Chalumbin Wind Farm Project

Bird and Bat Utilisation Survey Report

Prepared for:
Chalumbin Wind Farm Pty Ltd

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Document Information

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1.0 Introduction

1.1 Background

Chalumbin Wind Farm Pty Ltd (CWF), a subsidiary of Ark Energy Projects Pty Ltd (Ark), proposes to develop the Chalumbin Wind Farm Project (the Project) at a location approximately 15 km southwest of Ravenshoe in Far North Queensland within the Tablelands Regional Council Local Government Area (LGA), see **Figure 1-1**.

Attexo Group Pty Ltd (Attexo) has been engaged by CWF to undertake bird and bat utilisation surveys (BBUS) for the Project, in order to support Project approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as well as a Development Application (DA) for the Project to the State Assessment Referral Agency (SARA) under State Code 23: Wind Farm Development and State Code 16: Native Vegetation Clearing.

1.2 Project Area

The Project area is located across two properties, one freehold and the other leasehold. Both properties are primarily used for grazing and there are several easements intersecting them associated with roads and high-voltage electrical infrastructure. The Project area is predominantly characterised by remnant vegetation with one semi-perennial waterway, Blunder Creek, traversing both properties in an east-west direction.

Surrounding properties are used for grazing and conservation purposes, including National Parks and Timber Reserve abutting the northern and eastern boundaries of the Project area.

1.3 Project Description

The Project is proposed to consist of up to 86 wind turbines, linking access tracks and associated infrastructure including a new Powerlink connection substation and wind farm collector substations, permanent meteorological monitoring masts (met masts), medium and high-voltage underground and overhead powerlines, temporary construction compound and stockpile areas, and temporary and permanent site offices for asset management and operation and maintenance facilities.

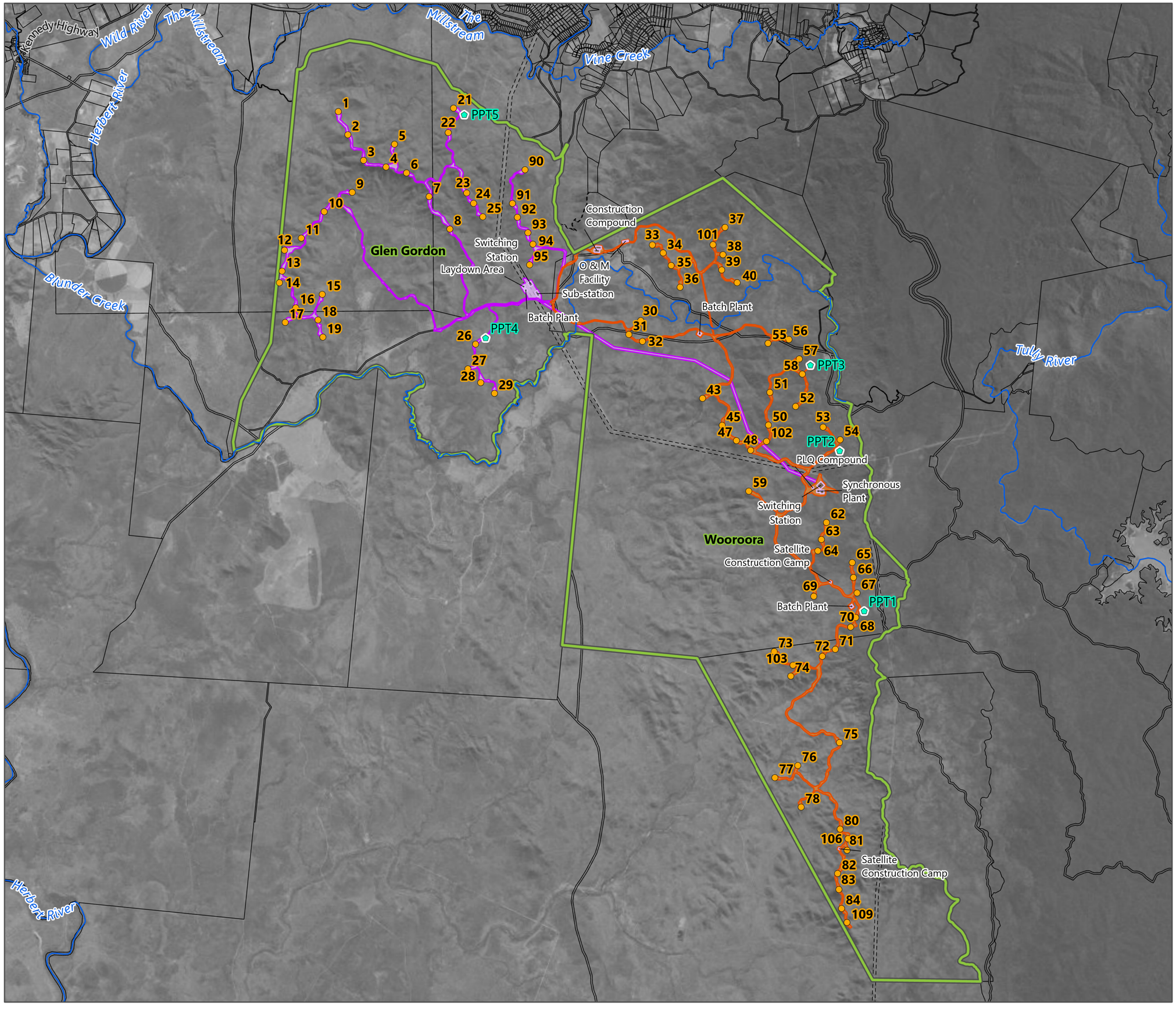
Turbine towers will be up to 160 m tall and turbine blades may be as long as 90 m. The Rotor Swept Area (RSA) is the physical area swept by the rotating blades as the turbine is operating. The indicative RSA for the Project is between 40 m and 265 m above ground level. Consideration of the RSA has been made when assessing the height range at which a flying bird could potentially collide with the turbine blades or nacelle.

1.4 Purpose and Scope

The purpose of a Bird and Bat Utilisation Survey (BBUS) is to provide baseline data on bird and bat use of the Project area following a Before-After-Control-Impact (BACI) design, in accordance with Appendix C of the Final PER Guidelines and State Code 23: Wind Farm Development (DILGP 2017). The BACI design will allow Ark to assess the impact of the Project on the local and migratory bird and bat community. Six pre-construction BBUS have been undertaken by experienced ecologists with two additional surveys to be completed, to account for seasonal variation in activity and migration. Results of these surveys will be used to ensure appropriate processes and methods are in place during the operational phase of the Project to manage potential impacts to bird species and identify species of particular concern.

The specific objectives of the BBUS are to:

- Review existing bird and bat data for the Project area;
- Describe the diversity of birds and bats found in the Project area;
- Identify the known or likely occurrence of conservation significant species;
- Identify bird species that are susceptible to collision impacts based on observed or recorded flight behaviours; and
- Identify bat species that are susceptible to barotrauma based on passive acoustic detection.



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Project Area

Figure 1.1

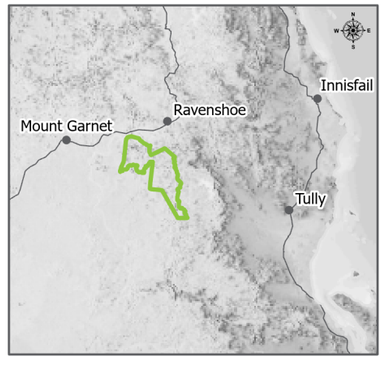
- Project Area Boundary
- Turbine
- Met-mast
- Facilities

Clearance Envelope

- Stage 1
- Stage 2
- Lot Boundary
- Easement

Date: 17/10/2022 Author: TOD

Project: EPU-004 Reviewed: NOD



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Data Source(s):
Digital Cadastral Database - Department of Resources (2022)
Earthstar Geographics, © State of Queensland (Department of Resources) 2022

2.0 Methodology

2.1 Desktop Assessment

A desktop assessment has been undertaken to identify and characterise bird species and habitat types that may be present within the Study area, which is defined as the Project area plus a 10 km buffer. The desktop assessment included a review of literature, searches of publicly available datasets and online mapping. The following information sources were reviewed as part of the desktop assessment:

- The Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool (PMST), to identify matters of national environmental significance that are known or considered likely to occur. Search results from October 2022 are provided in Appendix B of the PER (Attexo 2022);
- DCCEEW's Species Profiles and Threats database (SPRAT), Recovery Plans and/or Conservation Advice notes as relevant;
- The Department of Environment and Science (DES) Wildlife Online database, to identify bird species previously recorded within the Study area. Search results from October 2022 are provided in Appendix B of the PER (Attexo 2022);
- DES mapping for essential habitat, wetlands, watercourses and drainage features;
- Atlas of Living Australia (ALA) database;
- Department of Resources (DoR) regulated vegetation mapping (including remnant, high value regrowth and non-remnant vegetation);
- Batmap database from the Australasian Bat Society (ABS);
- Species distribution maps from various current field guides; and
- Published ecological information on threatened flora and fauna species where available.

Initial desktop searches were undertaken in September 2020 to inform field survey requirements; the desktop searches were repeated as part of the EPBC Referral and PER reporting in order to account for potential updates to government datasets and recent threatened species records. Information collected as part of the desktop assessment was used to identify bird species that may be found in the Project area and to determine appropriate survey locations for the BBUS.

2.2 Bird Utilisation Surveys

An initial programme of timed bird counts was undertaken in January 2021, prior to the Project footprint being identified. These surveys did not follow a BACI design and hence have only been included in this report in terms of the overall list of bird species recorded from the Project area to date. Six BUS following a BACI design have been undertaken based on the proposed Project footprint:

- 19-27 June 2021 (early dry season);
- 5-17 October 2021 (late dry season);
- 18-25 January 2022 (early wet season);

- 6-14 April 2022 (late wet season);
- 9-17 August 2022 (dry season); and
- 15-24 November 2022 (late dry season).

The results of these surveys are described fully in **Section 3.0**.

2.2.1 Survey Timing and Conditions

Weather conditions for the month prior to and during each survey are summarised in **Table 2-1**. Rainfall was measured at the Ravenshoe Alert gauge (weather station 31200), approximately 10 km from the Project area while temperature was measured at the Walkamin Research Station (weather station 31108), approximately 70 km from the Project area.

Table 2-1 Weather Conditions Indicative of the Project Area (BOM, 2022)

	May 2021	June 2021	Sept 2021	Oct 2021	Dec 2021	Jan 2022	Mar 2022	Apr 2022	Jul 2022	Aug 2022	Oct 2022	Nov 2022
Rainfall (mm)	54 (64.8)	35 (58)	44 (23.1)	41 (46.3)	159 (139.3)	289 (255)	164 (267)	186 (125)	104 (47.9)	57 (28.7)	76 (47.7)	82 (58.9)
Mean minimum temperature (ºC)	16.1 (16.2)	15.4 (14)	15.5 (14.8)	17.9 (16.7)	19.8 (19.8)	20.5 (20.3)	20.2 (19.7)	19.1 (18.2)	12.8 (13.1)	14.2 (13.4)	18.6 (16.7)	19.7 (18.5)
Mean maximum temperature (ºC)	25.1 (25.1)	25.2 (23.7)	26 (27.2)	32.1 (29.4)	31.1 (30.8)	30.6 (30.1)	30.5 (28.2)	28.1 (26.7)	23.1 (23.4)	25.1 (24.9)	31 (29.4)	31.4 (30.6)

Numbers in brackets represent the relevant meteorological averages between years 1968 and 2022.

2.2.2 Survey Locations

Bird counts were undertaken at 21 locations across the Project area, comprising 17 impact sites and four control sites as shown on **Figure 2-1**. Survey sites were distributed as evenly as possible across the Project area to maximise coverage of potential wind turbine locations. Given the large extent of the Project area and the ruggedness of the terrain, vantage-point surveys (VPS) were prioritised over standard point count surveys to maximise the observer's field of view across the Project area. Impact site VPS were located at the highest point in the landscape, with a viewshed radius of up to 1 km, depending on visibility. Control sites were located at least 1.5 km from proposed turbine locations, outside the wind farm development footprint and in areas of similar habitat.

Table 2-2 provides a description of the habitats associated with each survey point. Survey points were located to be representative of the habitat types found in the Project area. These predominantly comprise open eucalypt woodland (84 %) with some rocky pavements, riparian corridors and small isolated patches of notophyll vine forest.

Table 2-2 BUS Locations

Survey Site	Habitat Description	Photo	Turbine Locations within 1 km of the VPS and with Unhindered Line-of-sight
VPS1	Open woodland on an igneous hill with *Eucalyptus crebra* and *Corymbia intermedia* co-dominant, and an understorey comprising *Themada triandra* and *Lomandra longifolia*.		3, 4, 5 and 6
VPS2	Non-remnant (existing powerline easement) but with open Eucalypt woodland (*Eucalyptus portuensis* and *E. crebra* co-dominant) on either side.		95

Survey Site	Habitat Description	Photo	Turbine Locations within 1 km of the VPS and with Unhindered Line-of-sight
VPS3	Open Eucalypt woodland with *Eucalyptus portuensis, C. intermedia* and *E. crebra*.		43 and 44
VPS4	Open Eucalypt woodland comprising *Eucalyptus reducta* with *E. portuensis* and *Corymbia intermedia* on shallow granitic and rhyolitic soils.		35 and 36
VPS5	Non-remnant (existing powerline easement) but with *Corymbia intermedia* woodland with *Syncarpia glomulifera* on either side.		
VPS6	Non-remnant (existing powerline easement) but with *Corymbia intermedia / Eucalyptus resinifera* woodland with *Syncarpia glomulifera* on either side.		

Survey Site	Habitat Description	Photo	Turbine Locations within 1 km of the VPS and with Unhindered Line-of-sight
VPS7	Open Eucalypt woodland of *Corymbia citriodora* and *Eucalyptus portuensis* adjacent to the existing powerline easement (which is non remnant).		
VPS8	Non-remnant (existing powerline easement) but with mixed woodland to open forest of *Eucalyptus crebra*, *Corymbia clarksoniana* and *C. citriodora* on a tertiary plateau to either side.		
VPS9	Open Eucalypt woodland with *Eucalyptus portuensis* and *Corymbia citriodora* on granite uplands.		30 and 31
VPS10	Open Eucalypt woodland of *Eucalyptus crebra* and *Corymbia citriodora*, with *Themada triandra* in the understorey		75

Survey Site	Habitat Description	Photo	Turbine Locations within 1 km of the VPS and with Unhindered Line-of-sight
VPS11	Exposed granite and rhyolite rock outcrop with recently burned *Lophostemon confertus* shrubland		47 and 48
VPS12	Non remnant (cleared pasture).		57
VPS13	Open Eucalypt woodland on igneous hills.		21
VPS14	Non-remnant (existing powerline easement) but with open Eucalypt woodland (*Eucalyptus portuensis*, *Corymbia citriodora* and an understorey of *Themada triandra*) on either side.		90 and 91

Survey Site	Habitat Description	Photo	Turbine Locations within 1 km of the VPS and with Unhindered Line-of-sight
VPS15	Open Eucalypt woodland on igneous hills		
VPS16	Open Eucalypt woodland of *Eucalyptus portuensis* and *Corymbia abergiana*, with an understorey of *Themada triandra* and *Xanthorrhoea johnsonii*		77
VPS17	Low *Lophostemon confertus* shrubland on exposed granite and rhyolite.		12, 13 and 14
C1	Rocky pavement shrub complex with dominant *Lophostemon confertus* and *Xanthorrhoea johnsonii* in the understorey.		n/a control site on the north-western boundary of the Project area

Survey Site	Habitat Description	Photo	Turbine Locations within 1 km of the VPS and with Unhindered Line-of-sight
C2	*Lophostemon confertus* low to medium closed forest on exposed rocky slopes, with silver *Coleus* in the understorey.		n/a control site located in the north-eastern part of the Project area
C3	Non-remnant (existing powerline easement) but with open *Corymbia intermedia* woodland with *Allocasuarina littoralis* on either side.		n/a control site located outside the Project area, to the east
C4	Low woodland of *Eucalyptus portuensis, Corymbia intermedia, C. citriodora* and *E. crebra*.		n/a control site located on the south-western boundary of the Project area

Figure 2-1 BBUS Locations

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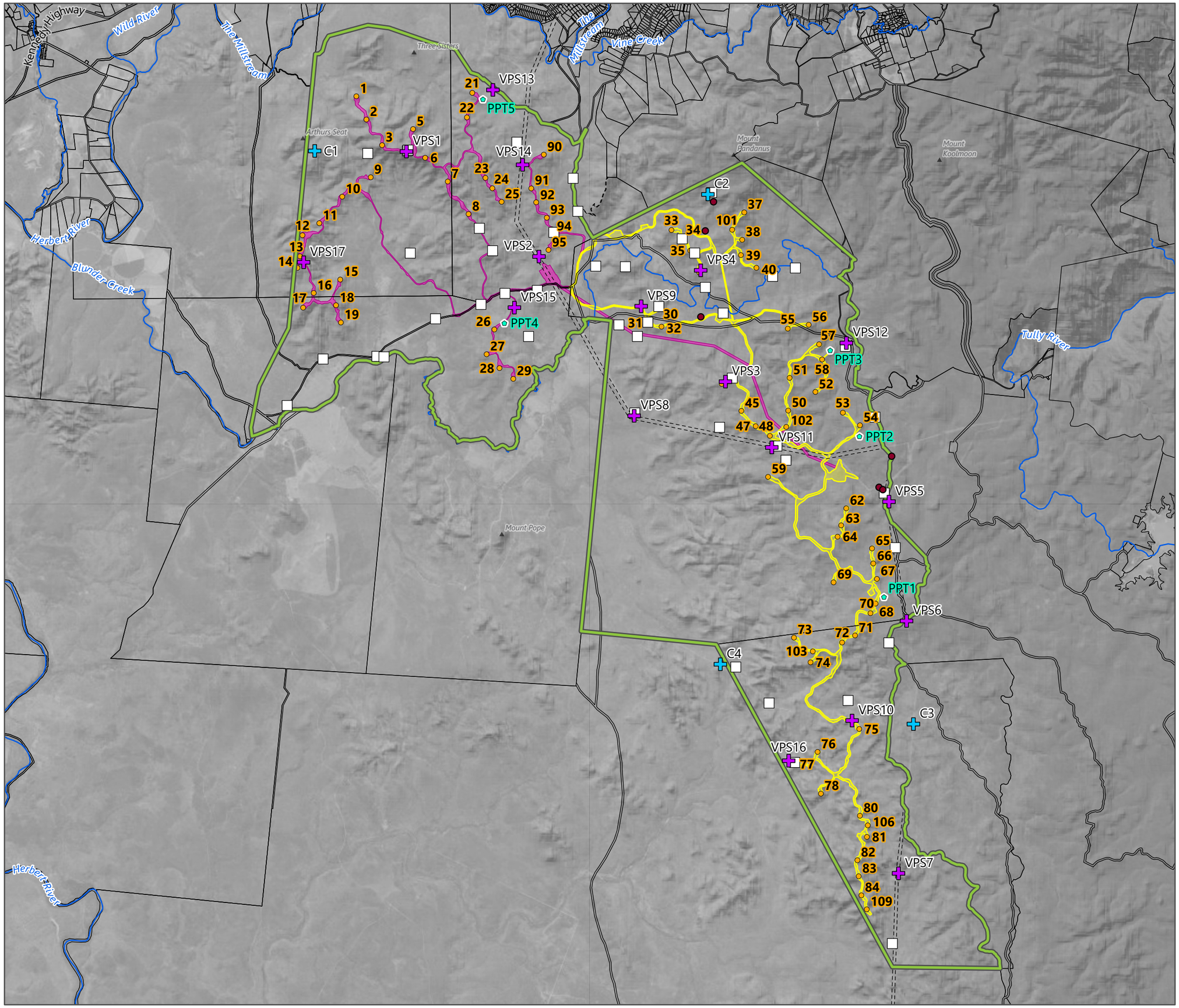

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Bird and Bat Survey Sites

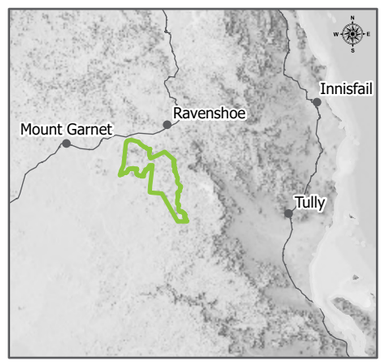
Figure 2.1

- Project Area Boundary
- Turbine
- Met-mast

Clearance Envelope
- Stage 1
- Stage 2

Bird Utilisation Survey Site
- Control Site
- Impact Site
- Harp trap
- Anabat Site
- Watercourse
- Lot Boundary
- Easement

Date: 2/03/2023 Author: TOD
Project: EPU-004 Reviewed: NOD



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Data Source(s):
Digital Cadastral Database - Department of Resources (2022)
Earthstar Geographics, © State of Queensland (Department of Resources) 2022

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2.2.3 Fixed Point Bird Counts

Timed fixed-point bird counts were conducted for 20 minutes at each survey site, repeated twice (morning before 10am and afternoon after 3pm). A spotting scope with a variable, 25x to 50x magnification was used to maximise bird detection and identification. This resulted in a survey effort of 1,680 minutes or 28 person-hours per survey event.

During each survey the following information was recorded:

- Survey site number;
- Date;
- Start and end time of the observation period;
- Species or best possible identification;
- Number of individuals recorded;
- Distance from plot centre when first observed;
- Closest distance;
- Height above ground (per the bands defined below);
- Behavioural activity (i.e. aerial pursuit of prey, ground searching, ambush predation, soaring, etc.);
- Habitat; and
- Flight path.

Bird activity was stratified into height bands to accommodate the RSA for the turbines, which has provisionally been identified as between 40 m and 265 m. Flight heights were listed as:

- Below RSA: any height between 0 m to 40 m above the ground;
- Within RSA: any height between 40 m and 265 m above the ground; or
- Above RSA: any height > 265 m above the ground.

2.2.4 Survey Schedule

Scheduling ensured that all points were visited equally at different times of day to allow for diurnal differences in bird movements and activity. During each survey event, each location was surveyed twice, once in the morning and once in the afternoon. An example survey schedule from the October BUS is provided in **Table 2-3**.

Table 2-3 Example Survey Schedule from October 2021 BUS

Survey Site	Date of Morning Survey	Date of Afternoon Survey
VPS1	October 7	October 8
VPS2	October 6	October 6
VPS3	October 15	October 10

Survey Site	Date of Morning Survey	Date of Afternoon Survey
VPS4	October 9	October 10
VPS5	October 13	October 12
VPS6	October 13	October 12
VPS7	October 12	October 13
VPS8	October 8	October 9
VPS9	October 8	October 7
VPS10	October 11	October 13
VPS11	October 15	October 16
VPS12	October 15	October 16
VPS13	October 6	October 6
VPS14	October 6	October 6
VPS15	October 6	October 5
VPS16	October 10	October 11
VPS17	October 14	October 14
C1	October 7	October 8
C2	October 9	October 17
C3	October 12	October 13
C4	October 10	October 11

2.2.5 Incidental Observations

In addition to the observations during fixed-point counts, incidental observations of birds of interest (listed threatened and migratory species, raptors and waterbirds) were made whilst travelling throughout the Project area. Emphasis was placed on observing birds that were moving through the landscape at RSA height.

2.2.6 Data Analysis

Data analysis was conducted in R version 4.2.1. (R Core Team 2022). Species accumulation curves were made using the specaccum() function from the Vegan Package (Oksanen et al 2022).

2.3 Bat Surveys

2.3.1 Harp Traps

During the dry season surveys (June 2021), harp traps were set in seven locations in flyways, at water sources (e.g. dams and creeks) and in forest openings. Traps were deployed for three nights at each of the survey locations (see **Table 2-3**).

2.3.2 Passive Acoustic Detection

Microbats rely on echolocation for orientation and foraging, and though the calls of almost all species are outside the range of human hearing, they can be detected by a bat detector. Anabat Swift detectors were installed along potential flyways (e.g. along an animal track or adjacent to a waterway) and set to record bat calls between dusk and dawn each night. During the wet season (January 2021), six Anabats were deployed at five locations each, while six Anabats were deployed at three locations each during the dry season (June 2021). Anabats were set to record for two consecutive nights at each location.

Anabats were also deployed during the April, August and November 2022 surveys at the BBUS locations listed in **Table 2-4**. Again, anabats were set to record for two consecutive nights before relocation.

Table 2-4 Anabat Deployment

April 2022	August 2022	November 2022
C1	C1	C1
C2	C2	C4
C4	C4	VPS1
VPS1	VPS1	VPS4
VPS2	VPS2	VPS6
VPS3	VPS3	VPS8
VPS4	VPS4	VPS10
VPS6	VPS6	VPS12
VPS7	VPS7	VPS15
VPS8	VPS8	VPS16
VPS10	VPS10	
VPS12	VPS11	
VPS15	VPS12	
VPS16	VPS15	

April 2022	August 2022	November 2022
	VPS16	

In total, 111 survey nights at 48 locations were achieved using the Anabats and over 100,156 files were recorded. The resulting library of recorded calls was then processed by an experienced technician and identified to species level where possible.

2.3.2.1 Bat Call Analysis

Recorded calls were processed using Anabat Insight (Version 2.0.2) software. The identification of calls was undertaken with reference to Reinhold et al. (2001) and Pennay et al. (2004) and through the comparison of recorded reference calls from North Queensland. Calls were identified to species level where possible.

Initial analysis involved review of all sequences with search phase calls analysed in more detail. Any sequence with less than three pulses were not analysed and were assigned to 'unknown'. Any calls with overlapping call frequencies and similar shape of plotted calls were assigned to species groups due to these being particularly difficult to differentiate using bat call analysis.

Where calls were identified that passed the above preliminary criteria, each call sequence ('pass') was assigned to one of five categories, according to the confidence with which an identification could be made:

- **Definite** - Pass identified to species level and could not be confused with another species. Where cluster analysis identifies that call attributes are within 95% confidence interval of documented species parameters.
- **Probable** - Pass identified to species level and there is a low chance of confusion with another species. Where cluster analysis identifies that species call attributes are within 80% to 95% confidence interval of documented species parameters.
- **Possible** - Pass identified to species level but short duration or poor quality of the pass increases the chance of confusion with another species. Cluster analysis identifies that species call attributes are within below 80% but greater than 60% of documented species call parameters.
- **Species group** - Pass could not be identified to species level but could belong to one of two or more species. Occurs more frequently when passes are short or of poor quality.
- **Unknown** - Either background 'noise' files or passes by bats which are too short and/or of poor quality to confidently identify.

In order to differentiate species calls, call shape characteristics were assessed based on different shaped 'pulses', and various dichotomous keys were used to develop filters and a decision tree within Anabat Insight to assist in the call identification analysis.

3.0 Results

3.1 Site Characterisation

The Project area is located on the southern edge of the Atherton Tablelands, a fertile plateau forming part of the northern extent of the Great Dividing Range in Queensland. The Project area is defined by a taller series of hills forming ridgelines, connected by numerous saddles or knolls, that extend along the eastern and northern boundaries of the Project area. The majority of the hills are associated with emergent granite formations rising to approximately 990 m AHD in the north, with the alluvial plains in the south being the lowest point within the Project area at approximately 671 m AHD. The proposed wind turbine locations are predominantly situated on the eastern and northern ridgelines, with elevations ranging from 730 m to 990 m.

The higher hills and ranges within the landscape are predominantly granite and occasionally rhyolite formations associated with Land Zone 12. Soils within this land zone are mainly tenosols on steeper slopes with chromosols and sodosols on lower slopes and gently undulating areas. The Project's proposed wind turbines are exclusively located on these formations.

The Project area is located along the boundary between the Wet Tropics bioregion (to the east) and the Einasleigh Uplands bioregion (to the west). Vegetation within the Project area is generally of remnant status and dominated by various communities associated with woodlands or open forests.

Blunder Creek is the largest waterway to traverse the Project area with a catchment of 142 km^2 and is semi-perennial. It flows east to west across the Project area before joining the Herbert River approximately 9 km to the west. Other waterways include creeks with a soft substrate bottom, and rocky gullies with distinct water holes and densely vegetated riparian vegetation. These waterways exhibit seasonal and episodic inundation as is typical for the region. A number of small farm dams also occur within the Project area. There are two small ephemeral wetland areas in the lower parts of the Project area, and a larger wetland (referred to as the General Plains swamp) approximately 3 km to the west, within a neighbouring property.

Figure 3-1 illustrates the site characterisation of the Project area, in terms of topographical features, habitat types and nearby conservation estate.

Results of the desktop analysis and field surveys completed to date (**Table 3-1**) found 22 listed threatened and/or migratory species known, likely to or with potential to occur within the Project area, based on the outputs of the desktop assessment and the various field surveys undertaken to date.

Table 3-1 Likelihood of Occurrence of Listed Threatened and/or Migratory Species

Species Name	EPBC Act Status	NC Act Status	Habitat and Ecology	Likelihood of Occurrence
Actitis hypoleucos, common sandpiper	Wetlands migratory, marine	SLC	The species utilises coastal and inland wetlands and is found amongst muddy margins or rocky shores associated with mangroves, estuaries and deltas of streams, and upstream banks including lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally jetties and piers (Geering et al. 2007; Higgins and Davies 1996).	**Potential to occur** The species was last recorded within the Study area (ALA) in 1979 (ALA) and was not observed during field surveys. There is limited potential habitat for the species within the Project area.

Species Name	EPBC Act Status	NC Act Status	Habitat and Ecology	Likelihood of Occurrence
			Roosting and foraging occur mostly amongst mangroves; however, the species has been found to roost and feed in adjoining grasslands (Higgins and Davies 1996).	
Apus pacificus, fork-tailed swift	Marine migratory, marine	SLC	The species is a non-breeding visitor to all states and territories in Australia (Higgins 1999) with records in north-east Queensland from near Cooktown to Townsville. The species mostly occurs over inland plains but sometimes above foothills, settled areas, treeless grasslands, above rainforests, wet sclerophyll forest, open forest or plantations of pines (Higgins 1999, BirdLife International 2019d), or in coastal areas over cliffs and beaches. The species exhibits foraging and movement that is completely aerial, with heights from 1-300 m above ground (SPRAT 2021).	**Known to occur** The species was recorded within the Project area in small numbers during the diurnal bird surveys in January 2021 and during the April 2022 BUS.
Calidris acuminata, sharp-tailed sandpiper	Migratory, marine	SLC	The species utilises muddy edges of shallow fresh or brackish wetlands with inundated or emergent sedges, grass, saltmarsh and other low vegetation. These include lagoons, swamps, lakes and pools near the coast, dams, waterholes, soaks, bore drains and swamps, saltpans and hypersaline salt-lakes inland, intertidal mudflats in sheltered bays, inlets, estuaries or seashores (SPRAT 2021). The species forages amongst inundated vegetation within wetlands or intertidal mudflats, whilst roosting occurs in mangroves (Minton and Whitelaw 2000), in vegetation at the edges of wetlands, sandy beaches and stony shores (Higgins and Davies 1996).	**Potential to occur** The species has been historically recorded within the Study area, with the most recent sighting being approximately 3.5 km west of the Project area in the General Plains swamp area in 2015 (ALA). The species was not observed in field surveys and minimal habitat may be present in the Project area.

Species Name	EPBC Act Status	NC Act Status	Habitat and Ecology	Likelihood of Occurrence
Calidris ferruginea, curlew sandpiper	CE, migratory, marine	CR	The curlew sandpiper is a visiting migrant during Australian summer, congregating at sheltered intertidal mudflats and at the muddy margins of terrestrial wetlands. It mainly occurs on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. It may also be recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand (SPRAT).	**Potential to occur** The species has not been recorded within the Study area (Wildnet or ALA) and it was not observed on site. There is minimal, marginal habitat within the Project area.
Calidris melanotos, pectoral sandpiper	Wetlands migratory, marine	SLC	The species prefers shallow, fresh to saline wetlands that have open fringing mudflats and low, emergent or fringing vegetation and is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands (SPRAT 2021).	**Potential to occur** The species has not previously been recorded within the Study area (ALA) and was not observed during field surveys. There is limited suitable habitat for the species.
Casuarius casuarius johnsonii, southern cassowary – southern population	E	E	The southern cassowary primarily occurs in rainforests associated vegetation but also uses woodlands, melaleuca swamps, mangroves and beaches for intermittent foraging. It requires a high diversity of fruiting trees to provide year-round supply of fleshy fruit and access to freshwater multiple times a day. Its core habitat is the coastal lowlands between Ingham and Mossman, as well as uplands in the southern Atherton tablelands (Latch 2007). Appendix 2 of the Recovery Plan lists REs that are considered Essential Habitat for the species (Latch 2007).	**Likely to occur** There are recent records of southern cassowary within the Study area (Wildnet) but not the Project area, with the most recent dating from 2020 (ALA). The species was not observed during the field surveys. There are small, isolated patches of two vegetation communities listed as Essential Habitat for the southern cassowary within the Project area (RE 7.3.8 and RE 7.8.7). The Project will not result in any clearing of these vegetation patches.

Species Name	EPBC Act Status	NC Act Status	Habitat and Ecology	Likelihood of Occurrence
Cuculus optatus, Oriental cuckoo	Migratory	SLC	The species has been recorded in conifer and mixed forests, riparian shrub thickets, forest bogs, burned-out and clear-cut areas at the final stages of overgrowing (BirdLife International 2019c).	**Potential to occur** The species has not previously been recorded within the Study area (Wildnet or ALA) and was not observed during field surveys.
Cyclopsitta diophthalma macleayana, Macleay's fig-parrot	-	V	This species frequents rainforests, gallery forests and adjacent open forests up to 750 m above sea level. During the breeding season, territories are centred around feeding trees (*Ficus spp.*) whilst communal roosts are used outside of breeding season (Forshaw 1992).	**Potential to occur** The species has been recorded within the Study area, within the Tully Falls and Koombooloomba National Parks to the east of the Project area. The most recent of these records dates from 1995 (ALA). The species has not been previously recorded within the Project area and was not observed during field surveys. There is minimal suitable habitat within the Project area and none of its preferred feeding trees were recorded during the botanical surveys.
Erythrotriorchis radiatus, red goshawk	V	E	The red goshawk is endemic to Australia. It occurs in a patchy, widespread distribution across coastal and sub-coastal regions of northern and eastern Australia. The species inhabits biodiverse, extensive, multi-species mosaics of mostly Eucalypt-dominated open forests and woodlands, in permanently watered, varied terrain. Its present association with rugged terrain may be an artefact of past patterns of habitat clearance, an interpretation supported by the pattern of early records (Czechura et al. 2010). Nests are restricted to trees that are taller than 20 m (mean height = 31 m, DERM 2012) and within 1 km of a watercourse or wetland (TSSC 2015b). Pairs are believed to remain within the nesting territory all year but may expand their home range	**Likely to occur** The species was known to nest historically on the Bush Heritage property 'Yourka' immediately to the south of the Project area, with the last recorded sighting in ALA dating from 2007. The Project area supports foraging and potential breeding habitat for the species. Targeted searches have been undertaken for nesting and foraging individuals, and no red goshawks have been recorded to date. A potential nest (unoccupied) was recorded during the diurnal bird surveys in January 2021, after the end of the nesting season. Targeted surveys for the red goshawk undertaken in optimal conditions during October 2021 and in December 2022 found no evidence of red goshawks using the previously identified nest (which appeared disused by any bird species), nor were any other

Species Name	EPBC Act Status	NC Act Status	Habitat and Ecology	Likelihood of Occurrence
			when not breeding (SPRAT 2021; TSSC 2015b).	potential nests identified within the Project area.
Gallinago hardwickii, Latham's snipe	Migratory, marine	SLC	The species occurs in permanent and ephemeral wetlands at altitudes up to 2000 m above sea level. The species preferred habitat includes open, freshwater wetlands with low, dense vegetation (swamps, flooded grasslands or heathlands, bogs) or habitat with saline or brackish water during migration and have been found in modified or artificial habitats close to human activity. Foraging and roosting habitat are characterised by areas of mud exposed or beneath shallow water with low, dense vegetation. The species is highly dispersive, moving in response to rainfall and availability of food (SPRAT 2021).	**Potential to occur** The species has been previously recorded within the Study area, in the General Plain wetland to the west of the Project area, in 2014 and 2015 (ALA). There is minimal suitable habitat within the Project area.
Hirundapus caudacutus, white-throated needletail	V, marine	V	The white-throated needletail is widespread in eastern and south-eastern Australia. It is recorded in all coastal regions of Queensland, extending inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains (SPRAT 2021). The species breeds in northern Asia and spends the non-breeding season (typically October – March inclusive) in Australia where it is almost exclusively aerial, occurring from heights of less than 1 m up to more than 1,000 m above the ground. The white-throated needletail occurs over most types of habitat, including cleared areas, but is most often recorded above wooded areas (SPRAT 2021).	**Known to occur** There are a number of historical records of white-throated needletail within the Study area, to the north, south and east of the Project area (ALA). One white-throated needletail was observed during the March 2021 field surveys, deceased apparently due to collision with the existing transmission line. Fifty individuals have been observed during the BBUS, typically as individuals or in small groups.
Hirundo rustica, barn swallow	Migratory, marine	SLC	The species occurs from sea level up to 3000 m above sea level and has been recorded in open country	**Potential to occur** The species has not previously been recorded within the Study area

Species Name	EPBC Act Status	NC Act Status	Habitat and Ecology	Likelihood of Occurrence
			in coastal lowlands, near water, towns and cities, and also in or over freshwater wetlands, paperbark *Melaleuca* woodland, mesophyll shrub thickets and tussock grasslands (Schodde and Mason 1999). The species prefers areas with accessible artificial structures such as barns, sheds and bridges for nesting and overhead wires or bare branches and twigs for perching, sunning and preening (Cramp 1988; Turner and Rose 1989).	(Wildnet or ALA) and was not observed during field surveys. However, there is suitable habitat for the species.
Monarcha melanopsis, black-faced monarch	Migratory, marine	SLC	The species is restricted to far northern Queensland, being a summer breeding migrant from New Guinea. The species is predominantly found in rainforests, eucalypt woodlands, coastal scrub and damp gullies, but may be found in more open woodland when migrating (BirdLife International 2016a).	**Known to occur** Recorded within the Project area during the diurnal bird surveys in January 2021.
Monarcha trivirgatus, syn *Symposiachrus trivigatus*, spectacled monarch	Migratory, marine	SLC	The species inhabits dense rainforests and moist eucalypt forests of eastern and north-eastern Australia, including waterside vegetation and mangroves (BirdLife International 2017a).	**Known to occur** The species has been previously recorded within the Project area in 1995 (ALA) and more recently (2012) within the broader Study area. It was recorded within the Project area during the October 2021 BUS.
Motacilla cinerea, grey wagtail	Migratory, marine	SLC	The species inhabits fast-flowing mountain streams and rivers with exposed rocks and shoals, often in forested areas, but is also found in lowland watercourses and canals where artificial waterfalls, weirs, millraces or lock gates are present. Species preferred habitat during non-breeding season includes farmyards, sewage farms, forest tracks, tea estates and town centres. Breeding habitat includes rock ledges, crevices in riverbanks, ledges in walls, under bridges or in	**Potential to occur** The species has not previously been recorded within the Study area (Wildnet or ALA) and was not observed during field surveys. However, there is suitable habitat for the species.

Species Name	EPBC Act Status	NC Act Status	Habitat and Ecology	Likelihood of Occurrence
			drainpipes (BirdLife International 2017b).	
Motacilla flava, yellow wagtail	Migratory, marine	SLC	The species occurs in damp or wet habitats with low vegetation including damp meadows, marshes, waterside pastures, sewage farms and bogs to damp steppe and grassy tundra (BirdLife International 2019a).	**Potential to occur** The species has not previously been recorded within the Study area (Wildnet or ALA) and was not observed during field surveys. However, there is suitable habitat for the species.
Myiagra cyanoleuca, satin flycatcher	Migratory, marine	SLC	The species inhabits heavily vegetated gullies in eucalypt-dominated forests and taller woodlands near wetlands or watercourses, and coastal forests, woodlands, mangroves, dry open woodland with grassy ground cover during migration (BirdLife International 2017c). The species is mostly absent from rainforests (SPRAT 2021).	**Known to occur** There is one historical record dating from 1981 of the species in the north-eastern corner of the broader Study area (ALA). It was recorded within the Project area during the October 2021 BUS.
Pandion haliaetus, osprey	Migratory, marine	SLC	The species inhabits a wide range of habitats that are within 3-5 km of water bodies including salt marsh, mangrove swamp, cypress swamp, lake, bog, reservoirs or rivers that are abundant with fish (del Hoyo et al. 1994; BirdLife International 2019b). Nesting habitat includes large dead trees on cliffs but also include artificial platforms such as power poles, communication towers and buildings which have been found to have more successful fledging during breeding (del Hoyo et al. 1994; BirdLife International 2019b).	**Potential to occur** There is a single record of the species dating from 2004 at the north-eastern extent of the Study area (ALA). It was not observed in field surveys and there is limited potential habitat within the Project area.
Rhipidura rufifrons, rufous fantail	Migratory, marine	SLC	The species inhabits dense, shady undergrowth of gullies in moist eucalypt forests and rainforests. The species prefers habitat with deep shading and is often seen close to the ground. The species may be found in more open habitats during migration (SPRAT).	**Known to occur** The species has previously been recorded on the boundary of the Project area with the Wet Tropics WHA, in 1995 (ALA). One individual was recorded on camera trap during the field surveys.

Species Name	EPBC Act Status	NC Act Status	Habitat and Ecology	Likelihood of Occurrence
Rostratula australis, Australian painted snipe	E, marine	E	The Australian painted snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire (SPRAT 2021)	**Potential to occur** There are no known historical records within the Study area (ALA) and the species was not observed during field surveys. There is only limited potential habitat available within the Project area.
Tringa nebularia, common greenshank	Migratory, marine	SLC	The species occurs in sheltered coastal habitats typically with large mudflats, saltmarshes, mangroves, or seagrass with fringing or emergent vegetation. These include embayments, harbours, river estuaries, deltas and lagoons, ephemeral and permanent wetlands such as swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and saltflats. The species has also been found in artificial wetlands (BirdLife International 2016b).	**Potential to occur** There is a single record of the species within the Study area, at the General Plains wetlands dating from 2015 (ALA). It was not observed during field surveys and there is minimal potential habitat within the Project area.
Tyto novaehollandiae Kimberli, masked owl	V	V	The masked owl is native to Australia, Indonesia and Papua New Guinea (BirdLife International 2018). The distribution of the masked owl (northern) within Australia is poorly known, and three subpopulations have been suggested: Kimberley, Northern Territory and Cape York (SPRAT 2021). In Queensland it occurs along the southern rim of the Gulf of Carpentaria, Cape York Peninsula and south to Atherton Tablelands and the Einasleigh-Burdekin divide (SPRAT 2021). The masked owl (northern) has been recorded from riparian forest, open forest, *Melaleuca* swamps and the edges of mangroves, as well as the edges of sugar cane fields	**Known to occur** There are a number of historical records of masked owl within the Study area, to the north and south of the Project area (ALA). During the January 2021 surveys masked owl was recorded vocalising at two locations on the Glen Gordon property; on multiple occasions alongside Blunder Creek (within riparian vegetation dominated by *Eucalyptus tereticornis* and *Casuarina cunninghamiana*) and once within mixed Eucalypt woodland dominated by *Corymbia intermedia, E. resinifera* and *E. portuensis*.

Species Name	EPBC Act Status	NC Act Status	Habitat and Ecology	Likelihood of Occurrence
			(SPRAT 2021). It requires large old-growth trees with large hollows for nesting (SPRAT 2021). It usually nests in patches of closed forest and feeds largely on small to medium sized terrestrial mammals. The subspecies probably breeds in March-October and nests are 7-8 km apart (SPRAT 2021). It is sedentary and territorial (SPRAT 2021).	

ARK ENERGY

Attexo

Chalumbin Wind Farm

Site Characterisation

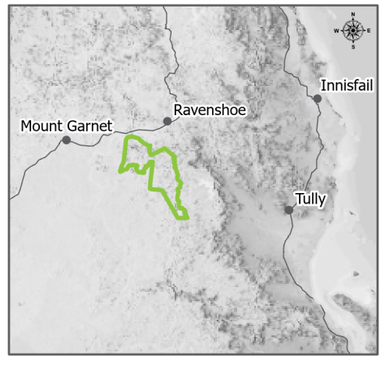
Figure 3.1

- Project Boundary
- Turbine Site

Clearance Envelope
- Stage 1
- Stage 2

Broad Habitat Type
- Habitat 1 - Open eucalypt woodland
- Habitat 2 - Riparian habitat
- Habitat 3 - Low Lophostemon and Acacia shrubland on exposed rocky substrates
- Habitat 4 - Notophyll vine forest
- Habitat 5 - Non-remnant
- Watercourse
- Lot Type Parcel
- Easement

Date: 17/10/2022 Reviewed: NOD
Author: TOD Project: EPU-004



0 1 2 3 4 5 Km

Scale: 1:125,000@A3

Data Source(s):
Digital Cadastral Database - Department of Resources (2021)
© State of Queensland (Department of Resources) 2022, Department of Resources, Dept.of Environment and Science, Esri, HERE, Garmin, Foursquare, METI/NASA, USGS, Esri, Geoscience Australia, NASA, NGA, USGS

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3.2 Bird Field Survey Results

3.2.1 Survey Suitability

The cumulative number of species observed from all surveys is 108 from a total of 250 observational periods. The species accumulation curve (**Figure 3-2**) shows that whilst new species are still being recorded, the number of new species is levelling off. Future surveys are discussed in **Section 4.0**. The species accumulation curve will be updated following subsequent survey events, to demonstrate the adequacy of the overall BBUS programme.

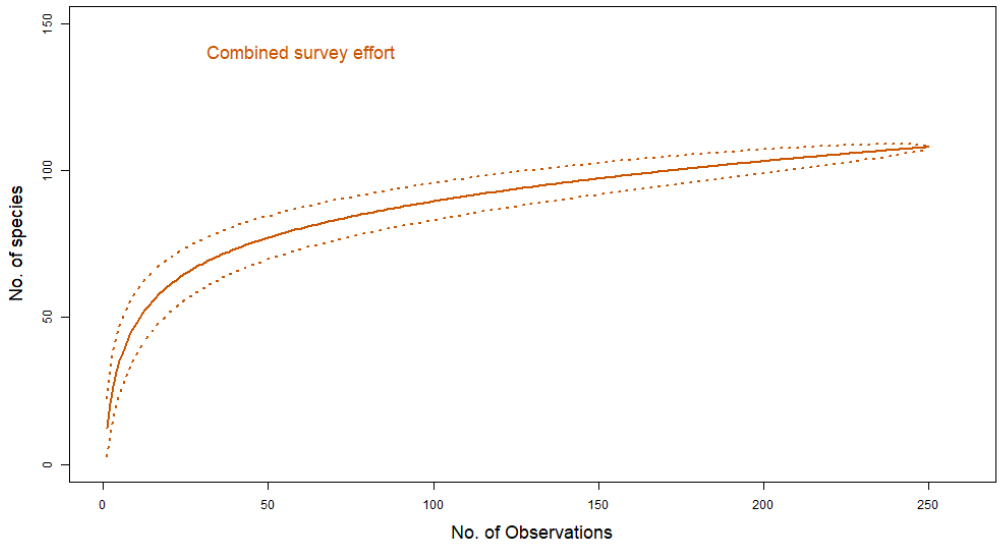

Figure 3-2 Species Accumulative Curve[1]

3.2.2 Species and Abundance

A total of 108 bird species have been recorded during the six BUS undertaken to date (June 2021, October 2021, January 2022, April 2022, August 2022 and November 2022); this rises to 147 species when incidental observations across all surveys are also included. A full species list is provided in **Appendix A** . Species recorded were lorikeets and honeyeaters, followed by songbirds.

Species richness was lowest in the June 2021 survey (53 species) and April 2022 surveys (54 species) compared with the November 2022 (74 species) and August 2022 surveys (70 species). The most frequently recorded species recorded in each survey are summarised in **Table 3-4**, the most abundant species was the rainbow lorikeet.

Total abundance was highest in the April 2022 surveys (2,285 birds) and August 2022 surveys (2,141 birds) followed by the November 2022 surveys (1,872 birds); the number of birds recorded during the October 2021 surveys and January 2022 was comparable (1,078 birds and 1,049 birds, respectively) and lowest abundance recorded in the June 2021 surveys (795 birds). Bird abundance in April 2022 and August 2022 is significantly higher than previous surveys. The most abundantly recorded species (**Table 3-4**) comprised nearly 27 % of all birds recorded.

[1] Species accumulation curve for survey efforts from June 2021, October 2021, January 2022, April 2022, August 2022 and November 2022. The total sample size for all surveys (n) is 250 fixed point bird counts, and the total number of species observed is 108. Accounting for rare species, if sampling continues might see ~117 +/- 2 SEs

Table 3-2 Summary of Birds across all Surveys

Survey time	June 2021	October 2021	January 2022	April 2022	August 2022	November 2022
Total abundance	795	1,078	1,049	2,285	2,141	1,872
Species richness	53	58	66	54	70	74
Number of new species recorded for the Project area (compared to all previous records)	53	17	11	8	15	6
Most abundant species	Rainbow lorikeet (133) Brown honeyeater (99) Noisy friarbird (63) Sulphur-crested cockatoo (50) Yellow-faced honeyeater (40)	Rainbow lorikeet (182) Australian swiftlet (112) Rainbow bee-eater (87) Sulphur-crested cockatoo (85) Scarlet honeyeater (42)	Rainbow lorikeet (159) Noisy friarbird (75) Australian swiftlet (68) Weebill (59) Noisy miner (37)	Rainbow lorikeet (1436) Noisy friarbird (85) Brown honeyeater (83) Noisy miner (73) Scarlet honeyeater (52)	Rainbow lorikeet (414) Yellow-faced honeyeater (164) Scaly-breasted lorikeet (133) Brown honeyeater (118) Noisy friarbird (117)	Rainbow lorikeet (234) Australian swiftlet (226) Noisy friarbird (145) Banded honeyeater (112) Yellow-faced honeyeater (103)
Proportion of threatened and migratory species	0 %	0 %	0 %	<1 % Fork-tailed swift (3) White-throated needletail (5)	0 %	2.4 % White-throated needletail (45)

3.2.3 Flight Heights

A summary of the number of birds recorded at these different height bands across all BUS is presented in **Table 3-5**. The total number of birds observed within the RSA height was highest during the April 2022 survey, which may have been influenced by the large numbers of rainbow lorikeets observed, followed by the August 2022 and November 2022 (1452 counts, 469 counts and 357 counts respectively).

There was a total of 51 species observed flying within RSA heights across all surveys with the highest number of species recorded in the August 2022 survey (25 species), followed by the November 2022 (17 species), April 2022 (16

species) and June 2021 surveys (14 species). **Figure 3-3** shows the most abundant species flying within RSA heights across all BUS.

Table 3-3 Summary of Birds Recorded within Three Flight Height Bands

	Impact Survey Sites		Control Sites	
Flight Height	**Count**	**Percentage of Total Count**	**Count**	**Percentage of Total Count**
June 2021				
A (below RSA)	505	77 %	125	91 %
B (within RSA)	144	22 %	11	8 %
C (above RSA)	9	1 %	1	1 %
Total	658		137	
October 2021				
A (below RSA)	598	69 %	197	93 %
B (within RSA)	267	31 %	14	7 %
C (above RSA)	2	<1 %	0	
Total	867		211	
January 2022				
A (below RSA)	809	90 %	143	95 %
B (within RSA)	90	10 %	7	5 %
C (above RSA)	0		0	
Total	899		150	
April 2022				
A (below RSA)	693	33 %	140	66 %
B (within RSA)	1380	67 %	72	34 %
C (above RSA)	0			
Total	2,073		212	
August 2022				
A (below RSA)	1,391	76 %	281	88 %
B (within RSA)	431	24 %	38	12 %

	Impact Survey Sites		Control Sites	
C (above RSA)				
Total	1,822		319	
November 2022				
A (below RSA)	1,340	83 %	175	67 %
B (within RSA)	270	17 %	87	33 %
C (above RSA)	0		0	
Total	1,610		262	

During the April 2022 BUS, the increased trend for numbers of birds recorded within the RSA height is due to the large numbers of rainbow lorikeets recorded, accounting for 1,436 of the total 2,285 individuals recorded within RSA during that entire survey period.

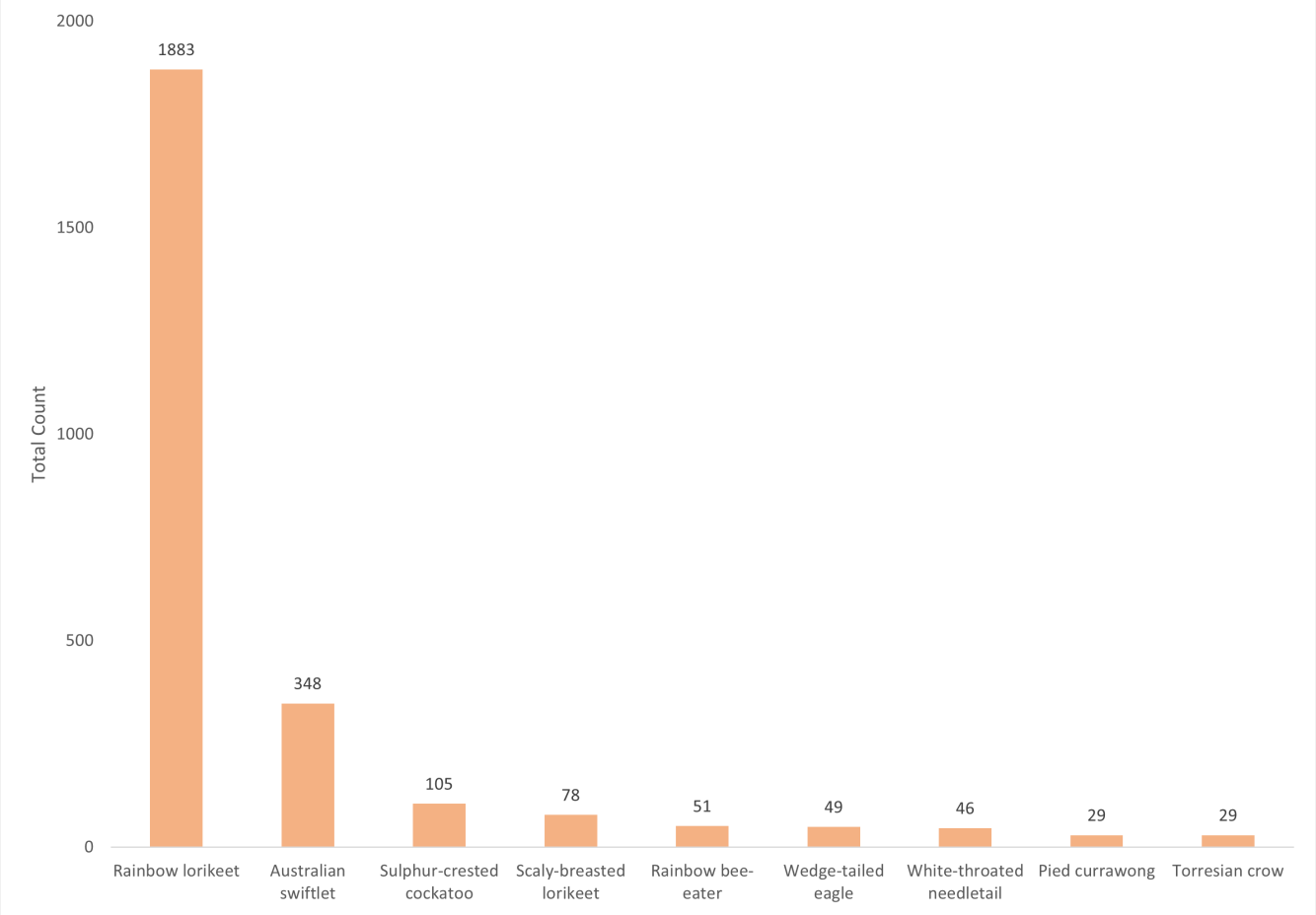

Figure 3-3 Species within RSA

3.2.4 Threatened and Migratory Species

The majority of the birds found to utilise the Project area are common, widespread species. Seven threatened and/or migratory species have been recorded during field surveys within the Project area, of which two species were observed during the BUS. These observations are described below.

3.2.4.1 White-throated Needletail

The white-throated needletail (*Hirundapus caudacutus*) is listed as Vulnerable and Migratory under the EPBC Act, and vulnerable under the NC Act. It is widespread in eastern and south-eastern Australia. It is recorded in all coastal regions of Queensland, extending inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains (SPRAT 2021). The species breeds in northern Asia and spends the non-breeding season (typically October – March inclusive) in Australia where it is almost exclusively aerial, occurring from heights of less than 1 m up to more than 1,000 m above the ground.

The white-throated needletail occurs over most types of habitat, including cleared areas, but is most often recorded above wooded areas (SPRAT 2021). One white-throated needletail was observed during the March 2021 fauna surveys. The specimen was found deceased within the existing transmission line corridor (**Plate 1**). In addition, five individuals were observed during the April 2022 BUS (one of which one was within RSA height) whilst 45 individuals (not as a single flock) were recorded during the November 2022 BUS (all of which were within RSA height).

Plate 1 White-throated needletail

3.2.4.2 Masked Owl (northern subspecies)

The northern subspecies of masked owl (*Tyto novaehollandiae Kimberli*) is listed as Vulnerable under both the EPBC Act and the NC Act. It is native to Australia, Indonesia and Papua New Guinea (BirdLife International 2018). The distribution of the masked owl (northern) within Australia is poorly known, and three subpopulations have been suggested: Kimberley, Northern Territory and Cape York (SPRAT 2021). In Queensland it occurs along the southern rim of the Gulf of Carpentaria, Cape York Peninsula and south to Atherton Tablelands and the Einasleigh-Burdekin divide (SPRAT 2021).

The masked owl (northern) has been recorded from riparian forest, open forest, *Melaleuca* swamps and the edges of mangroves, as well as the edges of sugar cane fields (SPRAT 2021). It requires large old-growth trees with large hollows for nesting (SPRAT 2021). It usually nests in patches of closed forest and feeds largely on small to medium sized terrestrial mammals. The subspecies probably breeds in March-October and nests are 7-8 km apart (SPRAT 2021). It is sedentary and territorial (SPRAT 2021).

The most likely cause of the species' decline is a shortage of food, as small and medium-sized native mammals are becoming increasingly uncommon across much of northern Australia (TSSC 2015a). The current regime of more intense, frequent and extensive fires may also reduce the availability of the large trees and hollows required for nesting (TSSC 2015a). One study has found that possums (specifically, common brushtail possums) monopolise hollows in woodland fragments at the expense of other species (TSSC 2015a).

During the January 2021 surveys masked owl was recorded vocalising at two locations on the Glen Gordon property; on multiple occasions alongside Blunder Creek (within riparian vegetation dominated by *Eucalyptus tereticornis* and *Casuarina cunninghamiana*) and once within mixed Eucalypt woodland dominated by *Corymbia intermedia, E. resinifera* and *E. portuensis*.

3.2.4.3 Fork-tailed Swift

The fork-tailed swift (*Apus pacificus*) is listed as Migratory under the EPBC Act and Special Least Concern under the NC Act. It is a non-breeding visitor to all states and territories of Australia. In Queensland, there are many coastal records of this species between Cooktown and Townsville, and they are also commonly found in drier habitat inland as far west as Longreach (SPRAT 2021). The species breeds in northern Asia and spends the non-breeding season (typically October – March inclusive) in Australia, moving further south as the summer progresses. In Australia, it is almost exclusively aerial, occurring from heights of less than 1 m up to more than 1,000 m above the ground.

One individual fork-tailed swift was recorded during the diurnal bird counts in January 2021, flying at an approximate height of 40 m. Three fork-tailed swifts were recorded within RSA height during the April 2022 BUS.

3.2.4.4 Black-faced Monarch

The black-faced monarch (*Monarcha melanopsis*) is listed as Migratory under the EPBC Act and Special Least Concern under the NC Act. It is a migratory flycatcher that is widespread in eastern Australia, including Queensland. It mainly occurs in rainforest ecosystems, including semi-deciduous vine thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll thicket, warm temperate rainforest and occasionally cool temperate rainforest (SPRAT 2021). It breeds in rainforest habitat and has been recorded breeding in the Atherton region. The species is insectivorous.

One black-faced monarch was observed during the diurnal bird surveys in January 2021.

3.2.4.5 Spectacled Monarch

The spectacled monarch (*Monarcha trivirgatus* syn. *Symposiarchus trivirgatus*) is listed as Migratory under the EPBC Act and Special Least Concern under the NC Act. The spectacled monarch is largely confined to the northeast and east coastal and near coastal regions of Australia. There are three recognised subspecies, of which *Symposiarchus t. melanorrhous* occurs from Yarraden in the north along the Queensland coast near Cairns to approximately Mackay in the south. Movements of this subspecies are not well understood although it is believed that this subspecies may migrate within this range or winter in PNG (DoE 2015). The species inhabits dense rainforests and moist eucalypt forests of eastern and north-eastern Australia, including waterside vegetation and mangroves (BirdLife International 2017b).

One spectacled monarch was observed incidentally (i.e. whilst travelling around the Project area, not during one of the timed counts) during the bird utilisation surveys in October 2021.

3.2.4.6 Satin Flycatcher

The satin flycatcher (*Myiagra cyanoleuca*) is listed as Migratory under the EPBC Act and Special Least Concern under the NC Act. The species is widespread in eastern Australia and vagrant to New Zealand. In Queensland, it is widespread but scattered in the east, mainly on passage or non-breeding periods (DoE 2015). The species inhabits heavily vegetated gullies in eucalypt-dominated forests and taller woodlands near wetlands or watercourses, and coastal forests, woodlands, mangroves, dry open woodland with grassy ground cover during migration (BirdLife International 2017a). It is mostly absent from rainforests (SPRAT 2021) although wintering birds in northern Queensland will use the rainforest-gallery forests interface (DoE 2015).

One satin flycatcher was observed incidentally during the bird utilisation surveys in October 2021.

3.2.4.7 Rufous Fantail

The rufous fantail (*Rhipidura rufifrons*) is listed as Migratory under the EPBC Act and Special Least Concern under the NC Act. It occurs in coastal and near coastal districts of northern and eastern Australia. It has breeding populations in Australia and also occurs in PNG, the Solomon Islands and Micronesia (SPRAT 2021). Some populations in east Australia are migratory, although its movement patterns are not fully understood. In the Atherton region populations possibly move altitudinally, with reporting rates above 500 m asl in the region of 37 % in summer and 0 % in winter (SPRAT 2021). The species prefers moist, dense habitats, including mangroves, rainforest, riparian forests and thickets, and wet eucalypt forests with a dense understorey (DoE 2015). When on passage a wider range of habitats are used, including dry eucalypt forests and woodlands, and Brigalow shrublands (DoE 2015).

Known threats including predation by black rats and habitat degradation caused by invasive vines such as rubber vine (DoE 2015). A rufous fantail was recorded by camera trap in April 2021 (**Plate 2**) within a small rainforest patch on a rocky drainage line, dominated by brush box (*Lophostemon confertus*).

Plate 2 Rufous fantail

3.2.5 Raptors

Ten species of raptor (diurnal bird of prey) were recorded during all of the surveys combined, all of which were recorded during the BUS as per **Table 3-6**. None of the raptor species observed are listed as threatened and/or migratory under the EPBC Act or the NC Act.

Wedge-tailed eagle was the most abundant raptor species observed. This species is known to collide with wind turbines due to its soaring flight while foraging. 78 % of wedge-tailed eagle records were within RSA height. Locally, small numbers of wedge-tailed eagles could be affected over the life of the Project; however, impacts are not anticipated to be of conservation concern as the population of this species is considered to be increasing (BirdLife International 2016c).

Table 3-4 Raptor Species Recorded During the BUS

Raptor Species	Below RSA	Within RSA	Above RSA	Total Number of Records	Flights within RSA (%)
Australian hobby	1			1	0
Black kite	1	1		2	50
Brown falcon	6	10		16	62
Brown goshawk	10	8		18	44
Collared sparrowhawk	3	2		5	40
Grey goshawk		1		1	100
Nankeen kestrel	12	5		17	29

Raptor Species	Below RSA	Within RSA	Above RSA	Total Number of Records	Flights within RSA (%)
Pacific baza	4	2		6	33
Peregrine falcon	1	2		3	67
Wedge-tailed eagle	2	49	8	59	83
Total	40	82	8	130	63

3.2.6 Waterbirds

No waterbirds were recorded during the BUS; however, the following 12 species were recorded during the January 2021 census and/or as incidental observations:

- Australasian grebe;
- Australian wood duck;
- Bush stone curlew;
- Cattle egret;
- Intermediate egret;
- Little pied cormorant;
- Masked lapwing;
- Pacific black duck;
- Plumed whistling duck;
- Straw-necked ibis;
- White-faced heron; and
- White-necked heron.

None of these species are listed as threatened and/or migratory under the EPBC Act or the NC Act. The Project area contains small farm dams and some semi-permanent watercourses that provide minimal habitat for waterbirds. Dams generally lack aquatic vegetation with banks disturbed from regular use by cattle.

3.3 Bat Field Survey Results

No threatened bat species were recorded during the surveys. A full list of bat species trapped or identified from analysis of calls recorded during surveys are listed in **Appendix A** . The following recorded microbat species are likely to fly within RSA height and hence could be at risk of collision with turbine blades (refer to Appendix G (Bird and Bat Management Plan):

- Eastern bent-wing bat (*Miniopterus schreibersii oceanensis*);
- Eastern free-tailed bat (*Mormopterus ridei*);
- Gould's wattled bat (*Chalinolobus gouldii*);;
- Northern freetail bat (*Chaerephon jobensis*);
- Northern free-tailed bat (*Mormopterus lumsdenae*);
- Troughton's sheathtail bat (*Taphozous troughtonii*);
- White-striped freetail bat (*Austronomous australis*); and
- Yellow-bellied sheathtail bat (*Saccolaimus flaviventris*).

4.0 Future Surveys

This report presents the results of the first six BBUS. The PER Guidelines require the Project to undertake seasonal BUS across two consecutive years in order to capture statistically significant data. This report will be updated with the results of future survey events.

5.0 Conclusions

Preliminary conclusions from the baseline BUS of the Chalumbin Wind Farm Project area undertaken to date are as follows:

- Species richness was lowest in the June 2021 (53 species) and April 2022 (54 species) surveys compared with the November 2022 (74 species) and August 2022 (70 species) surveys.
- Total abundance was highest in the April 2022 surveys (2,285 birds) and August 2022 surveys (2,141 birds) followed by the November 2022 surveys (1,872 birds); the number of birds recorded during the October 2021 surveys and January 2022 was comparable (1,078 birds and 1,049 birds, respectively) whilst the lowest abundance was recorded in the June 2021 surveys (795 birds).
- Flights within the RSA (40 m to 265 m) accounted for the following:
  - June 2021: 22 % of counts at impact sites and 8 % at control sites;
  - October 2021: 31 % of counts at impact sites and 7 % at control sites;
  - January 2022: 10 % of counts at impact sites and 5 % at control sites;
  - April 2022: 67 % of counts at impact sites and 34 % at control sites;
  - August 2022: 24 % of counts at impact sites and 12 % at control sites; and
  - November 2022: 17 % of counts at impact sites and 33 % at control sites.
- There were a total of 51 species observed flying within RSA heights across all surveys with the highest number of species recorded in August 2022 (25 species) survey, followed by the November 2022 (17 species), April 2022 (16 species) and June 2021 (14 species) surveys.
- The Project area supports comparatively few raptors and waterbirds, bird groups generally considered more likely to collide with operating wind turbines.
- Two threatened and/or migratory species were recorded during the BUS: white-throated needletail (48 individuals in two observations) and fork-tailed swift (three individuals in a single observation).

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Appendix A

Comprehensive Bird and Bat Species List

Family	Scientific name	Common name	NC Act	EPBC Act
Birds				
Acanthizidae	*Acanthiza reguloides*	Buff-rumped thornbill	C	
Acanthizidae	*Gerygone palpebrosa*	Fairy gerygone	C	
Acanthizidae	*Sericornis magnirostra*	Large-billed scrubwren	C	
Acanthizidae	*Smicrornis brevirostris*	Weebill	C	
Acanthizidae	*Gerygone olivacea*	White-throated gerygone	C	
Acanthizidae	*Acanthiza nana*	Yellow thornbill	C	
Acanthizidae	*Gerygone fusca*	Western gerygone	C	
Acanthizidae	*Acanthiza chrysorrhoa*	Yellow-rumped thornbill	C	
Accipitridae	*Milvus migrans*	Black kite	C	
Accipitridae	*Accipiter fasciatus*	Brown goshawk	C	
Accipitridae	*Accipiter cirrocephalus*	Collared sparrowhawk	C	
Accipitridae	*Accipiter novaehollandiae*	Grey goshawk	C	
Accipitridae	*Aviceda subcristata*	Pacific baza	C	
Accipitridae	*Aquila audax*	Wedge-tailed eagle	C	
Accipitridae	*Haliastur sphenurus*	Whistling kite	C	
Aegothelidae	*Aegotheles cristatus*	Australian owlet-nightjar	C	
Alcedinidae	*Ceyx azureus*	Azure kingfisher	C	
Anatidae	*Chenonetta jubata*	Australian wood duck	C	
Anatidae	*Anas superciliosa*	Pacific black duck	C	
Anatidae	*Dendrocygna eytoni*	Plumed whistling-duck	C	
Apodidae	*Aerodramus terraereginae*	Australian swiftlet	C	
Apodidae	*Apus pacificus*	Fork-tailed swift	SL	M
Apodidae	*Hirundapus caudacutus*	White-throated needletail	V	V
Ardeidae	*Bubulcus ibis*	Cattle egret	C	
Ardeidae	*Ardea intermedia*	Intermediate egret	C	
Ardeidae	*Egretta novaehollandiae*	White-faced heron	C	
Ardeidae	*Ardea pacifica*	White-necked heron	C	

Family	Scientific name	Common name	NC Act	EPBC Act
Artamidae	*Gymnorhina tibicen*	Australian magpie	C	
Artamidae	*Cracticus torquatus*	Grey butcherbird	C	
Artamidae	*Cracticus nigrogularis*	Pied butcherbird	C	
Artamidae	*Strepera graculina*	Pied currawong	C	
Artamidae	*Artamus leucorynchus*	White-breasted woodswallow	C	
Burhinidae	*Burhinus grallarius*	Bush stone-curlew	C	
Cacatuidae	*Calyptorhynchus banksii*	Red-tailed black-cockatoo	C	
Cacatuidae	*Cacatua galerita*	Sulphur-crested cockatoo	C	
Campephagidae	*Coracina lineata*	Barred cuckoo-shrike	C	
Campephagidae	*Coracina novaehollandiae*	Black-faced cuckoo-shrike	C	
Campephagidae	*Coracina tenuirostris*	Cicadabird	C	
Campephagidae	*Lalage leucomela*	Varied triller	C	
Campephagidae	*Coracina papuensis*	White-bellied cuckoo-shrike	C	
Caprimulgidae	*Caprimulgus macrurus*	Large-tailed nightjar	C	
Casuariidae	*Dromaius novaehollandiae*	Emu	C	
Charadriidae	*Vanellus miles*	Masked lapwing	C	
Climacteridae	*Climacteris picumnis*	Brown treecreeper	C	
Climacteridae	*Cormobates leucophaea*	White-throated tree-creeper	C	
Columbidae	*Geopelia humeralis*	Bar-shouldered dove	C	
Columbidae	*Macropygia amboinensis*	Brown cuckoo-dove	C	
Columbidae	*Phaps chalcoptera*	Common bronzewing	C	
Columbidae	*Ocyphaps lophotes*	Crested pigeon	C	
Columbidae	*Geopelia striata*	Peaceful dove	C	
Columbidae	*Geophaps scripta peninsulae*	Squatter pigeon (northern subspecies)	C	
Columbidae	*Lopholaimus antarcticus*	Topknot pigeon	C	
Coraciidae	*Eurystomus orientalis*	Dollarbird	C	
Corvidae	*Corvus coronoides*	Australian raven	C	

Family	Scientific name	Common name	NC Act	EPBC Act
Corvidae	*Corvus orru*	Torresian crow	C	
Cuculidae	*Chalcites osculans*	Black-eared cuckoo	C	
Cuculidae	*Cacomantis variolosus*	Brush cuckoo	C	
Cuculidae	*Scythrops novaehollandiae*	Channel-billed cuckoo	C	
Cuculidae	*Eudynamys orientalis*	Eastern koel	C	
Cuculidae	*Cacomantis flabelliformis*	Fan-tailed cuckoo	C	
Cuculidae	*Centropus phasianinus*	Pheasant coucal	C	
Cuculidae	*Chalcites lucidus*	Shining bronze-cuckoo	C	
Dicruridae	*Dicrurus bracteatus*	Spangled drongo	C	
Estrildidae	*Neochmia temporalis*	Red-browed finch	C	
Eurostopodidae	*Eurostopodus argus*	Spotted nightjar	C	
Eurostopodidae	*Eurostopodus mystacalis*	White-throated nightjar	C	
Falconidae	*Falco longipennis*	Australian hobby	C	
Falconidae	*Falco berigora*	Brown falcon	C	
Falconidae	*Falco cenchroides*	Nankeen kestrel	C	
Falconidae	*Falco peregrinus*	Peregrine falcon	C	
Halcyonidae	*Dacelo leachii*	Blue-winged kookaburra	C	
Halcyonidae	*Tanysiptera sylvia*	Buff-breasted paradise kingfisher	C	
Halcyonidae	*Todiramphus macleayii*	Forest kingfisher	C	
Halcyonidae	*Dacelo novaeguineae*	Laughing kookaburra	C	
Halcyonidae	*Todiramphus sanctus*	Sacred kingfisher	C	
Hirundinidae	*Petrochelidon nigricans*	Tree martin	C	
Maluridae	*Malurus melanocephalus*	Red-backed fairy-wren	C	
Megapodiidae	*Alectura lathami*	Australian brush turkey	C	
Megapodiidae	*Megapodius reinwardt*	Orange-footed scrubfowl	C	
Meliphagidae	*Cissomela pectoralis*	Banded honeyeater	C	
Meliphagidae	*Melithreptus gularis*	Black-chinned honeyeater	C	
Meliphagidae	*Entomyzon cyanotis*	Blue-faced honeyeater	C	

Family	Scientific name	Common name	NC Act	EPBC Act
Meliphagidae	*Bolemoreus frenatus*	Bridled honeyeater	C	
Meliphagidae	*Lichmera indistincta*	Brown honeyeater	C	
Meliphagidae	*Myzomela obscura*	Dusky honeyeater	C	
Meliphagidae	*Acanthorhynchus tenuirostris*	Eastern spinebill	C	
Meliphagidae	*Ptilotula fusca*	Fuscous honeyeater	C	
Meliphagidae	*Microptilotis gracilis*	Graceful honeyeater	C	
Meliphagidae	*Meliphaga lewinii*	Lewin's honeyeater	C	
Meliphagidae	*Philemon citreogularis*	Little friarbird	C	
Meliphagidae	*Philemon corniculatus*	Noisy friarbird	C	
Meliphagidae	*Manorina melanocephala*	Noisy miner	C	
Meliphagidae	*Myzomela sanguinolenta*	Scarlet honeyeater	C	
Meliphagidae	*Gavicalis virescens*	Singing honeyeater	C	
Meliphagidae	*Acanthagenys rufogularis*	Spiny-cheeked honeyeater	C	
Meliphagidae	*Melithreptus albogularis*	White-throated honeyeater	C	
Meliphagidae	*Caligavis chrysops*	Yellow-faced honeyeater	C	
Meliphagidae	*Manorina flavigula*	Yellow-throated miner	C	
Meropidae	*Merops ornatus*	Rainbow bee-eater	C	
Monarchidae	*Monarcha melanopsis*	Black-faced monarch	SL	M
Monarchidae	*Myiagra rubecula*	Leaden flycatcher	C	
Monarchidae	*Grallina cyanoleuca*	Magpie-lark	C	
Monarchidae	*Myiagra inquieta*	Restless flycatcher	C	
Monarchidae	*Myiagra cyanoleuca*	Satin flycatcher	SL	M
Monarchidae	*Monarchus trivirgatus*	Spectacled monarch	SL	M
Motacillidae	*Anthus novaeseelandiae*	Australasian pipit	C	
Nectariniidae	*Dicaeum hirundinaceum*	Mistletoebird	C	
Neosittidae	*Daphoenositta chrysoptera*	Varied sittella	C	
Oriolidae	*Sphecotheres vieilloti*	Australasian figbird	C	
Oriolidae	*Oriolus sagittatus*	Olive-backed oriole	C	

Family	Scientific name	Common name	NC Act	EPBC Act
Orthonychidae	*Orthonyx spaldingii*	Chowchilla	C	
Pachycephalidae	*Pachycephala pectoralis*	Golden whistler	C	
Pachycephalidae	*Colluricincla harmonica*	Grey shrike-thrush	C	
Pachycephalidae	*Colluricincla megarhyncha*	Little shrike-thrush	C	
Pachycephalidae	*Pachycephala rufiventris*	Rufous whistler	C	
Paradisaeidae	*Ptiloris victoriae*	Victoria's riflebird	C	
Pardalotidae	*Pardalotus punctatus*	Spotted pardalote	C	
Pardalotidae	*Pardalotus striatus*	Striated pardalote	C	
Petroicidae	*Eopsaltria australis*	Eastern yellow robin	C	
Petroicidae	*Heteromyias cinereifrons*	Grey-headed robin	C	
Petroicidae	*Microeca fascinans*	Jacky winter	C	
Petroicidae	*Poecilodryas superciliosa*	White-browed robin	C	
Phalacrocoracidae	*Microcarbo melanoleucos*	Little pied cormorant	C	
Podargidae	*Podargus strigoides*	Tawny frogmouth	C	
Podicipedidae	*Tachybaptus novaehollandiae*	Australasian grebe	C	
Pomatostomidae	*Pomatostomus temporalis*	Grey-crowned babbler	C	
Psittacidae	*Platycercus elegans*	Crimson rosella	C	
Psittacidae	*Alisterus scapularis*	King parrot	C	
Psittacidae	*Parvipsitta pusilla*	Little lorikeet	C	
Psittacidae	*Platycercus adscitus*	Pale-headed rosella	C	
Psittacidae	*Trichoglossus haematodus*	Rainbow lorikeet	C	
Psittacidae	*Aprosmictus erythropterus*	Red-winged parrot	C	
Psittacidae	*Trichoglossus chlorolepidotus*	Scaly-breasted lorikeet	C	
Psophodidae	*Psophodes olivaceus*	Eastern whipbird	C	
Ptilonorhynchidae	*Chlamydera nuchalis*	Greater bowerbird	C	
Rallidae	*Gallinula tenebrosa*	Dusky moorhen	C	
Rhipiduridae	*Rhipidura albiscapa*	Grey fantail	C	
Rhipiduridae	*Rhipidura rufifrons*	Rufous fantail	SL	M

Family	Scientific name	Common name	NC Act	EPBC Act
Rhipiduridae	*Rhipidura leucophrys*	Willie wagtail	C	
Strigidae	*Ninox connivens*	Barking owl	C	
Strigidae	*Ninox novaeseelandiae*	Southern boobook	C	
Sturnidae	*Acridotheres tristis*	Common myna	I	
Threskiornithidae	*Threskiornis spinicollis*	Straw-necked ibis	C	
Timaliidae	*Zosterops lateralis*	Silvereye	C	
Turdidae	*Zoothera lunulata*	Bassian thrush	C	
Turnicidae	*Turnix varius*	Painted button-quail	C	
Tytonidae	*Tyto novaehollandiae kimberli*	Masked owl (northern subspecies)	V	V
Bats				
Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail Bat	LC	
Emballonuridae	*Taphozous troughtoni*	Troughton's Sheathtail bat	LC	
Miniopteridae	*Miniopterus australis*	Little Bentwing Bat	LC	
Miniopteridae	*Miniopterus schreibersii oceanensis*	Eastern Bentwing Bat	LC	
Molossidae	*Austronomus australis*	White-striped Freetail Bat	LC	
Molossidae	*Mormopterus ridei*	Eastern Freetail Bat	LC	
Molossidae	*Mormopterus lumsdenae*	Northern Freetail Bat	LC	
Molossidae	*Chaerephon jobensis*	Northern freetail Bat	LC	
Pteropodidae	*Pteropus scapulatus*	Little Red Flying-fox	LC	
Pteropodidae	*Syconycteris australis*	Common Blosson Bat	LC	
Rhinolophidae	*Rhinolophus megaphyllus*	Eastern Horseshoe Bat	LC	
Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat	LC	
Vespertilionidae	*Chalinolobus nigrogriseus*	Hoary Wattled Bat	LC	
Vespertilionidae	*Nyctophilus bifax*	Northern Long-eared Bat	LC	
Vespertilionidae	*Scotorepens sanborni*	Northern Broad-nosed Bat	LC	
Vespertilionidae	*Vespadelus pumilus*	Eastern Forest Bat	LC	
Vespertilionidae	*Chalinolobus morio*	Chocolate Wattled Bat	LC	

Family	Scientific name	Common name	NC Act	EPBC Act
Vespertilionidae	*Chalinolobus picatus*	Little Pied Bat	LC	
Vespertilionidae	*Kerivoula papuensis*	Golden-tipped Bat	LC	
Vespertilionidae	*Pipistrellus adamsi*	Cape York Pipistrelle	LC	
Vespertilionidae	*Scotorepens balstoni*	Inland Broad-nosed Bat	LC	
Vespertilionidae	*Scotorepens orion*	South-eastern Broad-nosed Bat	LC	
Vespertilionidae	*Vespadelus troughtoni*	Eastern Cave Bat	LC	