Wind Holdings Pty Ltd - Bird & Bat Utilisation Survey				

Date: 10/02/2020

Data Source: © State of Queensland (Department of Natural Resources, Mines and Energy) 2019.

## 3 RISK ASSESSMENT

### 3.1 Birds

The risk assessment for collision-based impacts has considered the likelihood of occurrence, typical flight behaviour, distribution and biology. Risk categories are:

- Low Risk: low flight behaviour with the species typically foraging just above the tree canopy and below it.
- Medium Risk: has the potential to occasionally fly at RSA height and suitable habitat is present in the wind turbine area or immediately adjacent to it
- High Risk: known to regularly fly at or above RSA height, aerial insectivore foragers and suitable habitat present on or adjacent to the site

Previous assessments for the Project have identified bird and bat species most 'at risk' of impact by the operation of the wind farm, this includes Least Concern species. As a result, some Least Concern (common) bird species are included in the below risk assessment due to their presence and flight behaviour.

During the 2016 – 2019 bird surveys, the following six (6) species were observed exhibiting high risk flight behaviour flying within the RSA height.

- White-throated needletail (*Hirundapus caudacutus*) – V, MT, LM (EPBC Act)
- Fork-tailed swift (*Apus pacificus*) – MT (EPBC Act)
- Whistling kite (*Haliastur sphenurus*) – Least Concern (LC)
- Wedge-tailed eagle (*Aquila audax*) – LC (NC Act)
- Channel-billed cuckoo (*Scythrops novaehollandiae*) – (LC)
- Tree martin (*Petrochelidon nigricans*) – (LC)

An additional thirteen (13) bird species were identified during surveys which possess moderate to high risk flight behaviour, although all of these were recorded well below RSA height. The cockatoos, raptors, large waterbirds and aerial insectivores observed are included in the risk assessment.

- Spotted harrier (*Circus assimilis*) – LC (NC Act)
- Black-shouldered kite (*Elanus axillaris*) – LC (NC Act)
- Welcome swallow (*Hirundo neoxena*) – LC (NC Act)
- White-necked heron (*Ardea pacifica*) – LC (NC Act)
- Brown falcon (*Falco berigora*) – LC (NC Act)
- Australian hobby (*Falco longipennis*) – LC (NC Act)
- Peregrine falcon (*Falco peregrinus macropus*) – LC (NC Act)
- Rainbow bee-eater (*Merops ornatus*) – MT (EPBC Act)
- Cicadabird (*Coracina tenuirostris*) – LM (EPBC Act)
- Torresian crow (*Corvus orru*) – LC (NC Act)
- Australian magpie (*Gymnorhina tibicen*) – LC (NC Act)
- Sulphur-crested cockatoo (*Cacatua galerita*) – LC (NC Act)
- Yellow-tailed black-cockatoo (*Calyptorhynchus funereus*) – LC (NC Act)

Additional least concern, threatened or EPBC listed migratory bird species were identified as having a moderate – high potential to occur based on desktop searches (*Bird and Bat Utilisation Report, 2019*). Migratory shorebirds were also considered in the utilisation assessment and all migratory shorebirds were considered at low risk of collision (*Bird and Bat Utilisation Report, 2020*).

Subsequent surveys and assessments identified that the susceptibility for collision-based impacts is low or unlikely due to their population size, distribution, foraging behaviour, flight behaviour and

movement patterns. The following tables summarise the RSA utilisation behaviour and collision susceptibility for the following categories:

- Table 1 – Threatened and/or migratory bird species known to occur in the Project Area (PLA)
- Table 2 - Threatened and/or migratory bird species considered to have a moderate to high likelihood of occurrence in the Project Area (PLA)
- Table 3 – Common bird species known to occur in the Project Area (PLA) with a moderate to high risk flight behaviour

**Table 1 Threatened or Migratory Bird Species Known to Occur in Project Area (PLA)**

Scientific Name	Common Name	<sup>1</sup> Status EPBC / NC Act <sup>1</sup>	Likelihood	RSA Utilisation	Collision Risk Susceptibility
<i>Hirundapus caudacutus</i>	White-throated Needletail	V, MT, LM / SLC	Known	Foraging	High
<i>Apus pacificus</i>	Fork-tailed Swift	MM, LM / SLC	Known	Foraging	High
<i>Monarcha trivirgatus</i> (syn. <i>Symposiachrus trivirgatus</i> )	Spectacled Monarch	MT, LM / SLC	Known	Unlikely	Low
<i>Merops ornatus</i>	Rainbow bee-eater	LM / LC	Known	Foraging	Moderate
<i>Coracina tenuirostris</i>	Cicadabird	LM/ LC	Known	Unlikely	Low

<sup>1</sup> EPBC Act: V = Vulnerable, MM = Migratory Marine, MT = Migratory Terrestrial, MW = Migratory Wetlands, LM = Listed Marine MI=Listed Migratory  
NC Act: SLC = Special Least Concern, LC = Least Concern

The threatened and/or migratory bird species listed in Table 2 were considered as having a moderate or high likelihood of occurrence. Likelihood of occurrence and susceptibility of collision on the Project Area (PLA) is provided in the *Ecological Assessment Report (2019)* and summarised below.

**Table 2 Threatened or Migratory Bird Species Potentially Occurring in Project Area (PLA)**

Scientific Name	Common Name	<sup>1</sup> Status EPBC / NC Act <sup>1</sup>	Likelihood	RSA Utilisation	Collision Risk Susceptibility
<i>Ardea alba</i> (Syn. <i>A. modesta</i> )	Great Egret, White Egret	LM / LC	Moderate	Dispersing	Low
<i>Haliaeetus leucogaster</i>	White-bellied sea-eagle	LM / LC	Moderate	Dispersing	Low
<i>Ninox strenua</i>	Powerful owl	- / V	Moderate	Unlikely	Low
<i>Monarcha melanopsis</i>	Black-faced monarch	MT, LM / SLC	Moderate	Unlikely	Low

Scientific Name	Common Name	<sup>1</sup> Status EPBC / NC Act <sup>1</sup>	Likelihood	RSA Utilisation	Collision Risk Susceptibility
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	MT, LM / SLC	Moderate	Unlikely	Low
<i>Ardea ibis</i>	Cattle egret (Syn. <i>Bubulcus ibis</i> )	LM, MW / LC	Moderate	Dispersing	Low
<i>Rhipidura rufifrons</i>	Rufous Fantail	LM, MT / SLC	Moderate	Unlikely	Low
<i>Cuculus optatus</i>	Oriental cuckoo	MT / SLC	Moderate	Unlikely	Low

<sup>1</sup> EPBC Act: MT = Migratory Terrestrial, MW = Migratory Wetlands, LM = Listed Marine  
 NC Act: V = Vulnerable, SLC = Special Least Concern, LC = Least Concern

**Table 3 Common Bird Species Known or Likely to Occur in Project Area (PLA) with Moderate to High Flight Risk Behaviour**

Scientific Name	Common Name	<sup>1</sup> Status EPBC / NC Act <sup>1</sup>	Likelihood	RSA Utilisation	Collision Risk Susceptibility
<i>Ardea pacifica</i>	White-necked heron	NL / LC	Known to Occur	Dispersing	Moderate
<i>Circus assimilis</i>	Spotted harrier	NL / LC	Known to Occur	Dispersing	Low
<i>Elanus axillaris</i>	Black-shouldered kite	NL / LC	Known to Occur	Foraging	Moderate
<i>Falco berigora</i>	Brown falcon	NL / LC	Known to Occur	Foraging	High
<i>Falco longipennis</i>	Australian hobby	NL / LC	Known to Occur	Foraging	High
<i>Falco peregrinus macropus</i>	Peregrine falcon	NL / LC	Known to Occur	Foraging	High
<i>Haliastur sphenurus</i>	Whistling kite	NL / LC	Known to Occur	Foraging	High
<i>Aquila audax</i>	Wedge-tailed eagle	NL / LC	Known to Occur	Foraging	High
<i>Hirundo neoxena</i>	Welcome swallow	NL / LC	Known to Occur	Foraging	High
<i>Scythrops novaehollandiae</i>	Channel-billed cuckoo	NL / LC	Known to Occur	Dispersing	High
<i>Corvus orru</i>	Torresian crow	NL / LC	Likely to Occur	Territorial and aggressive flight behaviour	High
<i>Gymnorhina tibicen</i>	Australian magpie	NL / LC	Likely to Occur	Territorial and aggressive flight behaviour	High

Scientific Name	Common Name	<sup>1</sup> Status EPBC / NC Act <sup>1</sup>	Likelihood	RSA Utilisation	Collision Risk Susceptibility
<i>Petrochelidon nigricans</i>	Tree martin	NL / LC	Likely to Occur	Foraging	High
<i>Pelecanus conspicillatus</i>	Australian pelican	NL / LC	Likely to Occur	Dispersing	High
<i>Threskiornis Molucca</i>	Australian white ibis	NL / LC	Likely to Occur	Dispersing	High
<i>Ardea pacifica</i>	White-necked heron	NL / LC	Likely to Occur	Dispersing	Moderate
<i>Cacatua galerita</i>	Sulphur-crested cockatoo	NL / LC	Known to Occur	Dispersing	Moderate
<i>Calyptorhynchus funereus</i>	Yellow-tailed black-cockatoo	NL / LC	Known to Occur	Dispersing	High

<sup>1</sup> EPBC Act: MT = Migratory Terrestrial, MW = Migratory Wetlands, LM = Listed Marine, NL – Not Listed  
 NC Act: V = Vulnerable, SLC = Special Least Concern, LC = Least Concern

### 3.2 Bats

Seven (7) GHFF camps are located within 50km of the Project Area (PLA). GHFF are capable of nightly flights of up to 50 km from their roost to different feeding areas as food resources change; however, foraging areas are usually within 15 km of the day roost site. Likelihood of occurrence and susceptibility of collision on the Project site is provided in the *Ecological Assessment Report (2019)* and summarised in Table 4.

**Table 4 Threatened and Least Concern (Common) Bat Species Known or Likely to Occur**

Scientific Name	Common Name	Status EPBC / NC Act <sup>1</sup>	Likelihood	RSA Utilisation	Collision Risk Susceptibility
<b>Megabats (Flying-fox)</b>					
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V / LC	Known to occur (in NSF)	Dispersing	Moderate
<i>Pteropus scapulatus</i>	Little red flying-fox	NL / LC	High	Dispersing	Moderate
<i>Pteropus alecto</i>	Black flying-fox	NL / LC	High	Dispersing	Moderate
<b>Microbats</b>					
<i>Rhinolophus megaphyllus</i>	Eastern horseshoe bat	NL / LC	Occurs	Foraging	Low
<i>Chalinolobus gouldii</i>	Gould's wattled bat	NL / LC	Occurs	Foraging	High
<i>Chalinolobus nigrogriseus</i>	Hoary wattled bat	NL / LC	Occurs	Foraging	High

Scientific Name	Common Name	Status EPBC / NC Act <sup>1</sup>	Likelihood	RSA Utilisation	Collision Risk Susceptibility
<i>Nyctophilus sp.</i>	-	NL / LC	Occurs	Foraging	Low
<i>Scotorepens greyii</i>	Little broad-nosed bat	NL / LC	Occurs	Foraging	Low
<i>Miniopterus australis</i>	Little bent-wing bat	NL / LC	Occurs	Foraging	Low
<i>Miniopterus orianae</i>	Australian bent-wing bat	NL / LC	Occurs	Foraging	High
<i>Austronomus australis</i>	White-striped freetail bat	NL / LC	Occurs	Foraging	High
<i>Ozimops ridei</i>	Ride's free-tailed bat	NL / LC	Occurs	Foraging	Moderate
<i>Ozimops lumsdenae</i>	Northern free-tailed bat	NL / LC	Occurs	Foraging	Moderate
<i>Saccolaimus flaviventris</i>	Yellow-bellied sheathtail bat	NL / LC	Occurs	Foraging	High

## 4 MITIGATION MEASURES

Mitigation measures proposed are in accordance with industry standards and the mitigation recommendations provided in *Wind Farm Industry EPBC Act Policy Statement 2.3 (DoE, 2009)*.

Avoidance is the guiding principle to avoiding impacts on MNES (and MSES). Avoidance measures utilised in the Project include:

- The Project is set back a minimum of 4km from the Great Sandy Strait which is a known significant non-breeding area for EPBC listed migratory shorebirds.
- The Project Area (PLA) is located within an existing exotic pine plantation and avoids remnant vegetation and waterways.
- Electrical cabling will mostly be underground along existing access tracks which will further reduce the likelihood of collision and/ or electrocution of birds and bats.
- Other infrastructure such as construction compounds avoid remnant vegetation and waterways and therefore avoid damage to remnant areas of natural habitat.
- Existing forestry tracks will be used to provide access within the Project Area (PLA) and therefore avoids disturbance to remnant vegetation and habitat within remnant vegetation.

Additional management measures to reduce collision-based impacts during operation are associated with adaptive management and reducing the risk of attracting birds and bats into the RSA of the wind farm. The success of the management objectives are measured through the criteria outlined in Table 5.

## 5 MANAGEMENT AND MONITORING

Potential impacts to bats and birds will be managed through the implementation of the management objectives, activities and controls in Table 5. Management activities and controls will be implemented in accordance with the proposed schedule and success measured through the performance criteria also detailed in Table 5. Monitoring methods are in accordance with recommended operation phase impact monitoring provided in *Interim Standards for Assessing the Risks to Birds from Wind Farms in Australia (AusWEA 2005)*. The protocols are also considered applicable for flying-foxes and include:

- Dead bird/bat searches
- Indirect disturbance impact assessments
- Avoidance studies

Surveys undertaken between 2016 and 2019 are considered to provide adequate pre-construction baseline data which can be used to compare future changes. As such, post-construction / operational monitoring of identified 'at risk' species, coupled with adaptive management impact triggers is proposed to manage impacts on birds and bats from the Project. Surveys will be designed to ensure that bird/bat behaviour responses, including avoidance of turbines, and changes to site utilisation, are detected. These surveys will continue the BACI survey design, and will be:

- statistically capable of refuting the hypothesis that the high risk turbines are reducing the area of utilised habitat; and
- able to estimate the area of effective habitat loss.

It is expected that further refinement of the below management activities and criteria will be undertaken in consultation with the assessment agencies during the approval process and also in accordance with the Qld Government Development Approval (1912-14632).

Turbines are considered high risk if the utilisation surveys detect EPBC listed species within the vicinity of the turbine, or there is otherwise information evidencing likely presence/risk. EPBC species will be directly related to high risk turbines or clusters of high risk turbines. The risk assessment for each turbine (or cluster of like turbines) will describe, and take into account, surface type, ground cover, terrestrial vegetation extent and condition, and home range/proximity to known or predicted species roosting/foraging/breeding habitat, accounting for any natural or man-made buffers between these features and the turbine (e.g. cleared pine plantation compartment). The plan must also outline how the precautionary principle has been applied to assess risk and select low-risk turbines.

Although no threatened microbat species were assessed as likely to occur, operational phase microbat surveys on the least concern microbat species identified to occur will be included in further pre-construction (2-months prior to construction), post-construction surveys and mortality surveys.

### **5.1 Carcass Persistence Trials**

Carcass persistence trials will be undertaken:

- beneath and adjacent to turbines or collocated turbines identified as a high risk to EPBC species;
- as part of each formal monitoring event to maximise collision detection under varying scavenging rates; and
- stratified according to:
  - EPBC listed species carcass size;
  - surface type and vegetation cover, e.g. mature exotic pine, young pine or open compartments; and
  - season (summer/winter) to ensure variation in decomposition rates are captured.



Dingoes and cats are known to occur within the Project Area (PLA). Baits will be set with motion sensor camera traps to confirm presence and abundance of scavengers. This information may inform control programs to enhance persistence rates/improve detection, help explain changes to carcass persistence rates and inform ongoing persistence trials required to account/correct for fluctuating persistence rates.

## **5.2 Searchers Efficiency Trials**

Searcher efficiency trials will be undertaken to assess the efficiency of the ecologists (or detection dog) undertaken the carcass monitoring. Efficiency trials will be:

- Undertaken adjacent to turbines or collocated turbines specified in the approved management plan as a high risk to EPBC species, and in conjunction with formal collision monitoring;
- blind, that is, the searcher must not be aware they are undertaking an efficiency trial. To this end, the searcher efficiency trials are conducted in conjunction with the monthly collision monitoring (by distributing the additional carcasses under searched turbines);
- stratified according to surface type and vegetation cover, for example different age classes of exotic pine at the same turbine/cluster. Each searcher efficiency trial must use at least 10 carrion per size class.

Searchers will be either:

- detection dogs that are certified for the purpose of bird/bat carcass detection;
- suitably qualified ecologists; or
- a person trained by a suitably qualified ecologist in the detection of bird and bat carcasses.

Table 5 summarises the bird and bat monitoring management objectives.

**Table 5 Management Objectives, Activities, Timing and Performance Criteria**

Management Objectives	Management Activities and Controls	Timing	Performance Criteria for Measuring Success of Methods
Background bird and bat monitoring of all species	Establish baseline bird and bat utilisation and flight height data. (completed by Premise Environment 2016-2019)	Pre-approval and during Project design	All bird and bat species most at risk identified.
Pre-construction bird/bat monitoring	Pre-construction baseline bird and bat utilisation surveys. Continue BACI survey design.	Pre-construction. Additional pre-construction monitoring of all bird and bat species (regardless of conservation status) undertaken 2-months prior to construction.	Update birds/bats most at risk of collision.
Post-construction bird/bat Monitoring	Post-construction bird/bat utilisation surveys. Continue BACI survey design.	Operational. Monthly from August – November (4 events) and monthly from February – April (3 events) for the first 2 years Same survey points and BUS methods as pre-construction monitoring.	Post-construction surveys completed, and data compared to pre-construction monitoring. Statistical analysis of differences between pre and post data as per AusWEA 2005.
Mortality	<p>Monthly surveys to be undertaken at a stratified random representative selection of turbines (10%)</p> <p>Carcass monitoring will be undertaken during each survey by an ecologist or trained detection dog or other approved method.</p> <p>Searcher efficiency trials.</p> <p>Surveys will also be timed to occur at times of flowering of eucalypt and melaleuca where possible.</p> <p>Weather data will be recorded.</p> <p>If carcasses are identified the location and conditions will be recorded, including but not limited to visibility conditions such as fog, wind, rain, current and previous 24hr weather conditions</p>	<p>A monthly sample of 10% of the wind turbines, so that annually each turbine is inspected at least once, for a period of two years. Or, a greater frequency, subject to observations.</p> <p>Or, monthly stratified random locations with each strata having a minimum of 3 turbines. Strata may be north, south, east and west within the Project Area.</p> <p>Searcher efficiency trials are undertaken concurrently with carcass monitoring.</p>	If monitoring design requires amendments

Management Objectives	Management Activities and Controls	Timing	Performance Criteria for Measuring Success of Methods
	If carcass's are identified repeatedly for a period of 3 months a strategy will be developed to manage the risk of collision.		
Injured Wildlife	Injured wildlife taken to approved wildlife carer	Construction and Operation	Rehabilitated injured wildlife Register of injured wildlife

## 6 IMPACT TRIGGERS AND ADAPTIVE MANAGEMENT

An impact trigger is generally where there is evidence of death or injury to birds and/or bats as a result of collision with a wind turbine, or other interaction such as barotrauma.

For the purposes of this management plan, an impact trigger for Threatened Species occurs where a carcass (or recognizable part) of a threatened bird or bat species (listed as under the Commonwealth EPBC Act or Queensland NC Act) is found under or close to a turbine during any carcass search or incidentally during commissioning or operation. This would be reported to DES within 24 hours of the observation, unless possession is authorised by a DES rehabilitation permit. If a turbine strikes an EPBC listed species not specified in the EPBC conditions of approval, or an incidental carcass find detects an EPBC species at a low-risk turbine, the plan will be reviewed to manage those impacts.

Impact triggers are important in determining the success of the proposed mitigation measures and monitoring requirements. Where impact triggers are identified, adaptive management may be required to assess current mitigation measures and identify additional measures that may need to be implemented.

For non-threatened birds and bats, an impact trigger is where two or more of the same species, in two successive searches (2-successive monthly searches from the selected stratified random sample locations) at the same or adjacent turbine(s) is recorded (i.e. a total of four or more carcasses of the same species in two successive searches at the same turbine). Where population numbers are known the definition of an unacceptable impact on non-threatened species is any impact that is likely to reduce the viability of the population of the affected species in the bioregion.

If the event is considered a potentially regular occurrence (based on assessment of survey data), or likely lead to an unacceptable impact to the population (at the appropriate scale ie. Local, Regional, State, National); species-specific monitoring may be required. Should further monitoring confirm unacceptable impacts, further mitigation measures will be required.

If impacts are identified a targeted monitoring program will be undertaken to determine likely cause and potential mitigation measures. Measures may include:

- temporary shutdown of individual turbines. Utilisation bird and bat surveys to assist in determining isolation period.
- slow rotor speeds.

Hypothetical causes and potential mitigation measures are provided in more detail in Table 6.

**Table 6 Impact Triggers and Management Measures**

Hypothetic cause of impact	Mitigation Measure	Likelihood of Impact continuing following mitigation	Implementation Timing
Foraging source identified that attracts threatened species and 'at risk' species to impact areas (eg. Flowering eucalypts and melaleuca)	Trial acoustic and/or sonar to deter bats/birds	Low	Implement as according to agreed plan
	Slow rotor speeds or temporary shutdown of turbines. Utilisation bird and bat surveys determine isolation period.	Low	Immediately if identified as the cause of unacceptable impacts on threatened species
Bushfire, low pressure systems and storm fronts creating favourable conditions for aerial foragers	Slow rotor speeds or temporary shutdown of subject turbines during Summer period of known migratory aerial insectivores when birds may be on site. Repeat carcass surveys following extreme weather events to determine if events are linked to unacceptable impacts. Utilisation bird and bat surveys determine isolation period.	Low	Immediately following extreme Summer weather events such as large regional bushfires and severe weather fronts.
Low visibility due to wind/rain/fog	Repeat carcass surveys to determine if correlation is related to low visibility. Temporary shutdown on subject turbines identified as causing the impact.	Low	Immediately upon confirming cause

## 7 REPORTING REQUIREMENTS

The outcomes of monitoring and management actions will be documented to demonstrate continual compliance with performance criteria and to assist with rapid adaptive management measures.

Table 7 provides the proposed reporting schedule.

**Table 7 Reporting Schedule**

Activity	Reporting Requirement	Timing	Responsibility
Baseline monitoring (completed by Premise Environment 2016-2019)	Bird and bat utilisation report	Pre-approvals and during Project design.	Suitably Qualified Independent Ecologist
Pre-construction baseline bird and bat utilisation surveys	Update bird and bat utilisation report.	Fortnightly, 2-months before construction	Suitably Qualified Independent Ecologist
Post-construction bird/bat utilisation surveys	Post-construction bird and bat utilisation report	1 interim annual summary report and 1 final monitoring report incorporating pre-construction and post-construction bird/bat data	Suitably Qualified Independent Ecologist
<p>Carcass monitoring will be undertaken during each survey by an ecologist, trained detection dogs or other approved method.</p> <p>Surveys will also be timed to occur at times of flowering of eucalypt and melaleuca where possible.</p> <p>Weather data will be recorded.</p> <p>If carcasses are identified the location and conditions will be recorded, including but not limited to visibility conditions such as fog, wind, rain, current and previous 24hr weather conditions</p> <p>If carcass's are identified repeatedly for a period of 3 months a strategy will be developed to manage the risk of collision.</p>	Monthly assessment report and final mortality assessment report	<p>Monthly.</p> <p>Brief monthly inspection report within 48 hours of carcass surveys.</p> <p>Annual report following first 12 months of monitoring</p>	Suitably Qualified Independent Ecologist, trained detector dog or other approved method for relevant 'at risk' species
Injured wildlife taken to approved wildlife carer	Update register and include results in annual mortality report	Update fauna incident register within 48 hours	Environmental Officer

## 8 WORKS CITED AND RELEVANT REFERENCE DOCUMENTS

Fox & Co Environmental (2019). *Forest Wind Ecological Assessment of the Proposed Forest Wind Farm Project, FWH-02*

Fox & Co Environmental (2019). *Forest Wind Bird and Bat Utilisation Report, FWH-01*

State Code 23: Wind Farm Development, Planning Guidelines (Queensland Government, June 2018)

Wind farms and birds: Interim Standards for Risk Assessment. Report No. 2003.35 (2.2) (AusWEA, 2005)

Premise Environment (2017). *Forest Wind Ecological Assessment, Report No. 1701513b*



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