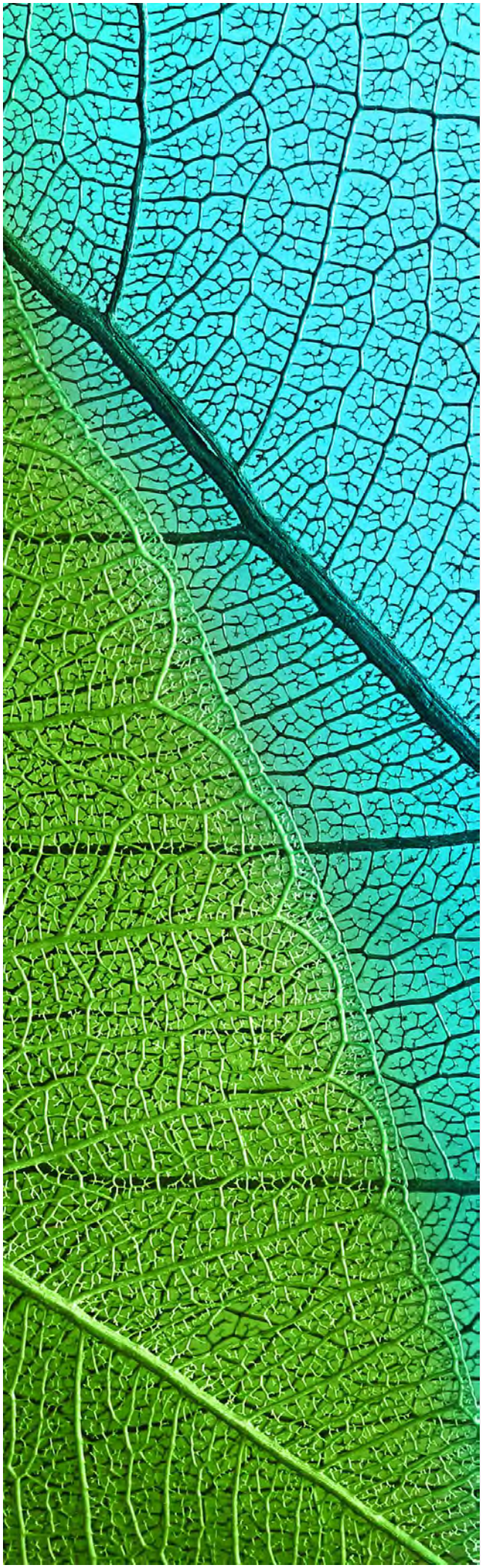

MacIntyre Wind Farm

Bird and Bat Adaptive Management Plan

Prepared for ACCIONA Energy Australia Global Pty Ltd

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Report No. 20033 (2.9)

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Executive Summary

Project Details

The Macintyre Wind Farm is located approximately 50 kilometres south west of Warwick, in south east Queensland. It is approved to include up to 169 wind turbines with a maximum tip height of approximately 285 metres. The current design includes 162 turbines with a tip height of approximately 230m.

Approval for this project was granted by the Australian Government under sections 130(1) and 133(1) of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 13 May 2022 (Reference: EPBC 2020/8756). Approval was also granted by the QLD Government under section 63 of the *Planning Act 2016* on 2nd August 2022 (Reference: 2206-29411 SPD).

This Bird and Bat Adaptive Management Plan (BBAMP) was prepared by a team of suitably qualified ecologists to satisfy both sets of approval conditions (EPBC 2020/8756 & 2206-29411 SPD). Table 1 lists relevant approval conditions and provides references to sections contained within this document where approval conditions have been addressed.

The overall aim of this BBAMP is to monitor the wind farm's impacts on bird and bat species, to identify if species of concern are significantly impacted and to outline a strategy for managing and mitigating any significant impacts on these species during the operation of the project.

Surveys

Field surveys were undertaken in accordance with the Queensland State Code 23 for Wind Farm Development (DILGP 2017) and the EPBC Act survey guidelines by various suitably qualified ecologists from 2011 until 2022. Habitat assessment surveys were undertaken based on vegetation quality and structure that may influence nesting or roosting opportunities for birds and bats (GHD 2020a). Various methods were employed for bird and bat surveys including:

- Bird Utilisation Surveys (BUS) – fixed-point sites using 2 hectare (ha) bird census method involved 20 minutes surveying a 2-ha area and recording all birds seen or heard. The surveys targeted conservation significant species.
- Aerial bird surveys were conducted to determine the potential of bird-turbine collision. This was done by two observers surveying the airspace for two 20-minute periods. All birds observed within 200m were recorded.
- Fixed point bird surveys for 10 minutes recording all bird species and numbers of individual birds heard or observed within 100 metres (targeting Regent Honeyeater, Painted Honeyeater and Swift Parrot).
- Fixed point bird surveys for 15 minutes recording all bird species and numbers of individual birds heard or observed within 200 metres.
- Driving/flushing surveys was done throughout the project area for easy detection of small ground-dwelling species. A total of 1,476 km was driven across all surveys.
- Nocturnal spotlighting and call playback were undertaken on 8 nights for potential occurrence of owls and nightjars.
- Incidental observations of all birds flying higher than 20m were recorded.
- Bat detector surveys were conducted using Anabats set at 28 sites. They were placed based on habitat type at 1-2m height and left over-night. Recorded echolocation calls were analysed by a specialist sub-consultant.

- Bat detector surveys were conducted using Song meter set at 7 sites. These surveys were completed across 4 seasons including: 2021 mid dry, 2021 late dry, 2021 early wet, 2022 mid wet using ultrasonic bat detectors.
- Harp trapping was undertaken using six two-bank harp traps set in suitable habitat for conservation significant microbat species (GHD 2020a).
- Vehicle based spotlighting and stationary dusk surveys at higher elevation were undertaken to target species of flying-fox, namely, the Grey-headed Flying-fox. Each watch was undertaken by two observers for one hour. All observations and incidental finds were recorded.

Targeted habitat mapping for Regent Honeyeater, Painted Honeyeater and Swift Parrot was undertaken based on the presence of habitat characteristics for each species as detailed in the Conservation Advice for Regent Honeyeater, Painted Honeyeater and Swift Parrot and the National Recovery Plans for Regent Honeyeater and Swift Parrot (Nature Advisory 2021b; Appendix 1). Targeted surveys for Regent Honeyeater, Painted Honeyeater and Swift Parrot have also been conducted within the project area (Nature Advisory 2021b).

Results

Across all pre-construction bird surveys, 182 bird species were recorded with common species being the most abundant. Across the bird baseline surveys comprising eight seasons of BUS, 149 bird species were recorded by Nature Advisory (Nature Advisory 2022 – Appendix 2). Fourteen (14) species of raptor were recorded, 65% of which were recorded flying at Rotor Swept Area (RSA) height. One listed bird species was observed flying at RSA height, the White-throated Needletail (*Hirundapus caudacutus*).

Fifteen microbat species were identified however no Grey-Headed Flying-fox or other listed bat species were observed during field surveys.

While only three (3) species listed under the EPBC Act and Queensland's *Nature Conservation Act 1992* (NC Act) were observed during surveys, White-throated Needletail (*Hirundapus caudacutus*), Squatter Pigeon (Southern) (*Geophaps scripta scripta*) and Glossy Black Cockatoo (*Calyptorhynchus lathami lathami)*, four (4) additional bird species and one (1) bat species listed under the EPBC Act and NC Act are considered a potential occurrence and include:

- Regent Honeyeater
- Painted Honeyeater
- Swift Parrot
- Powerful Owl
- Grey-headed Flying Fox.

Risk Assessment

The results of the habitat assessments and field surveys provided valuable information for the species risk assessment in Section 3. The risk assessment identifies the 'at-risk' species from the operation of the project. The outcomes of this risk assessment enable more targeted monitoring and management measures to be included, focussing on species and groups with a comparatively higher risk rating.

Risks to the majority of species assessed are considered negligible. Six (6) bird species and one (1) bat species have been identified as having a low risk rating of being affected by collision with operating turbines once the project is commissioned and turbines are operational. Five (5) out of the seven (7) species are listed under the NC Act and/or EPBC Act including;

- White-throated Needletail
- Swift Parrot
- Regent Honeyeater
- Powerful oOwl
- Fork-tailed Swift

Turbine Risk Rating and Collision Risk Modelling

The Commonwealth draft guidelines for managing the impacts of wind farms on avifauna (May 2024) require BBAMPs to assess the long-term risk of the wind turbines to EPBC Act listed birds using a range of analytical tools, and in particular Collision Risk Modelling (CRM) results.

CRM is typically undertaken for species that have been assessed to have a greater than low risk during the species risk assessment and for which regular usage enables the collection of adequate empirical data to run an acceptably accurate model. No species have been assessed to have a greater than low risk within the species risk assessment. Despite not meeting the criteria for adequate numbers of observations, despite two years of seasonal surveys as required by the May 2024 guidelines, a CRM was completed preliminarily using the observations of White-throated Needletail (refer Section 4.1 and Appendix 3). Based on the results of the utilisation surveys conducted for the CRM, there were no clear patterns of spatial use and a flat utilisation pattern was therefore assumed for this species across the site . The heat map and distribution of records for White-throated Needletail provide a preliminary visual support for this conclusion (refer Appendix 4).

A CRM was not feasible for the Regent Honeyeater as not a single individual was recorded during the many surveys conducted on site. Since CRM could not be used to assign differentiated risk levels for wind turbines, an alternative approach is to use historical records and distance to potential suitable habitat. Based on the proposed layout (Figure 1), no single turbine or cluster of turbines is considered to impose a higher risk than others, and the overall risk of the project is considered low (see also Section 4.3).

Long-term Monitoring Program

Section 5 of the BBAMP provides the details of the long-term monitoring program for the project. Monitoring methods will include bird and bat utilisation surveys, targeted listed species surveys, monitoring of 'at-risk' groups and carcass searches under operating wind turbines.

Throughout the long-term monitoring program mitigation measures outlined in Section 6 and impact triggers and decision-making framework in Section 7 will be implemented. Operational phase monitoring results will be utilised to update the White-throated Needletail CRM and to compare predicted collision rates and observed collisions. Similarly, the turbine risk ratings will be re-evaluated during the operation phase of the project in response to long-term monitoring program results should these reveal consistent spatial patterns of activity.

Contents

1. Introduction 1
1.1. Background 1
1.2. Requirements of this Bird and Bat Adaptive Management Plan (BBAMP) 1
1.3. BBAMP objectives 8
1.4. Terms, Definitions and Acronyms 9
1.5. Site description 12
2. Pre-construction Bird and Bat Information 13
2.1. Pre-construction survey methods 13
2.1.1. Bird and Bat Habitat Assessments 13
2.1.2. Bird Surveys 13
2.1.3. Bat Surveys 15
2.1.4. Before and After Control Impact Analysis 16
2.2. Pre-construction survey results 16
2.2.1. Birds 16
2.2.2. Bats 17
2.2.3. Likelihood of occurrence assessment 17
2.2.4. Targeted surveys for listed species 18
3. Bird and Bat Risk Assessment 19
3.1. Objectives 19
3.2. Information sources 19
3.3. Species and groups of concern 20
3.4. Methodology 21
3.5. Results 23
3.6. Summary 29
3.6.1. Wedge-tailed Eagle and other raptors 29
3.6.2. Fork-tailed Swift 29
3.6.3. Powerful Owl 30
3.6.4. Regent Honeyeater 30
3.6.5. Swift Parrot 31
3.6.6. White-throated Needletail 33
3.6.7. White-striped Freetail Bat 34
4. Turbine Risk Rating 35
4.1. Collision Risk Model 35

4.2. Turbine risk rating for White-throated Needletail 36
4.3. Turbine risk rating for Regent Honeyeater 36
4.3.1. Distance to historical records 37
4.3.2. Distance to potential suitable habitat 37
4.4. Turbine risk rating updates 37
5. Operational Phase Monitoring 38
5.1. Operational Bird Utilisation Surveys 38
5.1.1. Operational targeted surveys for listed bird species 38
5.2. Operational Bat Utilisation Surveys 39
5.3. Monitoring 'at risk' Species 39
5.3.1. Fork-tailed Swift, White-throated Needletail, Regent Honeyeater, Swift Parrot, Wedge-tailed Eagle and other raptors 39
5.3.2. Other bird species 40
5.4. Carcass Searches 41
5.4.1. Turbine selection 43
5.4.2. Search protocol 43
5.4.3. Searching with scent dogs 44
5.4.4. Carcass detection protocol (operational phase) 45
5.4.5. Incidental carcass protocol 45
5.4.6. Scavenger rates and trials 46
5.4.7. Detectability (searcher efficiency) trials 47
5.4.8. Analysis of results and mortality estimation 48
5.5. Personnel involved 49
5.6. Injured & deceased bird and bat handling protocol 50
5.7. Reporting 51
6. Mitigation Measures to Reduce Risk 53
6.1. Carrion removal program and stock forage control 53
6.2. Artificial Lighting 54
7. Impact Triggers and Decision-Making Framework 55
7.1. Listed species 55
7.1.1. Definition of impact trigger 55
7.1.2. Decision making framework and reporting 55
7.2. Non-listed (protected) species 58
7.2.1. Definition of Impact Trigger 58
7.2.2. Decision making framework 58

7.3. Supplementary mitigation measures 60
7.4. Specific management objectives, activities, timing and performance criteria 60
8. References 63

Tables

Table 1: Sections within the BBAMP that respond to recent Commonwealth and State wind farm approval conditions in Queensland 2
Table 2: Risk assessment - Assessed bird and bat species 21
Table 3: Likelihood criteria for a risk event to occur 22
Table 4: Consequence Criteria 22
Table 5: Risk matrix defining risk level based on likelihood and consequence 22
Table 6: Risk Assessment for birds and bats at MacIntyre Wind Farm 25
Table 7: Timing for scavenger trials 46
Table 8: Number of replicates for each scavenger trial 47
Table 9: Number of replicates per season for detectability trials, given two factors of size and visibility 48
Table 10: Vet and wildlife carer details for the local region 51
Table 11: Supplementary mitigation measures in the event of an *impact trigger* occurring – illustrative examples only 61
Table 12: Specific management objectives, activities, timing and performance criteria 62

Figures

Figure 1. Proposed layout of MacIntyre Wind Farm 10

Figure 2. Regional location of MacIntrye Wind Farm 11

Figure 3: Inner and outer carcass search zones underneath turbines 44

Figure 4: Decision making framework for identifying and mitigating *impact triggers* for listed species 57

Figure 5: Decision making framework for identifying and mitigating *impact triggers* for non-listed species 59

Appendices

Appendix 1: EPBC Act threatened birds - habitat and regional assessment and targeted surveys 68

Appendix 2: Bird Utilisation Survey Baseline Report Year Two 69

Appendix 3: MacIntyre Wind Farm White-throated Needletail Collision Risk Model 70

Appendix 4: White-throated Needletail habitat and records within MacIntyre WF 71

Appendix 5: Regent Honeyeater habitat within MacIntyre WF 72

Appendix 6: Swift Parrot habitat within MacIntyre WF 73

Appendix 7: Monitoring Data Sheet 74

Appendix 8: Carcass Data Sheet 75

1. Introduction

1.1. Background

The Macintyre Wind Farm is proposed to be located 50 kilometres south west of Warwick, in south east Queensland (Figure 2). It is approved to include up to 169 wind generating turbines with a maximum tip height of approximately 285 metres. The current design includes 162 turbines with a tip height of approximately 230m.

Approval for this project was granted by the Australian Government under sections 130(1) and 133(1) of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 13 May 2022 (Reference: EPBC 2020/8756). Approval was also granted by the QLD Government under section 63 of the *Planning Act 2016* on 2nd August 2022 (Reference: 2206-29411 SPD). This Bird and Bat Adaptive Management Plan (BBAMP) was prepared for the Department of State Development, Infrastructure, Local Government and Planning to comply with the approval conditions listed in Table 1 below. Commencement of operation of the wind farm is conditional upon the Minister's written approval of this BBAMP.

This BBAMP was prepared by a team of suitably qualified ecologists from Nature Advisory (formerly Brett Lane & Associates Pty Ltd) including; Cara Cappelletti (Technical Officer), Ben Green (Senior Zoologist), Liz Browne (Zoologist); Curtis Doughty (Senior Zoologist), Tom Cotter (Senior Zoologist), Bernard O'Callaghan (Director) and Brett Lane (Director & Principal Ecologist). Nature Advisory is grateful to Laura Cleary and Eliot Leach of Attexo Pty Ltd for a very helpful review of this document.

1.2. Requirements of this Bird and Bat Adaptive Management Plan (BBAMP)

Table 1 below lists the approval conditions from EPBC 2020/8756 and 2206-29411 SPD that relate to this BBAMP. This table provides references to sections contained within this document where approval conditions have been addressed.

Table 1: Sections within the BBAMP that respond to recent Commonwealth and State wind farm approval conditions in Queensland.

Condition number	Permit condition requirements	BBAMP Plan Sections
EPBC Act approval conditions – Bird and Bat Management		
31.	*The approval holder must submit a Bird and Bat Management Plan (BBAMP) to the department for the Minister's approval prior to commissioning. The approval holder must not commission unless the BBAMP has been approved by the Minister in writing.*	1.1
32.	*The approval holder must implement the approved BBAMP from the commencement of commissioning.*	1.3
33.	*Environmental outcomes* *The BBAMP must ensure the risk of turbine impact and barotrauma impacts on EPBC Act listed threatened species and EPBC Act listed migratory bird or bat species is minimised to the satisfaction of the Minister. The BBAMP must include, but is not limited to:* *a. adequate monitoring and analysis of findings to determine whether long-term site utilisation by EPBC Act listed threatened species and EPBC Act listed migratory bird or bat species is affected by the action.* *b. Ongoing review and improvement of monitoring for the timely identification of EPBC Act listed threatened species and EPBC Act listed migratory bird or bat species turbine collisions and barotrauma impacts and the timely collection and analysis of data.* *c. The development and implementation of on-ground management measures and corrective actions to achieve, to the satisfaction of the Minister, a long-term reduction in the risk of turbine collision and barotrauma impacts on EPBC Act listed threatened species and EPBC Act listed migratory bird or bat species.*	a. 5.1, 5.2 & 5.3 b. 5.4 c. 6 & 7.3
34.	*Desktop Assessment: Preliminary site characterisation* *The BBAMP must include a preliminary site characterisation for EPBC Act listed threatened species and EPBC Act listed migratory bird or bat species to identify all drivers of presence on the project site and utilisation of the project site. This characterisation must include, but is not limited to, the consideration of:* *i. site characteristics: focal habitat features, topography, prevailing wind and weather patterns, wetlands (including outside the project area), and distance to potential nesting, roosting and foraging areas.* *ii. species characteristics: behaviour, flight and demographic factors (e.g. species presence [ongoing, transitory/migratory]), site use (e.g. transit, roosting, breeding and/or foraging), flight paths (including migratory flight paths), flight heights, soaring, flocking, and population numbers.*	3.6
35.	*Site utilisation surveys* *The BBAMP must include the results of the 24 months of pre-commissioning site utilisation surveys for EPBC Act listed threatened species and EPBC Act listed migratory bird or bat species.*	2

Condition number	Permit condition requirements	BBAMP Plan Sections
EPBC Act approval conditions – Bird and Bat Management		
36.	*Commencing within 2 months after the first instance of commissioning, the approval holder must undertake bird and bat site utilisation surveys over a period of at least 24 months which must:* *a. be designed to ensure that species behaviour responses, including avoidance of turbines, and changes to project site utilisation, can be detected;* *b. be designed to support a before-after control-impact (BACI) monitoring framework;* *c. be conducted by a suitably qualified ecologist[1];* *d. include site utilisation survey methodologies, and proposed timings, which are consistent with the pre-commissioning site utilisation survey methodologies; and* *e. be able to inform adaptive mitigation and management measures, and corrective actions, to ensure that the* impacts *are minimised to the satisfaction of the* Minister*.*	5.1 & 5.2
37.	*<u>Long-term impact risk assessment</u>* *To assess the long-term risk of the wind turbines, the BBAMP must:* *a. Identify potential impacts to each relevant species from direct mortality, including analysis and mapping of suitable habitat, territories and activity/utilisation patterns/rates ('heat maps') in the project area and its surrounds.* *b. Assign a risk level of either low-risk turbine or high-risk turbine to each turbine depending on collision risk modelling results for EPBC Act listed threatened species and EPBC Act listed migratory bird or bat species. Modelling results must be based an assessment of the potential impact pathways on each relevant species (based on the desktop assessment and site utilisation surveys) including, but not limited to:* *i. direct mortality from turbine collision and barotrauma; and* *ii. potential changes to site utilisation during construction and following commissioning.*	3.5, 4 & 5
38.	*For all high-risk turbines identified in accordance with condition 37 above, the approval holder must undertake Mathematical Collision Risk Modelling and include it in the BBAMP in seeking the Minister's approval prior to commissioning:* *a. incorporating a project area-wide assessment to identify all high-risk turbines;* *b. incorporating data collected during the pre-commissioning site utilisation surveys;* *c. incorporating the recommendations of a peer-review of the model; and* *d. including a literature review, justification of the choice of the model used, and a statement of all assumptions and uncertainties.*	4 & Appendix 3

[1] A suitably qualified ecologist for the purpose of this BBAMP is an ecologist or ecological consultant with a relevant tertiary degree in an ecological field as a minimum and extensive field experience. This includes expertise in bird and/or bat identification, training monitoring personnel, data analysis and interpretation, adaptive management, and report preparation.

Condition number	Permit condition requirements	BBAMP Plan Sections
EPBC Act approval conditions – Bird and Bat Management		
39.	*The BBAMP must clearly demonstrate how relevant department policies and guidelines, and the SPRAT Database have been used to assess the potential impacts of mortality from turbine collision and barotrauma, and potential changes to site utilisation during construction and following commissioning on relevant EPBC Act listed threatened and EPBC Act listed migratory bird or bat species.*	3.2
40.	*The BBAMP must include a map for each relevant EPBC Act listed threatened species and EPBC Act listed migratory bird or bat species which identifies those portions of the project area identified as high risk in accordance with condition 37.*	Appendix 4, Appendix 5 & Appendix 6
41.	*<u>Long-term turbine collision and barotrauma monitoring</u>* *The BBAMP must include a long-term monitoring program to test the validity of the risk assessment assignation made in accordance with condition 37 above. The long-term monitoring program must:* *a. Include details of the nature, timing and frequency of monitoring to determine impacts to EPBC Act listed threatened species and EPBC Act listed migratory bird or bat species as compared to avoiding the impacts to the satisfaction of the Minister, and be sufficient to determine whether the BBAMP is likely to achieve the Minister's requirements in adequate time to implement all necessary corrective actions.* *b. Demonstrate how site-specific and species-specific risks and uncertainties have informed the design of the monitoring program (e.g. scavenger activity, searcher efficiency, etc.).* *c. Include a proposed timeframe for the regular validation and update of the Collision Risk Modelling using site-specific data collected through ongoing monitoring activities.* *d. Include details of requirements for DNA testing of carcasses that cannot be otherwise identified by a suitably qualified ecologist.* *e. Include details of requirements for carcass persistence trials to maximise turbine collision detection in a timely manner.* *f. Include details of requirements for searcher efficiency trials to maximise carcass detection in a timely manner.*	a. 5.3 & 5.4 b. 4 & 5 c. 4 & 5.3.1 d. 5.4.4 e. 5.4.6 f. 5.4.7
42.	*<u>Adaptive management framework</u>* *To ensure the BBAMP requirements will be achieved for relevant EPBC Act listed threatened and EPBC Act listed migratory bird or bat species, the BBAMP must include an adaptive management framework. The adaptive management framework must, at a minimum:* *a. Be designed to clearly demonstrate the linkages between:* *i. implementation of mitigation and management measures;* *ii. monitoring, reporting and investigations; and* *iii. implementation of corrective actions to ensure impacts are avoided to the satisfaction of the Minister.* *b. Be designed to incorporate site-specific data collected through ongoing monitoring activities and take into account changes to EPBC Act listed threatened and EPBC Act listed migratory bird or bat species risk ratings in accordance with the long-term monitoring program in condition 41.*	a. 5.7, 6 & 7 b. 5 c. 7 d. 7.3

Condition number	Permit condition requirements	BBAMP Plan Sections
EPBC Act approval conditions – Bird and Bat Management		
	c. Propose timeframes for the implementation of tangible, on-ground corrective actions to be implemented if monitoring indicates impacts are unacceptable. *d. Propose alternative mitigation and management measures supported by scientific literature if monitoring activities indicate impacts exceed impacts specified in the approved BBAMP.*	
43.	*If, during bird and bat utilisation surveys or during any other monitoring or incidental observation during post-commissioning, one or more individuals of an EPBC Act listed threatened species and EPBC Act listed migratory bird or bat species is detected within the vicinity* of a low-risk turbine, the approval holder must assign that turbine to be a high-risk turbine. A revised BBAMP reflecting the revised risk rating of turbines must be submitted to the department for the Minister's approval within five business days of such a detection.*	4.4
44.	*<u>Reporting requirements</u>* *The BBAMP must include, at a minimum, the following reporting commitments (and proposed timeframes) for the provision of site-specific and species-specific information to the department:* *a. Annual turbine strike reports comprising raw strike data and strike notifications, survey methodologies, results of detection/persistence trials, environmental/meteorological conditions and associated statistical analysis.* *b. Estimations of the annual mortality rate for each relevant EPBC Act listed threatened species and EPBC Act listed migratory bird or bat species, comprising supporting evidence from case studies of EPBC Act listed threatened species and EPBC Act listed migratory bird or bat species carcass size classes, results of persistence trials, searcher efficiency trials and substitute carrion trials, and annual probability of detection and monthly strike monitoring.* *c. Species occurrence records in accordance with the department's Guidelines for biological survey and mapped data (2018) available at: https://www.awe.gov.au/sites/default/files/documents/guidelines-biological-surveymapped-data.pdf using the species observation data template on the department's website (sensitive ecological data must be identified and treated in accordance with the department's Sensitive Ecological Data – Access and Management Policy V1.0 (2016) available at https://www.awe.gov.au/sites/default/files/documents/sensitive-ecological-dataaccess-mgt-policy.pdf or subsequent revision).*	a. 5.7 b. 5.7 c. 5.7
Queensland Planning Act 2016 approval conditions		
10.	*(a) Undertake bird utilisation surveys and collect baseline data in accordance with a Before-After-Control-Impact (BACI) design certified by a suitably qualified ecologist. These surveys are to be undertaken over two seasons after the commencement of the use.* *Each survey is to undertake the following procedure:*	2
	(i) *Establishment of 5 bird survey points (4 impact sites and 1 reference site).*	2

Condition number	Permit condition requirements	BBAMP Plan Sections
EPBC Act approval conditions – Bird and Bat Management		
	(ii) *15-minute point-based surveys counting and documenting the distance and flight height of each observed bird in accordance with a BACI sampling design. This is to involve two counts of each site in each of four periods of the day (early morning, late morning, early afternoon and late afternoon) corresponding to different periods of bird activity (a total of eight surveys per site).*	2
	(iii) *Within the 15-minute point-based survey:* • *All bird species and numbers of individual birds observed within 200 metres will be recorded* • *The species, the number of birds and the height of the bird when first observed will be documented* • *For species of concern (threatened species, waterbirds and raptors), the minimum and maximum heights will be recorded.*	2
	(iv) *Each survey point will be counted eight times each survey over the two survey periods (one wet season and one dry season) at different times of the day.*	2
	(v) *Compilation of a bird species lists for the site from the formal counts and incidental observations, and mapping of the location (and recording of behaviour) of any rare or threatened species.*	2
	(b) Upon completion of the surveys the requirement for additional surveys will be assessed and recommendations provided within a first-year annual report (including the results of the BACI design). *This annual report is to demonstrate whether the site continues to be utilised by the range of species identified during surveys conducted before the commencement of the use and assess any changes in abundance or behaviour.* *The BACI sampling design will be tested using the data collected in baseline and post- construction bird utilisation surveys and results presented in the annual report*	5
	(c) Provide the annual report required by part (b) of this condition to Department of State Development, Infrastructure, Local Government and Planning (windfarms@dsdilgp.qld.gov.au). *Note: The BACI sampling design is to be tested using the data collected in baseline and post-construction bird utilisation surveys and results presented in the annual report.*	5 & 7.4
11.	*(a) Prepare a Bird and Bat Adaptive Management Plan (BBAMP) certified by a suitably qualified ecologist. The BBAMP must include:*	1.1
	(i) *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*	3
	(ii) *incorporate baseline data, including additional pre-operational surveys, Collision Risk Modelling and Population Viability Analysis*	2 & 4
	(iii) *identification of threshold (trigger) levels for species*	7

Condition number	Permit condition requirements	BBAMP Plan Sections
EPBC Act approval conditions – Bird and Bat Management		
	(iv) *identification of mitigation measures and implementation strategies in order to reduce impacts on bird and bat groups*	6 & 7
	(v) *monitoring requirements*	5.1, 5.2, 5.3 & 5.4
	(vi) *a decision-making framework, including the trigger for operational shut-down*	7
	(b) Provide the BBAMP required by part (a) of this condition to Department of State Development, Infrastructure, Local Government and Planning (windfarms@dsdilgp.qld.gov.au).	1.1
	(c) Operate the development in accordance with the BBAMP.	1.1

*Vicinity means within 300 metres radius of the turbine at or above RSA.

1.3. BBAMP objectives

The overall aim of this BBAMP is to monitor the wind farm's impacts on bird and bat species, to identify if species of concern could be significantly impacted and to outline a strategy for managing and mitigating any significant impacts on these species during the operation of the project. Thus, this BBAMP will be implemented as the wind farm commences commissioning and turbines become operational (i.e. feeding power into grid which may be specific groups of turbines as wind turbines are installed).

The aim of this BBAMP will be achieved by establishing monitoring and management procedures consistent with the methods outlined by the Australian Wind Energy Association (AusWEA 2005) and endorsed in the Clean Energy Council's Best Practice Guidelines (CEC 2018). The Queensland State Code 23 – Wind Farm Development (Department of Infrastructure, Local Government and Planning 2017) Performance Outcome (PO) 5 requires the preparation of a Preliminary BBAMP to be included in the development application under State Code 23.

The specific objectives of this BBAMP, derived from conditions of approval, are:

- To implement a monitoring program to estimate the impact of the project on at-risk birds and/or bats that can reasonably be attributed to the operation of the project (Section 5.4);
- To directly record impacts on birds and bats through a statistically-based program of carcass searches (Section 5.4);
- To document an agreed decision-making framework that identifies *impact triggers* requiring a management response (Section 7);
- To detail potential mitigation measures and related implementation strategies to reduce impacts on birds and bats (Section 7.3); and
- To identify matters to be addressed in periodic reports on the outcomes of monitoring, the application of the decision-making framework, mitigation measures and their success (Section 7.4).

This plan adopts an adaptive management approach. Therefore, management measures set out in this BBAMP can be adaptively amended to ensure effective mitigation is implemented in response to the findings of monitoring. In addition, a suitably qualified ecologist will design any further monitoring required in response to evaluation of the specific monitoring in the BBAMP after the initial management period of 24 months following the commissioning of all wind turbines. Long-term monitoring will be undertaken by appropriately trained personnel as required. Note that although mitigation measures and monitoring may be subject to change per the adaptive approach, the overarching processes outlined in this plan will remain relevant for the life of the project.

This BBAMP has been developed based on the experience gained from the preparation and implementation of management plans to monitor and mitigate the impact of wind farm operations on birds and bats at numerous wind farms in Queensland, New South Wales and Victoria. At the time of writing, Nature Advisory has prepared and/or implemented management plans for the following wind farms: Lotus Creek and Coopers Gap in Queensland, White Rock, Cullerin Range, Gullen Range, Taralga, Capital and Woodlawn wind farms in NSW (BL&A 2011a & c, 2014, 2016), and Bald Hills, Macarthur, Berrybank, Crowlands, Hawkesdale, Lal Lal, Mt Gellibrand, Mt Mercer, and Ryan's Corner wind farms in Victoria (BL&A 2009, 2011b, 2012a-d, 2013a-c).

The approach developed for monitoring impacts on birds and bats has been refined from experience gained from other BBAMPs, their preparation, data review, and feedback from regulators and approval authorities, including both Commonwealth and State governments. This BBAMP has incorporated learnings and experience from past plans and incorporates the 'best practice' approach to monitoring a wind farm's impacts on birds and bats.

To ensure the efficacy of this adaptive management program, all activities undertaken will be subject to regular review and reporting by a suitably qualified expert (see Section 7.4).

1.4. Terms, Definitions and Acronyms

Acronym/term	Description
BBAMP	Bird and Bat Adaptive Management Plan.
Full Commissioning	All wind turbines generating electricity for commercial purposes.
DCCEEW	Department of Climate Change, Energy, the Environment and Water.
DESI	Department of Environment, Science and Innovation, Queensland. Formerly DES (Department of Environment and Science)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999.*
NC Act	*Nature Conservation Act 1992,* Queensland.
Operational Phase	Follows project commissioning. Continues until project is decommissioned.
RSA	Rotor Swept Area
Suitably Qualified Ecologist	A suitably qualified ecologist for the purpose of this BBAMP is an ecologist or ecological consultant with a relevant tertiary degree in an ecological field as a minimum and extensive field experience. This includes expertise in bird and/or bat identification, training monitoring personnel, data analysis and interpretation, adaptive management, and report preparation.
Trained Operations Staff	Wind Farm Operations personnel who have been trained and assessed by a suitably qualified and experienced consultant to retrieve incidental bird/bat carcasses.
RHE	Regent Honeyeater
WTE	Wedge-tailed Eagle
WTNT	White-throated Needletail

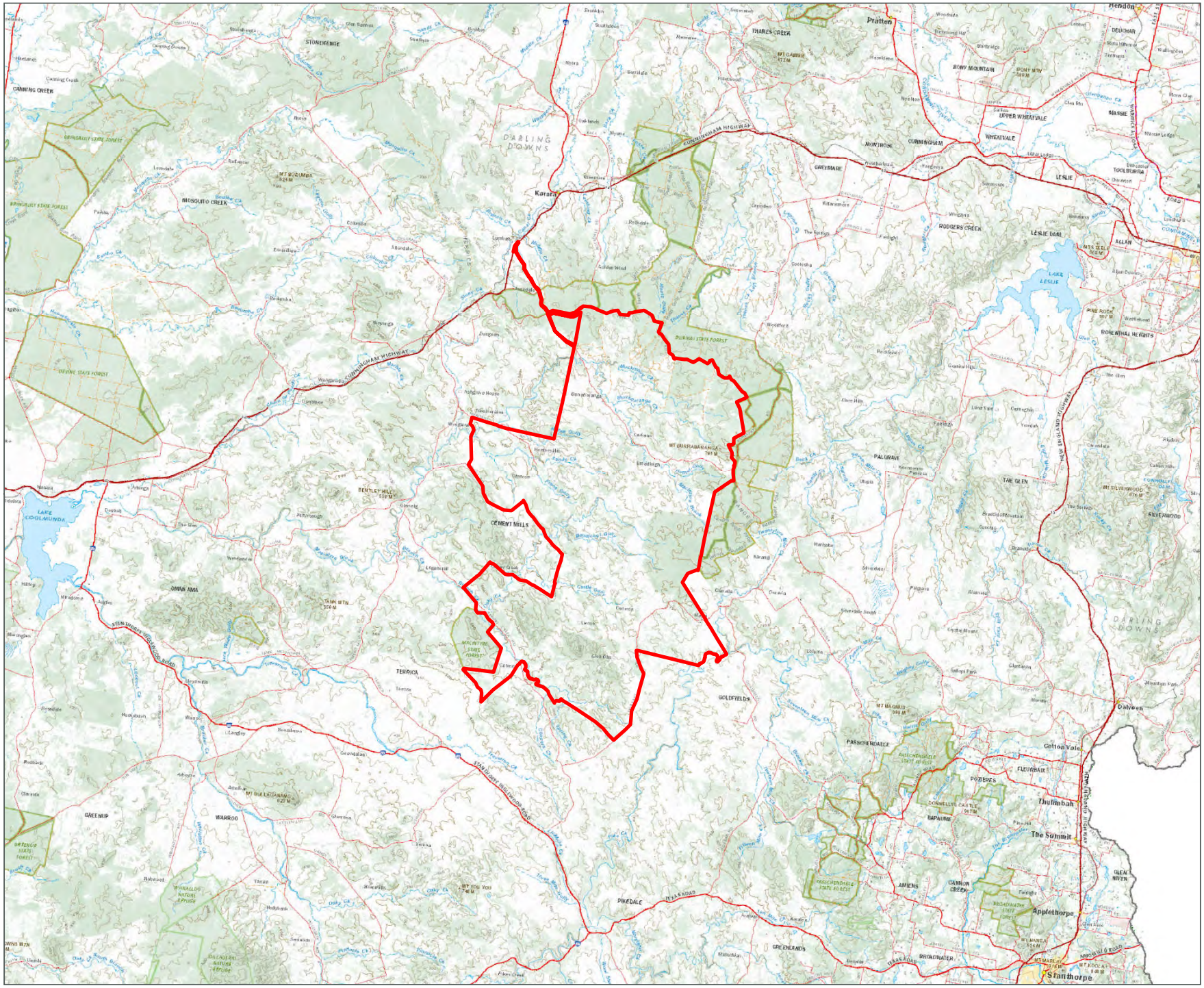

Figure 1: Regional Location of MacIntyre Wind Farm

Project: MacIntrye Wind Farm
Client: ACCIONA Energy Australia Global Pty Ltd
Date: 12/04/2021

MacIntyre Wind Farm Boundary

N

Metres
0 4,200

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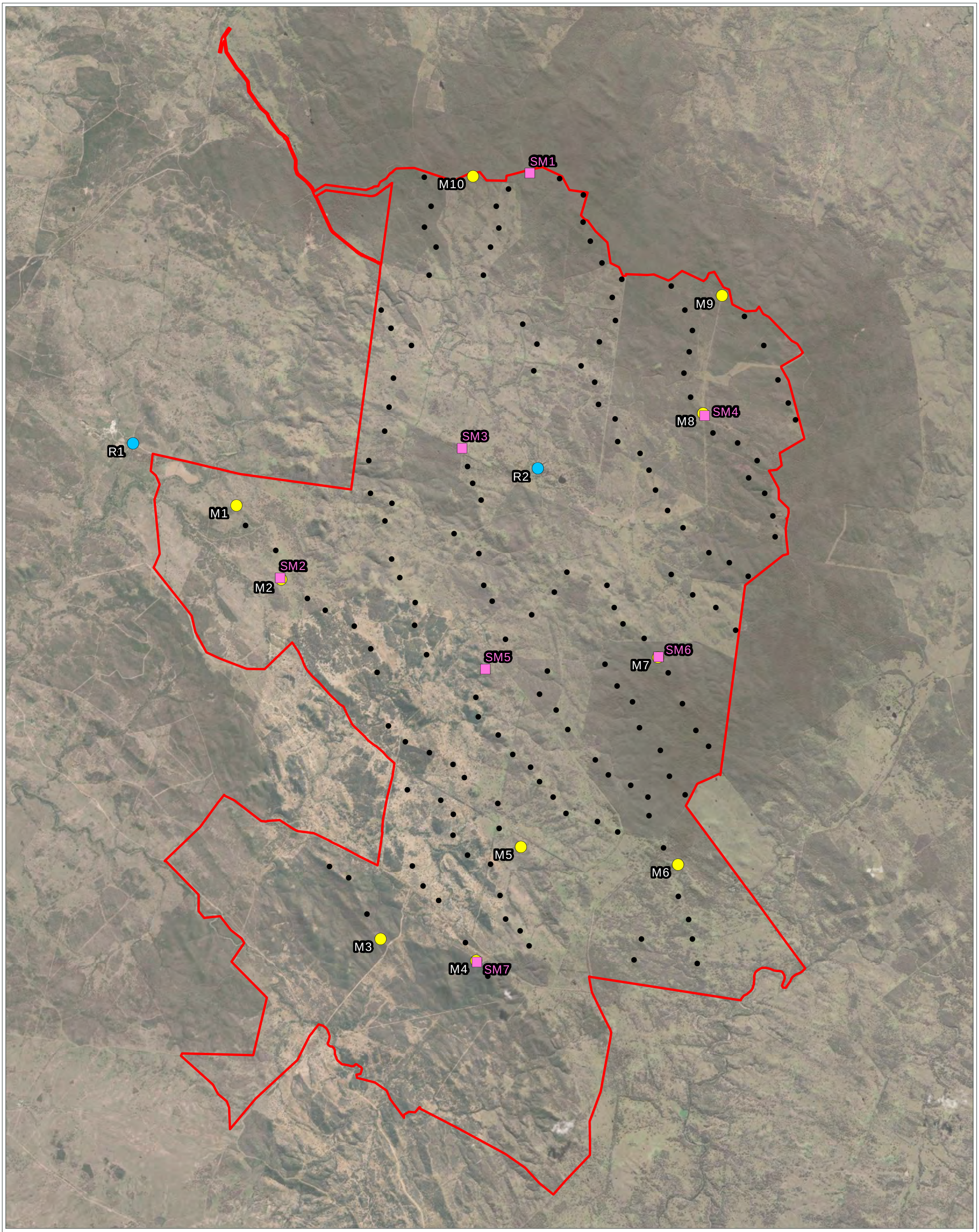

Figure 2: Proposed layout of MacIntyre Wind Farm

Project: MacIntyre Wind Farm Client: ACCIONA Energy Australia Global Pty Ltd Date: 20/06/2023

Study Area
- Wind Turbine (Proposed)

BUS
- Impact
- Reference
- Song Meter Points

N

Metres
0 1,800

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1.5. Site description

MacIntyre Wind Farm is proposed to be located approximately 50 kilometres south west of Warwick, 160 kilometres southwest of Brisbane and 170 kilometres west of the Gold Coast. It falls within the Southern Down Regional Council, Goondiwindi Regional Council, and Toowoomba Regional Council. The land is predominantly used for sheep farming and other agricultural purposes.

The project area is located within the Nandewar Northern Complex of the New England Tableland bioregion. The project area is dominated by Narrow-leaved Ironbark (*Eucalyptus crebra*), White Box (*E. albens*), Tumble-down Red Gum (*E. dealbata*), Silver-leaved Ironbark (*E. melanophloia*) and Spotted Gum (*Corymbia citriodora*). It lies 28 kilometres from Sundown National Park and is adjacent to the Durikai State Forest and MacIntyre State Forest. The project area also borders the proposed Karara Wind Farm, which collectively comprise the MacIntyre Wind Energy Precinct (DES 2023).

The project area ranges in elevation from 530-740 metres above sea level (GHD 2020a). It is moderately fragmented and has been heavily cleared.

Five broad fauna habitat types occur on the site (GHD 2020a): low eucalypt woodland on rocky hills, mixed eucalypt woodland/forest, ironbark open woodland with a grassy understorey, riparian woodland, and low shrubby regrowth (regrowth woodland with a shrubby understorey). Remaining land, not part of these habitat types, includes cleared or heavily modified grazing land and artificial dams. Heavy clearing and fragmentation have severely reduced habitat, and therefore, diversity of birds and bats. Some areas of remnant vegetation and woodland are, nonetheless, of moderate to high quality.

2. Pre-construction Bird and Bat Information

Acciona Energy Australia Global Pty Ltd (Acciona) engaged GHD to undertake a desktop review and field surveys to determine the potential impacts to birds and bats within the project area from the proposed wind farm. These are outlined in detail in the MacIntyre Wind Farm Bird and Bat Utilisation Report (GHD 2020a). Acciona engaged Nature Advisory to determine potential impacts to birds. These are outlined in detail in the MacIntyre Wind Farm EPBC Act threatened birds - habitat and regional assessment and targeted surveys report and MacIntyre Wind Farm Bird Utilisation Survey Baseline Report. These reports are summarised below.

These investigations have provided valuable information and contribute to the risk-assessment (Section 3) which identifies the 'at-risk' species from the operation of the project.

2.1. Pre-construction survey methods

Field surveys for MacIntyre Wind Farm were undertaken in accordance with the Queensland State Code 23 for Wind Farm Development (DILGP 2017) and generally in accordance with the EPBC Act survey guidelines by AECOM (2011-2012), EHP (2017-2018), GHD (2018-2019), and Nature Advisory (2020-2022). Habitat assessment surveys were undertaken based on vegetation quality and structure that may influence nesting or roosting opportunities for birds and bats (GHD 2020a).

Targeted habitat mapping for Regent Honeyeater, Painted Honeyeater and Swift Parrot was undertaken based on the presence of habitat characteristics for each species as detailed in the Conservation Advice for Regent Honeyeater, Painted Honeyeater and Swift Parrot and the National Recovery Plans for Regent Honeyeater and Swift Parrot (Nature Advisory 2021b; Appendix 1). Targeted surveys for Regent Honeyeater, Painted Honeyeater and Swift Parrot have also been conducted within the project area (Nature Advisory 2021b).

2.1.1. Bird and Bat Habitat Assessments

Bird and bat habitat assessments were conducted on the following dates.

Birds

- 12-15 December 2011 at 51 sites (AECOM)
- 26-30 October 2018 at 203 sites (GHD)
- 22-30 May 2020 (Nature Advisory)
- 15-19 June 2020 (Nature Advisory)
- 21-24 July 2020 (Nature Advisory)

Bats

- 12-15 December 2011 at 51 sites (AECOM)
- 26-1 November 2018 at 203 sites (GHD)

2.1.2. Bird Surveys

Bird surveys were conducted using the following methods:

- Bird Utilisation Surveys (BUS) – Fixed point bird surveys for 15 minutes recording all bird species and numbers of individual birds heard or observed within 200 metres

- Area searches in which bird counts involved 20 minutes surveying 2-hectare areas and recording all birds seen or heard. The surveys targeted conservation significant species
- Aerial bird surveys were conducted to determine the potential of bird-turbine collision. This was done by two observers surveying the airspace for two 20-minute periods. All birds observed within 200m were recorded
- Fixed point bird surveys for 10 minutes recording all bird species and numbers of individual birds heard or observed within 100 metres (targeting Regent Honeyeater, Painted Honeyeater and Swift Parrot)
- Driving/flushing surveys were undertaken throughout the project area for easy detection of small ground-dwelling species. A total of 1,476 km was driven across all surveys
- Nocturnal spotlighting and call playback were undertaken on 8 nights for potential occurrence of owls and nightjars. The active searches coincided with the setup of ultrasonic bat detectors
- Incidental observations of all birds flying higher than 20m were recorded. Actual Rotor Swept Area (RSA) height was not confirmed at the time of the surveys. The RSA has since been confirmed as 60 to 230 metres.

Dates and details for bird surveys undertaken at the project area are outlined below.

- 21-23 November 2012 – Bird utilisation 18 fixed-point sites (AECOM)
- 23-27 October 2017 – Bird utilisation 8 fixed-point sites (EHP)
- 31 October – 1 November – Targeted and flushing surveys (GHD)
- 14-18 January 2019 – Bird utilisation 64 fixed-point sites (GHD)
- 21-25 January 2019 – Bird utilisation aerial surveys 18 sites (GHD)

Baseline survey compilation

- 22-30 May 2020 – Bird utilisation 12 fixed-point sites (Nature Advisory)
- 22 September – 1 October 2020 – Bird Utilisation 12 fixed-point sites (Nature Advisory)
- 3-14 December 2020 – Bird Utilisation 12 fixed-point sites (Nature Advisory)
- 1-12 February 2021 – Bird Utilisation 12 fixed-point sites (Nature Advisory)
- 17-28 August 2021 – Bird Utilisation 12 fixed-point sites (Nature Advisory)
- 21 September – 2 October 2021 – Bird Utilisation 12 fixed-point sites (Nature Advisory)
- 14-20 December 2021 – Bird Utilisation 12 fixed-point sites (Nature Advisory)
- 1-6 February 2022 – Bird Utilisation 12 fixed-point sites (Nature Advisory).

2.1.3. Bat Surveys

Bats were surveyed using stationary ultrasonic bat detectors (bat utilisation surveys) and harp trapping.

Bat detector surveys were conducted using Anabats set at 28 sites. They were placed based on habitat type at 1-2m height and left over-night. Recorded echolocation calls were analysed by a specialist sub-consultant. Harp trapping was undertaken using six two-bank harp traps set in suitable habitat for conservation significant microbat species (GHD 2020a). Dates the Anabats and harp traps were deployed included the following.

- 12-15 December 2011 & 21-23 November 2012 – Bat Utilisation (Anabats) 5 sites (AECOM)
- 23-27 October 2018 –Bat Utilisation (Anabats) 5 sites (EHP)
- 14-18 January 2019 – Bat Utilisation (Anabats) 8 sites & 2 nights of spotlighting (GHD)
- 21-25 January 2019 – Bat Utilisation (Anabats) 10 sites & 2 nights of spotlighting (GHD)
- 4-8 February 2019 – Bat Utilisation (Anabats) repeated at 15 sites, harp traps at 12 sites & 2 nights of spotlighting (GHD).

Further pre-construction bat surveys were conducted by Nature Advisory at 7 fixed points within the project area. These surveys were completed across 4 seasons including: 2021 mid dry, 2021 late dry, 2021 early wet, 2022 mid wet using ultrasonic bat detectors. The aim of these surveys was to identify the assemblage of microbats (laryngeal-echolocating, insectivorous free-ranging bats) present at proposed wind turbine locations within the project area and allow for seasonable changes in microbat assemblage to be recorded. The microbat surveys assist with meeting Commonwealth and State approval conditions requiring pre-construction bat monitoring (Table 1).

Echolocation calls produced by microbats were recorded using ultrasonic bat detectors (Wildlife Acoustics Song Meter Mini Bat units). Detectors were secured to trees or stumps approximately 1.5 metres above ground level with the microphone directed towards potential microbat flyways (more open areas within habitat that microbats tend to fly back and forth along). Detectors were programmed to commence recording at sunset and cease at dawn, during which time detectors were triggered by ultrasonic noise and then recorded in full spectrum format. Each recording captured detector details, date and time and was written onto a SanDisk memory card.

Dates the bat detectors were deployed included:

- 16-28 August 2021 at 7 fixed-point sites (Nature Advisory)
- 20 September – 3 October 2021 at 7 fixed-point sites (Nature Advisory)
- 13–20 December 2021 at 7 fixed-point sites (Nature Advisory)
- 31 January – 7 February 2022 at 7 fixed-point sites (Nature Advisory).

The locations of bat survey sites are presented in Figure 1 as Song Meter Points. Recordings will be analysed to determine microbat species present at survey points. The results will be provided prior to project commissioning.

Vehicle based spotlighting and stationary dusk surveys at higher elevation were undertaken to target species of flying-fox, namely, the Grey-headed Flying-fox. Each watch was done by two observers for one hour. Coinciding with this, nocturnal active searches and call playback were done

for owls and nightjars, targeting the Powerful Owl. All observations and incidental finds were recorded. Spotlighting took place on two nights during the following periods.

- 26 October - 1 November 2018 (GHD)
- 14-18 January 2019 (GHD)
- 21-25 January 2019 (GHD)
- 4-8 February 2019 (GHD).

2.1.4. Before and After Control Impact Analysis

The pre-construction bird and bat utilisation surveys are designed to be statistically robust and in compliance with the Queensland State code 23: Wind farm development planning guidelines (DILGP 2022). The surveys are designed for a 'Before and After Control Impact' (BACI) analysis, using quantitative data from both reference (control) and impact (treatment) predetermined locations. Reference sites are at a sufficient distance from the proposed turbine locations to obtain data outside the zone of influence of the turbines. For the BUS, each fixed point is assessed twice during four daily periods (early morning, late morning, early afternoon, late afternoon), resulting in eight observation periods per site per survey. Post-construction surveys will be conducted at the same locations for two years using the same methodology (see Section 5). The comparative analysis will provide descriptive and quantitative analysis on changes in species diversity and composition from before to after construction.

2.2. Pre-construction survey results

2.2.1. Birds

Across all pre-construction bird surveys within the project site (includes both MacIntyre and Karara Wind Farms), 182 bird species were recorded (AECOM, GHD, EHP, Nature Advisory). Species with the most observations included Noisy Miner *(Manorina melanocephala),* Weebill (*Smicrornis brevirostris*), Noisy Friarbird (*Philemon corniculatus*), Torresian Crow *(Corvus orru),* Australian Magpie (*Cracticus tibicen*), Little Lorikeet *(Glossopsitta pusilla)*, Peaceful Dove *(Geopelia striata)*, Scaly-breasted Lorikeet *(Trichoglossus chlorolepidotus),* Common Bronzewing *(Phaps chalcoptera),* Yellow-faced Honeyeater *(Caligavis chrysops),* Superb Fairy-wren *(Malurus cyaneus)* and Grey Shrike-thrush *(Colluricincla harmonica)* (Nature Advisory 2021a, Nature Advisory 2022, GHD 2020a). Within the project site, 149 bird species were recorded by Nature Advisory across eight seasons of BUS (Nature Advisory 2022 – Appendix 2).

Fourteen species of raptor were recorded within the project site. The most common raptor species recorded included the Wedge-tailed Eagle *(Aquila audax),* Nankeen Kestrel *(Falco cenchroides),* Whistling Kite *(Haliastur sphenurus*), Little Eagle (*Hieraaetus morphnoides*), and Brown Falcon (*Falco berigora*). During the 24 months of pre-construction BUS conducted by Nature Advisory, 112 raptor observations were documented, with 65% of these observations (i.e. 73) corresponding to birds flying at or above RSA height.

The majority of bird observations (92%) recorded at the project area occurred below RSA height. One listed species was observed flying at RSA height, the White-throated Needletail *(Hirundapus caudacutus).* The five most abundant species recorded flying at RSA height at 'impact points' during Nature Advisory pre-construction BUS included: White-throated Needletail, White-browed Woodswallow (*Artamus superciliosus*), Torresian Crow, Australian Raven (*Corvus coronoides*), and Wedge-tailed Eagle.

2.2.2. Bats

During GHD field surveys (2018-2020), 15 microbat species were identified from the anabat recorders and harp traps. Previously, 10 of those microbat species were recorded during AECOM bat surveys (2011-2012). The bat call analyses revealed the most common microbat species to be Little Forest Bat *(Vespadelus vulturnis),* Eastern Free-tailed Bat (*Ozimops ridei*), Yellow-bellied Sheath-tailed Bat *(Saccolaimus flaviventris),* Little Broad-nosed Bat *(Scotorepens greyii)* and Bristle-faced Freetailed Bat *(Stirostris eleryi).* One Little Red Flying-fox *(Pteropus scapulatus)* was recorded flying at approximate RSA height. No Grey-Headed Flying-fox or other listed bat species were observed during field surveys.

2.2.3. Likelihood of occurrence assessment

Seven bird species and one bat species of conservation significance were known to be present or assessed as being likely to occur within the project area. Field surveys confirmed the presence of the following listed species:

- Squatter Pigeon
- White-throated Needletail
- Glossy Black Cockatoo.

Species considered as potentially occurring based on database searches and habitat suitability include the following:

- Regent Honeyeater
- Painted Honeyeater
- Swift Parrot
- Powerful Owl
- Grey-headed Flying Fox.

In addition, the EPBC Act Project Matters Search Tool (PMST) identified seven migratory species as potentially occurring within the Project area, including the following.

- Fork-tailed Swift
- Oriental Cuckoo
- White-throated Needletail
- Black-faced Monarch
- Yellow Wagtail
- Satin Flycatcher
- Rufous Fantail.

The likelihood of occurrence of these state and Commonwealth-listed species on the wind farm site, having regard to the habitats present and the species' habitat preferences, are discussed in Sections 2 and 3. A more detailed discussion on Regent Honeyeater, Painted Honeyeater, Swift Parrot and White-throated Needletail is provided below.

2.2.4. Targeted surveys for listed species

Specific assessments were carried out for key listed threatened and migratory birds with potential to occur in the Project area. The species of concern are listed below, including their status under the EPBC Act.

- Regent Honeyeater (*Anthochaera phrygia*) - Critically Endangered
- Painted Honeyeater (*Grantiella picta)* - Vulnerable
- Swift Parrot (*Lathamus discolor)* - Critically Endangered
- White-throated Needletail (*Hirundapus caudacutus*) – Migratory and Vulnerable

A report titled "*MacIntyre Wind Farm - EPBC Act threatened birds - habitat and regional assessment and targeted surveys*" (Nature Advisory 2021b; Appendix 1) has been prepared. This report was based on data obtained from a review of background information, including documents prepared under the EPBC Act and previous ecological reporting for the study area, as well as field surveys conducted by Nature Advisory Pty Ltd between the 22nd and 30th of May, 15th and 19th of June and 21st and 24th of July, 2020, the period when these species were most likely to occur in the region.

Previous records and reports indicate that the targeted listed species occur in the region at times. While extensive clearing has occurred within the study area, patches of remnant vegetation remain, some of which provide habitat for one or more of the targeted species. The quality and extent of this habitat has been characterised and mapped.

Surveys found: Regent Honeyeater habitat (8.060 hectares, which is also considered habitat critical to the survival of the species), Painted Honeyeater habitat (19.677 hectares) and Swift Parrot habitat (12.423 hectares). This has been mapped within the development footprint. These areas represent a small proportion of the development footprint and study area. The White-throated Needletail is almost exclusively aerial in Australia, therefore, it is anticipated to utilize any airspace above the project site.

The results of these surveys, including background information and confirmed presence of species and their habitats extent, were used to inform the Risk Assessment presented in Section 3.

3. Bird and Bat Risk Assessment

3.1. Objectives

The aim of this risk assessment is to guide the development of the BBAMP for the project by identifying those species or groups considered potentially at risk from either collision with turbine blades or disturbance by operating turbines. The outcomes of this risk assessment enable more targeted monitoring and management measures to be included, focussing on species and groups at greater risk.

Wind farm impacts on birds and bats can arise from three potential pathways listed below.

- Direct collision of birds and bats with transmission lines and towers or turbine blades at RSA heights.
- Indirect impacts, including:
  - Disturbance effects that exclude birds and bats from habitat; and
  - Barrier effects that limit bird and bat movements between essential resources, such as foraging and roosting areas.

The risk assessment has followed the procedure for risk assessment of AS/NZS ISO 31000 2009. The assessment has been undertaken as follows.

- Species or groups of concern have been short-listed based on their likelihood of occurrence in the Project area
- Two impact pathways have been assessed: a) collision with turbine blades; and b) indirect effects (including both disturbance and barrier effects)
- Impact likelihood criteria have been developed and applied to each impact pathway for each species or group of concern
- Impact consequence criteria have been developed and applied to each impact pathway for each species or group of concern
- The risk level for each species or group of concern from the two impact pathways has been determined consistent with a risk matrix (Table 5).

This risk assessment considers barotrauma for bats as a direct result of turbine blades at RSA in the same way as collisions, and does therefore not address this aspect of risk as a separate issue.

3.2. Information sources

To ascertain the species of concern that may occur on the project area the following sources were used.

- The Queensland Government Wildlife Online search database (Department of Environment and Science (DES) 2020 using a 60km search region centred over the Project area, with a central point of latitude and longitude of: -28.3997, 151.5989
- The EPBC Act Protected Matters Search Tool (PMST) (DOEE 2020) using a search region that included the project area, with a 20km radius from the central point of latitude and longitude of -28.3997, 151.5989
- The Ecological Assessment Report for the Project (GHD 2020b)

- The Bird Utilisation Survey Baseline Report for the Project (Nature Advisory 2021a – Appendix 2)
- The EPBC Act threatened birds - habitat and regional assessment and targeted surveys for the Project (Nature Advisory 2021b – Appendix 1).

3.3. Species and groups of concern

Species of concern include the following.

- Bird and bat species occurring in MacIntyre Wind Farm listed as threatened or migratory under legislation NC Act and/or the EPBC Act.
- Species for which 0.1% or more individuals of their flyway populations (where known) occurs within the project area and may exhibit 'risk behaviour'[2], potentially interacting with operating turbines

From the foregoing information sources, a list of species with potential to occur in the search region was generated. Of these, a shortlist of species of concern was then generated based on the likelihood of occurrence on the project area itself given the habitat present and occurrence of the species in the search region.

The original site assessments (GHD 2020a) identified listed threatened and migratory species likely to occur on the Project area, some of which were detected during on-site fauna survey work. Further to these listed species, a number of additional taxa potentially susceptible to collisions, including non-listed species, have been identified in the current review that were not originally considered.

Experience at other wind farms in Australia has shown that some microbats, such as the Gould's Wattled Bat and various raptor species, particularly Wedge-tailed Eagle, are more susceptible to collision with turbine blades due to their flight behaviour (Nature Advisory data). As such, these two species have been included as species of concern in the risk assessment.

The short-listed species and groups are given in Table 2.

[2] Defined as a number equal or more than 0.1% of the estimated total population, flying within 400m or between turbines at RSA height.

Table 2: Risk assessment - Assessed bird and bat species

EPBC Act listed migratory species
▪ Common Sandpiper ▪ Curlew Sandpiper ▪ Fork-tailed Swift ▪ Latham's Snipe ▪ Osprey ▪ Pectoral Sandpiper ▪ Rufous Fantail ▪ Satin Flycatcher ▪ Sharp-tailed Sandpiper
EPBC Act listed threatened birds
▪ White-throated Needletail (EPBC: Vulnerable)
EPBC Act and NC Act listed threatened birds
▪ Australian Painted Snipe (NC Act & EPBC: Endangered) ▪ Painted Honeyeater (NC Act & EPBC: Vulnerable) ▪ Red Goshawk (NC Act: Endangered & EPBC Act: Vulnerable) ▪ Regent Honeyeater (NC Act: Endangered & EPBC Act: Critically endangered) ▪ Squatter Pigeon (NC Act & EPBC: Vulnerable) ▪ Swift Parrot (NC Act: Endangered & EPBC Act: Critically endangered)
NC Act listed threatened birds
▪ Glossy Black-Cockatoo (NC Act: Vulnerable) ▪ Powerful Owl (NC Act: Vulnerable)
EPBC and NC Act listed threatened bats
▪ Corben's Long-eared Bat (NC Act & EPBC: Vulnerable) ▪ Grey-headed Flying-Fox (EPBC: Vulnerable) ▪ Large-eared Pied Bat (NC Act & EPBC: Vulnerable)
Other species or groups of species of concern (i.e. common species)
▪ Yellow-bellied Sheathtail Bat ▪ Little Red Flying-Fox ▪ White-striped Freetail Bat ▪ Gould's Wattled Bat ▪ Wedge-tailed Eagle ▪ Other raptor species (including: Black Kite, Brown Falcon, Brown Goshawk, Little Eagle, Nankeen Kestrel, Pacific Baza, Peregrine Falcon, Square-tailed Kite and Whistling Kite)

The risk assessment process was applied to all the foregoing species and groups.

3.4. Methodology

The risk assessment process was based on the Risk Evaluation Matrix Model used to measure the overall risk of a potential impact event, in this case birds or bats striking turbine blades or being deterred from using part of the wind farm due to disturbance. The assessment is based on the *likelihood* of that event and, should it occur, its *consequences*. This model is currently used across a wide range of industry sectors, for assessing environmental risk. The Risk Evaluation Matrix Model complies with the ISO31000 Risk Assessment Standard.

The assessment requires criteria to be developed for likelihood and consequence. These criteria are provided respectively in Table 3 and Table 4. Table 5 shows the risk levels used and how they are determined from the assessed likelihood and consequence levels.

Table 3: Likelihood criteria for a risk event to occur

Likelihood	Description
Certain	It is very probable that the risk event could occur in any year (>95%)
Almost Certain	It is more probable than not that the risk event could occur in any year (>50%)
Likely	It is equally probable that the risk event could or could not occur in any year (50%)
Unlikely	It is less probable than not that the risk event could occur in any year (<50%)
Rare	It is improbable that the risk event could occur in any year. (<5%) The risk event is only theoretically possible or would require exceptional circumstances to occur.

Table 4: Consequence Criteria

Negligible	Low	Moderate	High	Severe
Occasional individuals lost but no reduction in local or regional population viability.	Repeated loss of small numbers of individuals but no reduction in local or regional population viability.	Moderate loss in numbers of individuals, leading to minor reduction in localised or regional population viability for between one and five years.	Major loss in numbers of individuals, leading to reduction in regional or state population viability for between five and ten years.	Extreme loss in numbers of individuals, leading to reduction in regional or state population viability for a period of at least 10 years

Table 5: Risk matrix defining risk level based on likelihood and consequence

		Consequence				
		Negligible	*Low*	*Moderate*	*High*	*Severe*
Likelihood	*Certain*	*Negligible*	*Low*	*High*	*Severe*	*Severe*
	Almost Certain	*Negligible*	*Low*	*Moderate*	*High*	*Severe*
	Likely	*Negligible*	*Low*	*Moderate*	*High*	*High*
	Unlikely	*Negligible*	*Negligible*	*Low*	*Moderate*	*High*
	Rare	*Negligible*	*Negligible*	*Negligible*	*Low*	*Low*

The relevant likelihood and consequence levels were determined by using data recorded from the project area and with reference to any available information on the local, regional and wider status of the species and bird groups concerned. It also was informed by previous Nature Advisory monitoring at over 17 wind farms in eastern Australia and the carcass data generated over the last 15 years at those wind farms.

3.5. Results

Table 6 provides the results of the initial likelihood and consequence assessment based on the inputs from the aforementioned sources and includes the following information as part of the risk assessment process.

- Species or group;
- Reasons for inclusion;
- Threatened species status;
- Hazard or source event (i.e. turbine collision or indirect disturbance);
- Likelihood and consequence scores for each hazard;
- Risk rating; and
- Comments relating to risk rating scores.

Table 6 includes a summary of the previous findings for each considered species or group and their relevance to the assessment.

The RSA for turbines at the MacIntyre Wind Farm site is planned to be a minimum of 60 metres above the ground to 230 metres above the ground. Given that the vast majority of birds and bats generally fly within tree canopy height or lower (below 30 metres above the ground) the risk of collision is lower than that of turbines with RSA height below 30 metres.

The risk associated with wind turbine collision and indirect effects at the MacIntyre Wind Farm for most assessed bird and bat species was rated as negligible. The exceptions are described below.

The White-throated Needletail flies regularly at turbine height and flocks may pass over and through the study area during their non-breeding season (October to April). Impacts on the White-throated Needletail have been recorded at wind farms elsewhere in eastern Australia. Thus, the assessment of this species as at low risk is based on the implementation of appropriate mitigation measures, if impacts occur, to ensure there is no significant impact on this species.

Given the occurrence of collisions involving Wedge-tailed Eagle (WTE) at many wind farms, this species is addressed in this risk assessment. WTEs occur at most wind farms, and their behaviour does not appear to be adversely affected, even successfully breeding within 200 metres of operating turbines (BL&A, unpubl. data). Thus, risks to this species arise from likely collisions but not indirect disturbance. The risk to the WTE was therefore considered to be low.

Based on data from other wind farms in eastern Australia, collisions of other raptor species are likely. Commonly occurring raptor species recorded to collide with turbines include Nankeen Kestrel and Brown Falcon (BL&A, unpubl. data). Both these species and Brown Goshawk, Pacific Baza, Black Kite, Little Eagle, Peregrine Falcon, Square-tailed Kite, and Whistling Kite are recorded at the project site and should be added to this group of concern. These species appear not to be deterred by the presence of operating wind turbines. Overall, the risk from collision with turbines

to these raptors is low as these species are generally widespread and common, making population impacts unlikely.

Two Critically Endangered species under the EPBC Act, the Regent Honeyeater and Swift Parrot have been assessed as having a 'low risk' of colliding with turbines at the project site. Records of these species are scarce in the project area and may only be present on rare occasions, following large-scale nomadic movements in search of food resources. During these movements it is possible that they may fly at RSA height, however it is considered that flight at canopy height is more typical. Any collision with either species would have serious consequences given the small size of both populations.

The Powerful Owl is also at low risk of collision with turbines at the project site. Suitable habitat for this species occurs on and adjacent to the project area in the form of eucalypt woodlands. There are areas of suitable habitat along the eastern boundary of the MacIntryre Wind Farm site in the old growth forest/woodland habitat that is connected to Durikai State Forest. Dispersing juvenile owls may fly longer distances, including over open country

The White-striped Freetail Bat is common and widespread across eastern Australia and is not listed as threatened. This species has been recorded on the site and has been regularly recorded colliding with turbines at other wind farms in eastern Australia. It is expected that there will be collisions with turbines and therefore is at low risk, with minor impacts on the local population.

Table 6: Risk Assessment for birds and bats at MacIntyre Wind Farm

Common Name	Reason for inclusion	Listed species status	Hazard or source event	Likelihood of risk event	Consequence	Risk rating	Comments
Birds							
Australian Painted Snipe *(Rostratula australis)*	Species or species habitat likely to occur	NC Act & EPBC Act: Endangered	Collision with operating turbine	Rare	Moderate	Negligible	This species is widespread throughout QLD though is rare usually being recorded in the Murray-Darling Basin. Generally, inhabits shallow terrestrial freshwater 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; often with scattered clumps of lignum or cane grass or sometimes tea-tree (Melaleuca). Sometimes utilises areas that are lined with trees, or that have some scattered fallen or washed-up timber (DAWE 2020). It has not been recorded from the project area or in the search region. This species is considered highly unlikely to occur and unlikely to collide with turbines is unlikely to be subject to any indirect disturbance.
			Indirect disturbance including barrier effects	Rare	Moderate	Negligible	
Common Sandpiper *(Actitis hypoleucos)*	Species or species habitat likely to occur	EPBC Act: Migratory NC Act: Special least concern	Collision with operating turbine	Rare	Negligible	Negligible	This species inhabits a wide range of coastal or inland wetlands with varying levels of salinity; mainly muddy margins or rocky shores of wetlands (Higgins & Davies 1996). In eastern Australia usually occur along the coastline. No suitable habitat on site and it has not been recorded on the project area or in the search region. It is considered unlikely to collide with turbines or be subject to any indirect disturbance.
			Indirect disturbance including barrier effects	Rare	Negligible	Negligible	
Curlew Sandpiper *(Calidris ferruginea)*	Species or species habitat likely to occur	EPBC Act: Critically endangered & migratory NC Act: Endangered	Collision with operating turbine	Rare	Negligible	Negligible	This species occurs along the coast or on large inland lakes and swamps (Higgins and Davies 1996). No suitable habitat occurs on site and it has not been recorded in the project area or in the search region. It is considered unlikely to collide with turbines or be subject to any indirect disturbance.
			Indirect disturbance including barrier effects	Rare	Negligible	Negligible	
Fork-tailed Swift *(Apus pacificus)*	Species or species habitat likely to occur	EPBC Act: Migratory NC Act: Special least concern	Collision with operating turbine	Likely	Low	Low	This species is known to follow storm systems and fronts. It typically flies at and above RSA height. Loss of a small number of individuals each year is not considered to be of significance as the species is still numerous in Australia. This species has not been recorded on the site though has been recorded within the 60km search radius and is considered likely to occur there regularly during the non-breeding season. This species will fly between turbines, which are not considered to cause any indirect disturbance.
			Indirect disturbance including barrier effects	Unlikely	Low	Negligible	
Glossy Black-Cockatoo *(Calyptorhynchus lathami)*	Species or species habitat likely to occur	NC Act: Vulnerable	Collision with operating turbine	Unlikely	Low	Negligible	The Glossy Black-Cockatoo typically feeds on the cones of she-oak trees, nests in hollows in eucalypts and usually flies at or below canopy height. This species has been recorded in the project area and in the surrounding search region. It has been observed in close proximity (100 m) to turbines on other wind farms in eastern Australia with no recorded collision incidents. It is considered unlikely that this species would fly into turbines or that the turbines would cause any kind of indirect disturbance.
			Indirect disturbance including barrier effects	Unlikely	Low	Negligible	
Latham's Snipe *(Gallinago hardwickii)*	Species or species habitat likely to occur	EPBC Act: Migratory	Collision with operating turbine	Unlikely	Low	Negligible	Latham's Snipe breeds mostly in Japan and migrates to Australia from late August and stays until March. While in Australia it occupies wetlands and roosts in nearby dense vegetation during the day. It may occur in very small patches of habitat, such as alpine bogs and roadside ditches (Higgins and Davies 1996). Some birds may pass through the project area stopping at vegetated farm dams, but the area provides no extensive habitat so visits are likely to be rare. It is therefore considered to be unlikely to collide with turbines in the area or be disturbed indirectly. Should a collision occur, there would be little impact on the overall population, estimated at a minimum 25,000 birds (Wetlands International 2018).
			Indirect disturbance including barrier effects	Unlikely	Low	Negligible	
Osprey *(Pandion haliaetus)*	Species or species habitat likely to occur	EPBC Act: Migratory NC Act: Special least concern	Collision with operating turbine	Unlikely	Negligible	Negligible	The Osprey is a water dependant raptor that favours coastal areas, typically large river mouths, lagoons and lakes (OEH 2020). No suitable habitat occurs on site and it has not been recorded in the project area or in the search region. It is considered unlikely to collide with turbines or be disturbed indirectly.
			Indirect disturbance including barrier effects	Unlikely	Negligible	Negligible	
Painted Honeyeater *(Grantiella picta)*	Species or species habitat likely to occur	NC Act & EPBC Act: Vulnerable	Collision with operating turbine	Unlikely	Low	Negligible	This species is strongly associated with mistletoe around the margins of open forests and woodlands; it occurs from Gulf of Carpentaria to southern Victoria and eastern South Australia, mostly inland of the Great Divide (Higgins *et al*. 2001). It has not been recorded on the project area and only a single record has been documented from the search
			Indirect disturbance including barrier effects	Unlikely	Negligible	Negligible	

Common Name	Reason for inclusion	Listed species status	Hazard or source event	Likelihood of risk event	Consequence	Risk rating	Comments
							region. This species usually flies within the tree canopy so would be unlikely to be affected by turbines and would rarely visit the project area.
Pectoral Sandpiper *(Calidris melanotos)*	Species or species habitat likely to occur	EPBC Act: Migratory NC Act: Special least concern	Collision with operating turbine	Rare	Negligible	Negligible	This species occurs along the coast or on large inland lakes and swamps. It has not been recorded on the project area or in the search region. It is unlikely to collide with turbines or be subject to indirect disturbance.
			Indirect disturbance including barrier effects	Rare	Negligible	Negligible	
Powerful Owl *(Ninox strenua)*	Species or species habitat likely to occur	NC Act: Vulnerable	Collision with operating turbine	Likely	Low	Low	Suitable habitat for this species occurs on and adjacent to the project area in the form of eucalypt woodlands. It is known to occur in the Durikai State Forest to the east and no individuals were detected during field surveys (GHD 2020a). There are areas of suitable habitat along the eastern boundary of the MacIntryre Wind Farm site in the old growth forest/woodland habitat that is connected to Durikai State Forest. A total of 20 turbines are currently proposed in this habitat which increase the risk of collision with this species. For most of its life, the Powerful Owl restricts its activities to forested habitat and does not fly often over open country (Higgins 1999; Soderquist *et al*. 2002). Dispersing juvenile owls may fly longer distances, including over open country. With proposed turbines located within old growth woodland it is likely that a collision may occur, indirect disturbance from turbines may be less of a problem.
			Indirect disturbance including barrier effects	Unlikely	Low	Negligible	
Red Goshawk *(Erythrotriorchis radiatus)*	Species or species habitat likely to occur	EPBC Act: Vulnerable NC Act: Endangered	Collision with operating turbine	Unlikely	Low	Negligible	This raptor is sparsely distributed from northern Western Australia to north-eastern Queensland and formerly south to north-east New South Wales. It occurs in open woodland and forest habitats preferring habitats with high abundance of birds as a food source, permanent water and are often found in riparian habitats along watercourses (OEH 2020). Suitable habitat is limited on the project area and it is unlikely to occur. It has not been recorded on the project area or in the surrounding search region. It is unlikely to collide with turbines or to be subject to indirect disturbance.
			Indirect disturbance including barrier effects	Unlikely	Low	Negligible	
Regent Honeyeater *(Anthochaera phrygia)*	Species or species habitat likely to occur	EPBC Act: Critically endangered NC Act: Endangered	Collision with operating turbine	Rare	High	Low	Inhabits dry eucalypt forests and River Sheoak near rivers and creeks on inland slopes of the Great Dividing Range (DAWE 2020). It has been recorded once in the project area in 1995 (S Debus 2021, pers. comm. 8 February) and there are several records on neighbouring land. In the rare event that a Regent Honeyeater would collide with a turbine the consequences would be high due to the small population of this species. A collision would be unlikely due to the low occurrence of the species in the area and the fact that the species rarely flies at RSA. However, as a migratory species it may travel at greater heights. It is unlikely that the proposed wind farm would cause any indirect disturbance to this species.
			Indirect disturbance including barrier effects	Unlikely	Low	Negligible	
Rufous Fantail *(Rhipidura rufifrons)*	Species or species habitat likely to occur	EPBC Act: Migratory NC Act: Special least concern	Collision with operating turbine	Unlikely	Low	Negligible	Occurs in wetter forests, woodlands and gullies along the coast and ranges along the eastern seaboard of mainland Australia. Sometimes occur on the inland slopes, especially on migration (Higgins *et al*. 2006). No records on site though there are several observations from the search region. This species usually forages in the foliage or understorey layers and given limited suitable habitat it is unlikely to be impacted by turbines.
			Indirect disturbance including barrier effects	Unlikely	Low	Negligible	
Satin Flycatcher *(Myiagra cyanoleuca)*	Species or species habitat likely to occur	EPBC Act: Migratory NC Act: Special least concern	Collision with operating turbine	Unlikely	Low	Negligible	This species occurs in forest and woodlands along the eastern seaboard of Australia including Tasmania (Higgins *et al*. 2006). After breeding in south-eastern Australia, it migrates to north Queensland and New Guinea during autumn and winter. Has been recorded in the project area on one occasion (GHD 2020a). This species is fairly common and so any collisions with turbines at the project area is unlikely to cause measurable impacts to its population. Indirect disturbance is considered to be unlikely as the site is outside its usual migration route.
			Indirect disturbance including barrier effects	Unlikely	Low	Negligible	
Sharp-tailed Sandpiper *(Calidris acuminata)*	Species or species habitat likely to occur	EPBC Act: Migratory NC Act: Special least concern	Collision with operating turbine	Rare	Negligible	Negligible	This species occurs along the coast or on large inland lakes and swamps (Higgins and Davies 1996). No suitable habitat occurs on site and it has not been recorded on the project area or in the search region. It is considered unlikely to collide with turbines or to be indirectly disturbed by the project.
			Indirect disturbance including barrier effects	Rare	Negligible	Negligible	
	Species or species habitat likely to occur	NC Act & EPBC Act: Vulnerable	Collision with operating turbine	Unlikely	Low	Negligible	This species inhabits terrestrial environments in tropical open dry woodlands and less often in savanna (Higgin and Davies 1996). This species has been recorded on site and in

Common Name	Reason for inclusion	Listed species status	Hazard or source event	Likelihood of risk event	Consequence	Risk rating	Comments
Squatter Pigeon (southern subspecies) *(Geophaps scripta scripta)*			Indirect disturbance including barrier effects	Unlikely	Low	Negligible	the search region. It spends the majority of its time on the ground, is not typically a high-flying bird and is considered unlikely to collide with turbines or be subject to any indirect disturbance.
Swift Parrot *(Lathamus discolor)*	Species or species habitat likely to occur	EPBC Act: Critically endangered NC Act: Endangered	Collision with operating turbine	Rare	High	Low	The species breeds in Tasmania and migrates to the mainland of Australia in April. There are records of it occurring in QLD in some years during the non-breeding season (DAWE 2020). It spends winter inland of the Great Divide feeding on eucalypts, particularly Mugga Ironbark and box species. It has not been recorded on the project area though there are several records from the search region. This species has the potential to occur in the project area. This species generally flies at and below canopy height and collision is considered unlikely. Furthermore, the turbines are unlikely to cause any indirect disturbance. Any collision would have serious consequences given the small size of the population.
			Indirect disturbance including barrier effects	Unlikely	Low	Negligible	
Wedge-tailed Eagle *(Aquila audax)*	Species or species habitat likely to occur	N/A	Collision with operating turbine	Almost certain	Low	Low	The Wedge-tailed Eagle is the species most exposed to collision risk due to its common habit of soaring and circling at height while foraging. Several birds of this species have been struck at other wind farms in eastern Australia. Disturbance is not an issue, with the eagle breeding successfully as close as 200 metres from operating wind turbines.
			Indirect disturbance including barrier effects	Unlikely	Negligible	Negligible	
White-throated Needletail *(Hirundapus caudacutus)*	Species or species habitat likely to occur	EPBC Act: Vulnerable and Migratory NC Act: Vulnerable	Collision with operating turbine	Likely	Low	Low	This species is known to follow storm systems and fronts. Occasional mortality has been reported at other wind farms where it occurs (Nature advisory, pers. obs.). It typically flies at and above RSA height.. This species has recently been uplisted from Vulnerable to endangered under the EPBC Act and the population estimated is41,000 individuals (Garnett and Baker 2021). As such a loss of 0.1% of the population or 41 individuals has been adopted by the DCCEEW as a significant impact to the species. It has been recorded in the project area and in the search region and is considered likely to occur during the non-breeding season. If impacts to this species are detected during the operational monitoring, the impact trigger and decision-making framework provided in Section 7 is to be implemented to avoid significant impacts to this species.
			Indirect disturbance including barrier effects	Unlikely	Negligible	Negligible	
Other Raptors	Species or species habitat likely to occur	N/A	Collision with operating turbine	Almost certain	Low	Low	The Black Kite, Brown Falcon, Brown Goshawk, Little Eagle, Nankeen Kestrel, Pacific Baza, Peregrine Falcon, Square-tailed Kite and Whistling Kite have been recorded at the project area (GHD 2020a, Nature Advisory 2021a). These species fly at RSA heights and have been known to collide with turbines. The widespread and common status of these species makes population impacts unlikely. These species appear not to be deterred by the presence of operating wind turbines and most species occur regularly at other wind farms in eastern Australia.
			Indirect disturbance including barrier effects	Unlikely	Negligible	Negligible	
Bats							
Corben's Long-eared Bat *(Nyctophilus corbeni)*	Species or species habitat likely to occur	NC Act & EPBC Act: Vulnerable	Collision with operating turbine	Unlikely	Low	Negligible	This species is distributed across the Murray-Darling basin with the Pilliga Scrub region being a stronghold for the species (OEH 2020). It occurs in a wide variety of habitats usually associated with water courses and permanent water (Churchill 2008). It roosts in tree hollows, crevices and under loose bark. This species has not been recorded on the project area or in the search region, though there are some records from state parks further to the west. It is slow-flying and agile, prefers to fly in the understorey foraging on non-flying prey and will even crawl along the ground to hunt (OEH 2020). It is unlikely to fly at RSA height and therefore unlikely to collide with turbines. The turbines are not considered to cause any indirect disturbance.
			Indirect disturbance including barrier effects	Unlikely	Negligible	Negligible	
Gould's Wattled Bat *(Chalinolobus gouldii)*	Species or species habitat likely to occur	N/A	Collision with operating turbine	Almost certain	Negligible	Negligible	A common and widespread species. Juveniles disperse from December or January which may result in higher rates of collision. It nests in tree hollows or buildings and flies within the canopy and sub canopy but will pass over open areas and can forage up to 15km from roosts (Churchill 2008). It has been recorded in the project area and it has been recorded colliding with turbines at other wind farms. As a common and widespread species population impacts are unlikely. The turbines are not considered to cause any indirect disturbance.
			Indirect disturbance including barrier effects	Unlikely	Negligible	Negligible	

Common Name	Reason for inclusion	Listed species status	Hazard or source event	Likelihood of risk event	Consequence	Risk rating	Comments
Grey-headed Flying-Fox *(Pteropus poliocephalus)*	Species or species habitat likely to occur	EPBC Act: Vulnerable	Collision with operating turbine	Unlikely	Low	Negligible	Foraging habitat exists within the project area and it may use the area occasionally as it moves in conjunction with flowering and fruiting seasons. There are two Little Red Flying-Fox camps within 45 km of the project area. Grey-headed Flying-Fox may join these camps from time to time in low numbers but it is unlikely to occur in large numbers. The species flies at RSA height when travelling to foraging sites from roosting sites which could bring it into contact with turbines. Given the low numbers likely to occur on the site, the development is unlikely to have a significant impact on the species' population. Estimates from 2005 of this population total around 674,000 (DAWE 2020) so the potential loss of the occasional individual is unlikely to be of ecological significance. The turbines are not considered to cause any indirect disturbance.
			Indirect disturbance including barrier effects	Unlikely	Negligible	Negligible	
Large-eared Pied Bat *(Chalinolobus dwyeri)*	Species or species habitat likely to occur	NC Act & EPBC Act: Vulnerable	Collision with operating turbine	Unlikely	Low	Negligible	This species has a patchy distribution across Qld in well-timbered areas containing gullies (OEH 2020). It has not been recorded on the project area or in the search region and is considered unlikely to occur (GHD 2020a). They fly relatively slowly at low to mid-canopy level. It is unlikely to collide with turbines and turbines are not considered to cause any indirect disturbance.
			Indirect disturbance including barrier effects	Unlikely	Negligible	Negligible	
Little Red Flying-Fox *(Pteropus scapulatus)*	Species or species habitat likely to occur	N/A	Collision with operating turbine	Likely	Negligible	Negligible	Foraging habitat exists within the project area and it may use the area occasionally as it moves in conjunction with flowering and fruiting seasons. There are two Little Red Flying-Fox camps within 45 km of the project area. This species has been observed foraging in trees in the project area (GHD 2020a). The species flies at RSA height when travelling to foraging sites from roosting sites which could result in collision with turbines. Given the high abundance of this spices across its distribution the potential loss of the occasional individual is unlikely to be of ecological significance. The turbines are not considered to cause any indirect disturbance.
			Indirect disturbance including barrier effects	Unlikely	Negligible	Negligible	
White-striped Freetail Bat *(Austronomus australis)*	Species or species habitat likely to occur	N/A	Collision with operating turbine	Almost certain	Low	Low	This species roosts in trees and is widespread across Qld. It occurs in a variety of habitats, including urban areas, woodland, shrubland, open agricultural land with scattered trees, grasslands and deserts (Churchill 2008). It is fast flying and not designed for manoeuvrability. It often flies at RSA heights. This species has been recorded at the project area after the risk assessment was finalised and it is known to regularly collides with turbines at other wind farms in eastern Australia. Given the high abundance of this species across its distribution the loss of individuals is unlikely to pose a significant risk to the species' population. The turbines are not considered to cause any indirect disturbance.
			Indirect disturbance including barrier effects	Unlikely	Negligible	Negligible	
Yellow-bellied Sheathtail Bat *(Saccolaimus flaviventris)*	Species or species habitat likely to occur	N/A	Collision with operating turbine	Likely	Negligible	Negligible	This species is a wide-ranging bat that occurs across northern and eastern Australia. It more commonly occurs in the northern areas of the country. It roosts in tree hollows, buildings and in treeless landscapes and is known to utilise mammals' burrows (OEH 2020). It forages for flying insects and is known to fly high and fast over the tree canopy (Churchill 2008) and can fly at RSA heights. This species has been recorded from the project area and in the surrounding search region. This puts it at risk of collision with turbines though the risks are considered negligible due to its stable status in Qld. Turbines are not considered to cause any indirect disturbance.
			Indirect disturbance including barrier effects	Unlikely	Negligible	Negligible	

3.6. Summary

Risks to the most of species likely to or with potential to occur in the project area have been assessed as negligible. Six (6) bird species/taxa and one (1) bat species have been identified as having a low risk of being affected by collision with operating turbines once the project is commissioned and turbines are operational. Only five species are listed under the NC Act and/or EPBC Act. Preliminary site and species characterisation for EPBC Act listed threatened species and EPBC Act listed migratory bird or bat species are described below to identify all drivers of presence on the project site and utilisation of the project site.

The following subsections summarise the outcomes of the initial risk assessment (Table 6) and include pertinent observations from all onsite surveys conducted and data analysed up to date.

3.6.1. Wedge-tailed Eagle and other raptors

Species characteristics

Raptors are generally considered at risk of colliding with turbine blades due to their specific flight behaviours, often capable of soaring at RSA heights. Indeed, quantitative studies have shown that the Accipitriformes (diurnal raptors) are the group among birds with the highest rates of collisions (Thaxter *et al.* 2017).

Site characteristics

The WTE has been recorded at the project site. Despite not being listed under the EPBC Act or NC Act, it is exposed to collision risk due to its common habit of soaring and circling at height while foraging. Among raptors, it was the most frequently observed species flying at RSA heights during surveys conducted within the project area (77% of WTE sightings; Nature Advisory 2022 – Appendix 2). Many birds of this species have been struck at other wind farms in eastern Australia. Disturbance by the presence of turbines is thought to not be an issue, with anecdotal evidence of the eagle breeding successfully as close as 200 metres from operating wind turbines (Nature advisory, unpubl. data).

Other raptor species such as Black Kite, Black-shouldered Kite, Brown Falcon, Brown Goshawk, Little Eagle, Nankeen Kestrel, Pacific Baza, Peregrine Falcon Square-tailed Kite and Whistling Kite, observed at the project area, may also be at risk of collision with turbine blades.

Conclusion

As all raptors recorded within the project site are widespread and common species, population consequences are predicted to be low.

3.6.2. Fork-tailed Swift

Species characteristics

Fork-tailed Swift is listed as Migratory under the EPBC Act and mainly prefers open forest or plains. It is almost exclusively aerial and feeds up to hundreds of metres above the ground but can feed among open forest canopies. The species breeds internationally and seldom roosts in trees (Higgins 1999). It begins to arrive in Australia usually from October - November and migrates back to Asia from mid-April (Higgins 1999).

Site characteristics

This species typically flies at and above RSA height. Loss of a small number of individuals each year is not considered to be of significance as the species is still numerous in Australia. This species has

not been recorded in the project area though has been recorded in the broader search region and is considered likely to occur there regularly during the non-breeding season (October to April). This species will fly between turbines, which are not considered to cause any indirect disturbance (Nature Advisory pers. obs. at other wind farms).

Conclusion

This species could be at risk of colliding with turbines due to its aerial behaviour when it occasionally appears in the area. Nonetheless given it is widespread geographically and has a large population, any impacts from the development are likely to be negligible. The low frequency of occurrence makes collecting data for collision risk modelling unfeasible and, given the low risk from the project, unwarranted. If there are further records of this species in the from the BUS surveys generating sufficient data collision risk modelling will be undertaken.

3.6.3. Powerful Owl

Species characteristics

Powerful Owl is listed as Vulnerable under the NC Act but not listed under the EPBC Act. For most of its life, the Powerful Owl restricts its activities to forested habitat and does not fly often over open country (Higgins 1999; Soderquist et al. 2002). Dispersing juvenile owls are likely to fly longer distances, including over open country.

Site characteristics

Suitable habitat for this species occurs on and adjacent to the project area in the form of eucalypt woodlands. It is known to occur in the Durikai State Forest to the east. No individuals were detected during field surveys (GHD 2020a). Areas of suitable habitat occur along the eastern boundary of the MacIntryre Wind Farm site in the old growth forest/woodland habitat that is connected to Durikai State Forest. A number of turbines are currently proposed in this habitat which increases the risk of turbine collision for this species. With proposed turbines located within old growth woodland there is potential for a collision but indirect disturbance from turbines may be less of a problem, evidenced by successful breeding of Powerful Owls in NSW within 1 km of turbines (Nature advisory, pers. obs.).

Conclusion

Probability of collisions with turbines are unlikely due to the lack of records within the project site and surroundings.

3.6.4. Regent Honeyeater

Species characteristics

Regent Honeyeater (RHE) is listed under the EPBC Act as Critically endangered and under the NC Act as Endangered. It is a highly nomadic and mobile species, with a patchy distribution that extends from south-east Queensland to central Victoria. Records are widely distributed across the species' range, but it is only found regularly at a few localities in NSW and Victoria where most of the sightings have been recorded (Department of the Environment 2015a). In QLD RHE is typically a nonbreeding visitor (Higgins et al. 2001). In 2010, there were an estimated 350 – 400 individuals in the wild but only approximately 100 pairs (Kvistad et al. 2015). The adult population has continued to decline over the last decade and has a male-biased sex ratio (Crates et al. 2019, Nature Advisory 2021b). RHE feed on nectar from a range of eucalypts and mistletoe, as well as lerp, honeydew and insects (Oliver 2000).

Site characteristics

The RHE is most commonly associated with box-ironbark eucalypt woodlands, spotted gum-ironbark woodlands and dry sclerophyll forest and seems to prefer more fertile sites with higher soil water content, including creek flats, broad river valleys and lower slopes. Mature, large individual trees tend to be more important as they produce more nectar more reliably. The species also uses road-side remnant vegetation, remnant patches in farmland and urban areas, and travelling stock routes. Nests are typically in the canopy of mature, rough-barked trees such as ironbarks, sheoaks and Rough-barked Apple (*Angophora floribunda*) (Department of the Environment 2015a, 2016; Geering and French 1998; Oliver et al. 1998).

RHE has been recorded once in the project area in 1995 (S Debus 2021, pers. comm. 8 February) and there are several records on neighbouring land, although potential habitat on the site is limited in extent (Appendix 5, Nature Advisory 2021b). High quality habitat for RHE occurs mostly in lowlands and riparian zones within the study area (Appendix 5), particularly along tributaries of MacIntyre Brook, consisting of mature River She-oak and Blakeley's Red Gum riparian strips, with scattered Angophora, Yellow Box and White Box. These riparian zones have connection with the location of known breeding records and sightings directly adjacent to the study area, on the neighbouring property, Glenelg. Some potential habitat, consisting of Ironbark/Box/Lemon-scented Gum woodland habitat is also present.

Conclusion

Probability of collisions with turbines are unlikely due to the limited extent of good habitat, the low frequency of occurrence of the species in the area (Section 3.5) and the species' preference for moving about in the tree canopy lower than RSA height; therefore, significant impacts are considered highly unlikely. However, in the rare event that a RHE collided with a turbine the consequences would be high due to the small population of this species and its critically endangered status. Despite the species rarely being recorded flying at heights within the RSA, its nomadic behaviour makes it possible but not confirmed that it may fly above the tree canopy when moving longer distances. As a precautionary approach, monitoring during the operational phase as proposed in this plan will provide additional informationon the occurrence of the species in the project area and any changes to the current level of risk (Section 5.3.1).

3.6.5. Swift Parrot

Species characteristics

Swift Parrot is listed under the EPBC Act as Critically endangered and under the NC Act as Endangered. This species breeds in Tasmania in summer and the entire population migrates north and leaves the island for the winter. While on mainland Australia, the Swift Parrot typically disperses through Victoria and New South Wales, however, smaller numbers are observed in south-east Queensland on a regular basis (Saunders & Tzaros 2011). The species preferentially forages in large, mature trees in eucalypt forests and woodlands, particularly box-ironbark forest and woodlands as well as grassy woodlands (Saunders & Tzaros 2011). The species exhibits high site fidelity, returning to locations on an irregular cyclic basis (Threatened Species Scientific Committee 2016).

The Swift Parrot population was estimated at 2000 individuals in 2010 (Garnett et al. 2011) but has since declined to approximately 750 individuals (Nature Advisory 2021b).

There is limited information on the flight heights of Swift Parrot, flight height data for a variety of parrot species of south-eastern Australia indicates that parrot species fly within RSA at times, although most

flight heights are recorded below RSA. While foraging, Swift Parrots generally fly within the tree canopy, although while flying between feeding and roosting locations and on migration, the species may fly higher (Smales 2005).

In south-east Queensland, records indicate that Swift Parrot typically feed on lerp and nectar from Yellow Box, Grey Box (*Eucalyptus microcarpa*), Forest Red Gum (*E. tereticornis*) and Swamp Mahogany. There is a strong association between Swift Parrot and Mugga Ironbark, White Box and Spotted Gum elsewhere in their mainland distribution (Saunders & Tzaros 2011). The species has been recorded in Durikai State Forest to the north of the study area.

Site characteristics

High quality habitat was observed in patches throughout the study area (Appendix 6) containing Ironbark–Lemon-scented Gum woodland as well as one patch of Swift Parrot high quality containing White Box in heavy flower with an abundance of Scaly-breasted Lorikeet (*Trichoglossus chlorolepidotus*). This patch may provide higher nectar and lerp yields. Isolated high-quality patches of Mugga Ironbark were present within the study area, however, were not flowering during the survey.

The Swift Parrot habitat within the study area is not considered priority habitat for the species as the patches of Swift Parrot habitat within the study area are:

- not used for nesting with nesting occurring in Tasmania (Saunders & Tzaros 2011);
- not used by large proportions of the Swift Parrot population with no records of the species within the study area from WildNet, Birdata and Atlas of Living Australia databases and following targeted surveys for the species as well as following Bird Utilisation Surveys and fauna surveys throughout the study area (GHD 2020b, Nature Advisory 2020b). It is noted there is high quality Swift Parrot habitat adjacent to Durikai State Forest (as shown in Appendix 6);
- not repeatedly used between seasons (lack of site fidelity) with no records of the species within the study area. It is noted there are some Swift Parrot records within the adjacent Durikai State Forest with records from July 2017 to September 2017, from May 2018 to September 2018 and in June 2021; and
- not used for prolonged periods of time (lack of site persistence) with no records of the species within the study area.

It is noted that the Swift Parrot habitat within the study area may possess phenological characteristics that may support Swift Parrot foraging if sufficient levels of lerp and nectar are available in winter flowering eucalypt species, however, there are no Swift Parrot records within any of these patches (noting that heavy flowering of the winter flowering species White Box was observed in one patch within the study area and outside the development footprint) and high quantities of lerp was not observed in these patches. This indicates that these patches may not produce sufficient levels of lerp and/or nectar to allow the species to forage and are therefore not considered likely to be of importance to the Swift Parrot. As a result of the above, Swift Parrot habitat mapped within the study area is not considered habitat critical to the survival of the species.

Conclusion

It has not been recorded on the site though there are several records from the wider search region. This species has the potential to occur on the site, although suitable and potential habitat is limited in extent (Appendix 6, Nature Advisory 2021b). This species generally flies at and below canopy height and collision is considered unlikely. Furthermore, the turbines are unlikely to cause any indirect

disturbance. Any collision would have serious consequences given the small size of the population and its critically endangered status.

3.6.6. White-throated Needletail

Species characteristics

This species is widespread in eastern and south-eastern Australia and is recorded in all coastal regions of Queensland and NSW, extending inland to the western slopes of the Great Dividing Range and occasionally onto the adjacent inland plains. The species is also widespread in Victoria and Tasmania and occurs in south-eastern South Australia (Threatened Species Scientific Committee 2019).

The White-throated Needletail subspecies that occurs in Australia is *Hirundapus caudacutus caudacutus*. This subspecies is a trans-equatorial migrant that breeds in the Northern Hemisphere summer and migrates south for the Southern Hemisphere summer. The White-throated Needletail is mostly aerial in Australia, flying at heights of less than one metre up to more than 1000 metres above the ground. It has been recorded eating a wide variety of insects, including beetles, cicadas, flying ants, bees, wasps, flies, termites, moths, locusts and grasshoppers (Threatened Species Scientific Committee 2019).

The species occurs over most habitat types and is recorded most often above wooded areas, including open forest and rainforest, and may also fly below the canopy between trees or in clearings. When flying above farmland, it is more often recorded above partly cleared pasture, plantations or remnant vegetation at the edge of paddocks (Threatened Species Scientific Committee 2019).

In Australia, confirmed and high confidence records of White-throated Needletail roosting indicate the species roosts in dense foliage of canopy trees in large tracts of treed remnant vegetation along or contiguous with mountain ranges. The species is also reported to roost in tree hollows (Threatened Species Scientific Committee 2019), bark on trees or rock faces and is likely to have traditional roost sites (Department of the Environment 2015c). It has been noted that the number of references to White-throated Needletail roosting in trees possibly over-emphasizes such occurrences. During extreme conditions including bushfires and cold, hot or inclement weather, the species is also known to take refuge in tree hollows, trees and stunted scrub (Department of Agriculture, Water and the Environment 2021).

White-throated Needletail has been observed in the airspace above the study area at 17 locations during formal BUS surveys and as incidental records.

Site characteristics

No roosting habitat for White-throated Needletail was recorded within the study area when implementing the surveys.

While treed remnant vegetation is present within the study area consisting of low eucalypt woodland on rocky rises, ironbark open woodland, mixed eucalypt woodland/forest and mixed eucalypt woodland on alluvial flats, it did not occur along or was contiguous with a mountain range.

White-throated Needletail have been observed over the study area. Individuals have been recorded flying between 10 metres and 300 metres above ground level (Nature Advisory 2020b). The species has the potential to occur across the entire airspace throughout the study area (Appendix 4).

Noting the species breeds in the Northern Hemisphere and is only present In Australia from October to April, the airspace above the study area may seasonally provide an area for White-throated

Needletail to forage and disperse, with its occurrence being stochastic (based on observations to date). The airspace above the study area represents such a small percentage of available airspace in Australia that the habitat on the site is not critical to the survival of the species.

There is currently no evidence to suggest that White-throated Needletail roosting habitat is present within the study area. The Sundown National Park is located 28 kilometres to the south of the study area contains a large tract of treed remnant vegetation along a mountain range that may provide potential roosting habitat for White-throated Needletail but there is no current evidence of roosting there

Conclusion

The White-Throated Needletail species typically flies at and above RSA height. It has been recorded within the study area and is considered to occur irregularly between October to April. At Australian wind farms, collision related impacts typically involve small number of individuals (Hull *et al*. 2013, TSSC 2019 , Nature Advisory data). However, it is a species that requires mortality monitoring and should mortality be recorded the adaptive management framework in this management plan would be triggered (refer Section 7).

3.6.7. White-striped Freetail Bat

Species/Site characteristics

This species is not listed under the EPBC Act or NC Act, but it is known to be a fast flying species and often flies at RSA heights. This species has been recorded on the site and regularly collides with turbines at other wind farms in eastern Australia.

Conclusion

Given the high abundance of this species across its distribution the loss of individuals is unlikely to pose a significant risk to the species' population. The turbines are not considered to cause any indirect disturbance.

4. Turbine Risk Rating

Condition 37 of the EPBC Act approval (EPBC 2020/8756) requires the BBAMP to assess the long-term risk of the wind turbines. The approach to turbine risk rating is set out in the May 2024 draft guidance from DCCEEW and this is addressed here. Potential impacts to each relevant species through activity / utilisation / patterns / rates ('heat maps') and assignation of a 'low' or 'high' risk for each turbine depending on Collision Risk Modelling (CRM) results are required. The definition of low-risk turbine and high-risk turbine provided in the EPBC Act approval are presented below.

Low-risk Turbine

A low-risk turbine is a wind turbine that has been rated low-risk based on collision risk modelling for EPBC listed bird and bat species.

High-risk turbine

High-risk turbine means a wind turbine that has been identified through collision risk modelling for EPBC Act listed threatened species and EPBC Act listed migratory bird or bat species as being high-risk or from an EPBC Act listed threatened species and EPBC Act listed migratory bird or bat species being detected within the vicinity of the turbine.

The risk assessment provided in Table 6 (refer Section 3.5), determined no species have been assessed to have a greater than low risk. Based on the EPBC Act approval, two (2) species of concern have been discussed further:

- Regent Honeyeater, and
- White-throated Needletail.

Heat maps are constructed using actual detections to produce a visual representation of a given species spatial distribution and density in a defined area. CRM is a process used to predict and assess the likelihood of collisions between wind turbine and flying species. Sufficient baseline data including species abundance, flight patterns, and behaviours of target species in the project area is required to provide reliable CRM results.

Despite the vast number of surveys conducted between 2011 and 2022 across the study area, there is no evidence of the presence of Regent Honeyeater onsite. As such, a heat map and CRM for this species cannot be produced. An alternative approach for determining turbine risk ratings for this species is provided in Section 4.3.

For EPBC Act listed species, the WTNT is the only EPBC Act listed species recorded at the project site during surveys for which a CRM was completed (refer Section 4.1). A heat map for the White-throated Needletail is provided in Appendix 4.

4.1. Collision Risk Model

An initial Collision Risk Model (CRM) for White-throated Needletail has been developed for MacIntyre Wind Farm. The CRM is based on limited observational data gathered during BUS surveys. With the limited available data the CRM by Symbolix predicts potential for an estimate of approximately 54 annual collisions of White-throated Needletails assuming a 98% avoidance rate (Appendix 3).

Data collected for developing the current CRM is based on 20 White-throated Needletail detections over the 80 days of surveys and the statisticians recommended that the number for robust estimations for a CRM is 50-70 detections (See Appendix 3). The small sample size does not reflect

a lack of survey effort; rather, it indicates that the species is relatively rare at the project site (see Appendix 3, Section 3.1). The stochastic nature of its occurrence makes predicting survey effort to meet the required target number of observations difficult. To provide a better understanding of the collision risk and validate the estimates in the context of MacIntyre Wind Farm, further data from operational phase monitoring will be pooled and an updated CRM for this species will be developed (Section 5.3.1). Furthermore, recorded mortality rates can also inform assessment of the scale of impact.

In addition, it is important to note that the CRM is only a theoretical predictive model and its reliability is limited by the limited number of observed occurrences of the species on the site during the two-year bird utilisation survey. In addition, the CRM is highly conservative in nature and the reason for this is that all the parameters estimated as inputs into the model are conservative, i.e. seasonality, flying at night, occupation of the site, etc.

The operational phase monitoring (refer Section 5) will be used to re-evaluate turbine risk rating, and regular validation and update to the CRM. If possible, it may be able to develop an evidence based avoidance rate for the White-throated Needletail.

Early and timely impacts on WTNT mortality will be recorded during carcass searches, with impact triggers and the decision-making framework to be implemented (Section 7.1.2). A significant impact to the species is an impact to 0.1% of the population, being 41 individuals. The adaptive management framework in this plan will ensure timely and appropriate mitigation responses.

4.2. Turbine risk rating for White-throated Needletail

A CRM was undertaken on a preliminary basis for White-throated Needletail (refer Section 4.1 & Appendix 3). Based on the results of the utilisation surveys conducted for the CRM, there were no clear patterns of spatial use other than a flat utilisation pattern by this species across the survey sites. The heat map and distribution of records for White-throated Needletail provide provisional visual support for this conclusion (Appendix 4).

Based on the current results provided by the White-throated Needletail utilisation surveys and CRM results, there is no evidence that a single turbine or cluster(s) of turbines pose a relatively higher risk of collisions than others. Therefore, without any evidence to the contrary, any turbine should be considered equally likely to be involved in a potential collision event with this species.

As such, a low-risk turbine rating has been assigned to all turbines for this species. Turbine risk ratings will be re-evaluated throughout the operational phase monitoring period and updated if required.

4.3. Turbine risk rating for Regent Honeyeater

A CRM was not feasible for the Regent Honeyeater as not a single individual was recorded during the surveys conducted on site. Even by increasing the sampling effort, it is extremely unlikely to achieve a sufficient sample size to run a CRM for this species due to its nomadic behaviour, the very limited potential habitat within the project site, and its relatively low numbers in this northernmost region of its distribution (Higgins *et al*. 2020).

Since a CRM cannot be used to assign differentiated risk levels for wind turbines, an alternative approach is to use historical records and distance to potential suitable habitat. Based on the proposed layout (Figure 1. Proposed layout of MacIntyre Wind Farm), no single turbine or cluster of turbines is considered to impose a higher risk than others, and the overall risk of the project is considered low (see also Section 3.6). This conclusion has been reached based on the criteria described below.

4.3.1. Distance to historical records

The only single historical record at the project site is from 1995 where two individuals were recorded 100 m in from the southern boundary of the study area (S Debus 2021, pers. comm. 8 February 2021). The closest turbine to the location of this record is >4 km north.

4.3.2. Distance to potential suitable habitat

A map of potential habitat is provided in Appendix 5, which only represents 1.4% of the total area of the project site. Furthermore, only 0.8% of the total area is classified as relatively high-quality habitat with a patchy and sparse distribution across the site.

The Regent Honeyeater is considered infrequent and found in relatively low numbers overall in Queensland (Higgins *et al*. 2001, 2020) and it is unlikely to breed within the project site due to the limited potential suitable habitat, the lack of breeding records in the region, and the distant known breeding sites, the closest in the Bundarra-Barraba region (NSW) >260 km southwest of the project (known breeding sites reviewed in Department of the Environment 2015a, 2016).

Despite the abovementioned, a precautionary approach is to assume that there is a possibility that the species may occasionally visit the site, and that breeding events are unlikely but plausible, and that on site it would be mostly utilising woodland patches classified as high-quality habitat. However, the project avoids mapped high-quality habitat, and all turbine locations are considered to be at a safe distance from any Regent Honeyeater high-quality habitat, with the closest turbine approximately 400 m from high-quality habitat. This is considered a safe distance as it is known that breeding birds generally move up to 40-100 m from their nests to forage (Higgins *et al*. 2001).

All turbines have been assigned a low risk rating of potential collisions for this species. Turbine risk ratings will be re-evaluated throughout the operational phase monitoring period and updated if required.

4.4. Turbine Risk Rating Updates

In accordance with condition 43, if during bird and bat utilisation surveys or during any other monitoring or incidental observation during post-commissioning, one or more individuals of an EPBC Act listed threatened species and EPBC Act listed migratory bird or bat species is detected within the vicinity (i.e. defined as within 350 metres radius of the turbine) of a low-risk turbine, this turbine must be revised to be a high-risk turbine. A revised BBAMP reflecting the revised risk rating of turbines must be submitted to the department for the Minister's approval within five business days of such a detection.

5. Operational Phase Monitoring

The main components to implement the BBAMP are summarised below.

- A statistically robust carcass monitoring program (random or stratified random sampling design) to detect birds and bats that collide fatally with operating turbines, as a basis for an estimate of overall bird and bat mortality rates at the project (Section 5.4.8)
- Specific management contingencies for key species and groups identified in the risk assessment and/or initiated due to a specific *impact trigger* (Section 7)
- Mitigation measures to reduce the possible interactions between birds and bats, and operating turbines (Section 7.3).

Section 5 describes the survey methodologies to be implemented once the entire wind farm is commissioned (i.e. all wind turbines are generating electricity for commercial purposes). Formal, turbine searches will commence during the operational phase of the project, however incidental carcass finds during the construction phase will also be reported.

Formal carcass searches (statistically designed sampling) will be carried out for a total of 24 months once all wind turbines are generating electricity for commercial purposes following commissioning. All monitoring data gathered will be compiled after the first and second years BBAMP implementation and impacts and outcomes will be evaluated. The findings will be used to report on the impact of the wind farm on bird and bat species and to determine if further monitoring (or other activities) will be required in subsequent years to address identified risks and impacts.

5.1. Operational Bird Utilisation Surveys

A comprehensive baseline pre-commissioning BUS has been undertaken as outlined above (see Section 2) and baseline report based on a BACI design provided (see Appendix 2).

BUS surveys will be repeated following commissioning of all turbines and when the wind farm is generating electricity for commercial purposes. The first BUS will commence within 2 months of the wind farm being commissioned and the surveys will be completed over a period of at least 24 months using the methodology described in Section 2.1.

BUS surveys will be assessed and reported in the first-year annual report. The analysis of the data from the BUS surveys will be used to determine whether the site continues to be utilised by the range of species identified in the pre-commissioning surveys and assess any changes in abundance or behaviour related to operations, with a focus on the species of concern that are at greater than negligible risk of impact. The surveys have been designed in a method (10 impact points and 2 reference points) that provides comparative statistical analysis of changes. Additional data collected can be used to update or run Collision Risk Models where required and sufficient data is available.

These surveys will seek to demonstrate.

5.1.1. Operational targeted surveys for listed bird species

Operational targeted surveys will be replicated for the Regent Honeyeater, Painted Honeyeater and Swift Parrot using the same survey methods as detailed in the threatened bird assessment report in Appendix 1, as carried out during the surveys conducted in the pre-construction phase (Section 2.2.4). These surveys will be replicated during the first year of operation and reported along with the first-year annual BUS report.

5.2. Operational Bat Utilisation Surveys

Bat utilisation surveys will be repeated following commissioning of all turbines and when the wind farm is generating electricity for commercial purposes. Survey methodology will be consistent with the pre-construction surveys conducted by Nature Advisory (Section 2) with ultrasonic bat detectors (Wildlife Acoustics Song Meter Mini Bat units (or another equivalent unit). Recorded echolocation calls will be analysed by a specialist sub-consultant.

The bat utilisation survey will provide context for the carcass searches (Section 5.4) and assist in understanding the effects of the wind farm on bat use of the site. Like BUS, bat utilisation surveys will be completed over a period of at least 24 months post commissioning. Results will be assessed in the first and second annual reports.

5.3. Monitoring 'at risk' Species

'At risk' species have been identified through the risk assessment (Section 3). These are summarised below.

- Wedge-tailed Eagle
- Fork-tailed Swift
- Powerful Owl
- Regent Honeyeater
- Swift Parrot
- White-throated Needletail
- White-striped Freetail Bat.

Impacts on any of these species will be identified in the carcass searches described in Section 5.4 below. In addition, specific monitoring will be undertaken for some of these species of concern; this is discussed further below.

In the event that listed birds or bats are found during carcass searches, or incidentally, an appropriate response will be identified as described in the procedure in Section 7 of this BBAMP.

5.3.1. Fork-tailed Swift, White-throated Needletail, Regent Honeyeater, Swift Parrot, Wedge-tailed Eagle and other raptors

Once the wind farm is fully operational and carcass monitoring commences, regular monthly monitoring will be undertaken of flight movements of the Wedge-Tailed Eagle, Fork-tailed Swift, Regent Honeyeater, Swift Parrot, White-throated Needletail and raptors for 24 months following commissioning of all the turbines for the generation of electricity for commercial purposes. This observational data will contribute to determining whether operating turbines affect the behaviour of these species. Observations will be recorded as the searchers move through the wind farm.

Information recorded will include, as a minimum, the following.

- Date location and duration of observation period
- Time and duration of flight
- Number of birds, and approximate age (if known)
- Flight height above ground (range)
- Habitat over which the flight was observed

- Flight behaviour observed, included soaring, directional flight (flapping), kiting, circling, gliding and diving.
- Other occasional behaviours included feeding, territorial displays, fighting and perching.

A monitoring data form is included in Appendix 7. Flight paths will be plotted as accurately as possible on large-scale aerial photographs of the project area.

In addition, nesting activity will also be incidentally recorded. Any eagle nests observed will be recorded by GPS location and revisited during the breeding season (in August to December) to monitor nesting activity and outcome.

The monitoring of birds as outlined above is likely to vary with potentially higher utilisation in the wet and early dry seasons. However, consistent monitoring across all seasons will enable the identification of possible seasonal changes.

A series of adaptive management measures are proposed in this BBAMP to reduce the potential for high numbers of raptors using the project area. These are outlined in Section 6.

Further information from targeted surveys during the first year of operations for the White-throated Needletail will be collected to increase the sample size to increase the reliability — in terms of accuracy and precision — of CRM estimates. For gathering WTNT CRM data, a 40-min fixed-point count method will be used at pre-determined locations. The following data is to be documented for each WTNT flight observed during the survey.

- Number of birds
- Time first observed
- Time the bird/s flew out of sight or landed
- Distance and bearing from observer (distance to the centre of the group if more than one WTNT is flying together)
- Height of the bird/flock when first observed
- The height range of the bird/flock while observed (minimum and maximum heights)
- Direction of flight
- Flight behaviour (either soaring, foraging, circling, etc.)
- Flight paths will be mapped.

Each survey point will be visited at different times of the day with a focus on late afternoon / early evening. Four replicates of each survey point will be taken across the survey period.

5.3.2. Other bird species

All other bird species were considered to be at a 'negligible' risk from the project. These species would be subject to the standard protocols that operate once the BBAMP comes into effect, namely, any bird found during the carcass searches (Section 5.4) or incidentally by Operations staff will be reported and stored in a freezer on-site for confirmation of its identity and for use in scavenger trials. The incidental discovery of carcasses by Operations staff will be subject to the recording requirements described in Section 5.4.5.

In the event the carcass of a listed species is identified incidentally, the protocols outlined in Section 7 will be implemented.

5.4. Carcass Searches

The purpose of carcass searches is to determine the actual impact of the project on birds and bats by attempting to estimate the annual number of birds and bats that collide fatally with operating turbines. Mortality rates can be estimated for all bird species combined, and all bat species combined. If listed species are found underneath a turbine, the mortality rate for that particular listed species may also be estimated, subject to sufficient data being available.

Mortality is defined as any dead bird or bat detected within 120 metres of the turbine. Detection can be either during the formal carcass searches (designed to generate an estimate in accordance with a statistically rigorous sampling design) or at other times (incidental observation, often by Operational staff or by ecologist on site outside of formal carcass searches). A protocol is triggered whenever a carcass is found, either within the formal searches or incidentally to collect consistent and useful data on the fatality event (see below).

Collision by birds and bats with operating turbines will be monitored through a statistically rigorous carcass-search program for a minimum period of two years which will commence when the wind farm has been commissioned. This will ensure statistically useable and robust results are generated from the carcass monitoring program that include an estimate of both bird and bat mortality rates, together with an estimate of sampling precision.

It will be assumed that any intact dead bird or bat, or bird feather spot (defined as a clump of five feathers or more), detected beneath an operating turbine has died as a result of collision or interaction with turbine blades, unless there are obvious signs of another cause of death. Feather spots will be assumed to be remains of a bird carcass after scavenging and the scavenger correction factor will not be applied to them (Section 5.4.6).

Additional incidental monitoring of mortality from blade strike by wind farm personnel at operating wind farms typically serves to:

- provide supplementary data that can inform adaptive management of the collision risk i.e. patterns of mortality related to seasonal changes or local conditions; and
- detect mortality of listed and non-listed bird and bat species, which can be used to understand actual bird and bat impacts.

The search protocol outlined below has been developed to detect species that have fatally collided with operating turbines at other wind farms. The consistent application of this protocol will ensure that statistically robust, spatially and temporally consistent data are collected on bird and bat mortality at the site, in a manner comparable with other, similarly monitored wind farms.

Several factors, such as carcass scavenging and carcass detectability, can affect mortality rate estimates and must be measured and included in any estimate of overall mortality rates for the site.

A scavenged carcass may increase the variability in mortality rate estimates and thus carcasses will be assessed for possible scavenging (i.e. evidence of animal disturbance to the carcass) and rates will be estimated from experimental trials (Sections 5.4.6).

Human or canine detectability of carcasses is also a potential confounding variable and protocols have been developed to control this factor in the final mortality estimates. Section 5.4.7 provides more detail on this issue.

The practical considerations that have informed the design of the carcass search program and associated trials are listed below.

- Very few carcasses are found under turbines in Australia compared with Northern Hemisphere wind farms (on average, less than half the number in the Northern Hemisphere based on Nature Advisory data across ten wind farms in Australia);
- Carcasses of a suitable range of sizes for scavenger and detectability trials are difficult to source and usually involve a combination of carcasses found under operating turbines and those found along roads and other legal sources. Note that it is illegal to source un-cleaned carcasses from poultry producers;
- For statistical reasons, it is likely to be very difficult to determine more than the grossest of differences in scavenging rate or detectability across the year and there is no evidence in the literature for significant differences between seasons in scavenger activity. Therefore, annual scavenger and detectability correction factors will be generated and applied; and
- It is known that detectability will be easier in short grass at the dry time of the year compared with in longer grass at the wet time of the year, and detectability trials will be scheduled at both times to provide representative correction factors.

Similar methods have been recommended in a number of other approved bird and bat monitoring programs in Queensland, New South Wales and Victoria. Implementation of bird and bat monitoring programs in Australia is still developing (since 1998), and the techniques described here are based on lessons from a number of such programs already implemented; for example, Hull et al. (2013), Nature Advisory findings from fifteen bird and bat impact monitoring projects, knowledge of experimental design and statistical analysis, and recent feedback to Nature Advisory from the DCCEEW.

After two years of mortality monitoring, a detailed report will be prepared for the Proponent detailing a review of the mortality detection program and providing recommendations for the future in response to any revised or newly identified risks at the site, including risks and impacts on EPBC Act listed migratory and resident species – see Section 5.7 for reporting requirements. The following Sections are outlined below.

- **Turbine selection for survey** (Section 5.4.1): how the turbines will be selected for the search
- **Search protocol for ecologists** (Section 5.4.2): the size of area beneath turbines to be searched and how this area will be systematically searched and results recorded
- **Searching with scent dogs** (Section 5.4.3): Searching protocol to be implemented if scent dogs are chosen to undertake carcass searches
- **Carcass detection protocol** (Section 5.4.4): The process of recording a carcass and what to do with it
- **Incidental carcass protocol:** (Section 5.4.5): outlining the procedure to be adopted in the event of an incidental carcass or feather spot find by Construction or Operation personnel outside the formal carcass-searches
- **Scavenger rates and trials** (Section 5.4.6): definition of scavenging and how experimental trials will be conducted
- **Detectability (observer) trials** (Section 5.4.7): definition of detectability and the experimental trial methodology

5.4.1. Turbine selection

The project comprises of 162 turbines. It is proposed that a minimum of 20% of the turbines will be searched monthly, totalling at least 32 turbines. Turbines will be stratified into groups (strata) representing parts of the project area with different habitats and different limitations on search areas (see Section 5.4.2). Within these strata, a minimum of three turbines will be selected randomly, so that each turbine in a stratum will have an equal chance of being selected. The selection of the 32 turbines to be included in the search will be made prior to the commencement of the first search and will remain the same throughout the monitoring period to maximise the accuracy and precision of the bird and bat mortality estimates.

5.4.2. Search protocol

All searches will be undertaken by personnel trained and regularly assessed by the supervising ecologist to ensure they implement the required monitoring methods effectively and consistently, and are able to identify any carcasses (or evidence of collision, such as feather spots) found under wind turbines.

The search area beneath each turbine has been determined as the area to find bats and medium to large bird carcasses with turbines of this size (Hull & Muir 2010). Based on the Hull and Muir model (2010) 95% of bat carcasses are expected to be found within 74 metres of the turbine, and carcasses of medium to large birds are expected to be reasonably recorded to 120 metres.

Given this evidence, inner and outer circular search zones have been designated. The inner zone targets the detection of carcasses of bats and small to medium and large sized birds. In the inner zone, a circle is formed with a 60-metre radius from the turbine and transects are spaced every 6 metres (Figure 3). The outer zone will comprise the zone between the 60 metre and 120 metre radius circles. Although they may be recorded in the inner zone, the outer zone will ensure the adequate detection of carcasses of medium to larger sized birds, which can fall further away from turbines. Search transects in the outer zone are spaced at 12 metres and carried out from the edge of the inner zone out to the edge of the outer zone.

Given that the defined transect spacing and total search area are based on experience and evidence from previous studies (Arnett *et al*. 2005, Hull and Muir 2010) they are considered to be ample to detect bats and the bird species of concern identified in the risk assessment.

Areas under many turbines are located on steep hills and with difficult to access terrain. Search areas under some turbines are densely treed. For these reasons, turbine searches within 120 metres will only cover hardstands and sections of access tracks and roads within treed and/or steep areas that cannot be accessed safely. The results will be stratified regarding this factor.

The order of turbines searched will be randomized between searches. All carcasses found will be recorded using the form provided in Appendix 8.

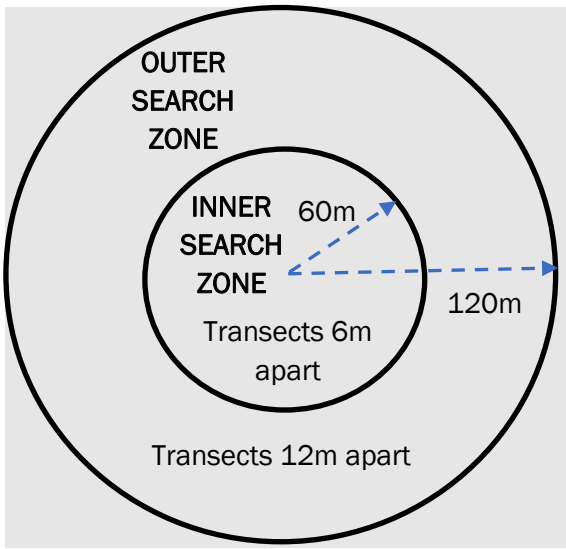


Figure 3: Inner and outer carcass search zones underneath turbines

5.4.3. Searching with scent dogs

Trained scent dogs are another option that could be used to undertake the carcass searches. However, this will depend upon the availability of trained dogs and dog handlers the appropriate skills to undertake the searches. The decision for using scent dogs will depend primarily on the availability of trained dogs for the 24-month turbine strike monitoring period. Once a method (human or canine) is chosen, it will be used for the entire monitoring duration if possible.

Although scent dogs may have a better rate of detection, this factor can be corrected in the searcher efficiency trials outlined below (Section 5.4.7). Some land holders also prefer that dogs not be used at certain times of the year, depending on land use.

A search protocol using scent dogs is provided below:

- The search area will remain the same (a 120-metre radius) however the transects used to search the radius will be modified for the effective use of scent dogs.
  - Under ideal conditions (moderate wind, no rain, mild temperature), 30 metre transects will be walked at a slow pace by the handlers into the wind allowing the dog to zig zag across the transect either side to a distance of 15 metres or more, and cover the entire search area. When walking with the wind (i.e. during the return transect); the handler will walk more slowly than when walking into the wind, allowing the dog to move ahead and zig zag back towards the handler.
  - The transect width will be reduced in less ideal conditions that might affect the dog's ability to track scent (high wind, rain). The handler will make decisions of the reduction in transect size (e.g. 20 or 10 metres) based on research by Bennet (2014).
  - A GPS collar will be fitted to the dog which will allow the handler to track movements in real time and allow the handler to ensure the entire search area has been effectively covered by the dog.

- Search areas will be loaded onto GPS prior to commencing searches to allow the handler to see the exact borders of the area and the dog's movements within it.

Upon finding a carcass, the carcass detection protocol below will be followed.

5.4.4. Carcass detection protocol (operational phase)

If a carcass is detected (a 'find') the following variables will be recorded in the Carcass Search Data Sheet (see Appendix 8).

- Position of carcass in relation to the turbine i.e. distance in metres and compass bearing of the carcass from the base of the turbine
- Substrate and vegetation, particularly if it was found on a track or hard-stand area without vegetation as this may assist in quantifying the number of carcasses not found in areas where ground cover makes carcasses less visible
- Species, age, number, sex (if possible), signs of injury and estimated date of strike. Where the state of remains does not permit species identification, DNA testing will be undertaken, overseen by a suitably qualified ecologist. Results of DNA testing and subsequent identification of the carcass is to be included in the next annual report;
- Weather (including recent extreme weather events, if any), visibility, maintenance of the turbine and any other factors that may affect carcass discovery; and
- If the species is not able to be immediately identified (e.g. an incidental find, and there is not an ecologist on site), photographs must be provided to the qualified ecologist within 2 business days of the find, for identification purposes. The ecologist must reply within 2 business days, for the possible reporting of an impact, as outlined in Section 7. The carcass should be stored as outlined below.

The carcass will be handled according to standard procedures, as follows.

- The carcass will be removed from the turbine site to avoid re-counting
- The carcass will be handled by personnel wearing rubber gloves, packed into a plastic bag and then placed in a second plastic bag;
- The carcass will be clearly labelled by including a copy of its completed Carcass Search Data Sheet in the second plastic bag to ensure that its origin can be traced at a later date, if required
- The double-bagged carcass will be transferred to an on-site freezer (at the project area office) for storage. The carcass will be available for a second opinion on the species identity, if necessary, and for use in scavenger and detectability trials (Sections 5.4.6 and 5.4.7). The freezer will only be used for holding carcasses and not for other uses.

The monitoring program will need to obtain under a NC Act authority (Scientific Purposes Permit) for keeping remains of native wildlife by the proponent. This authority will also detail the most appropriate disposal methods.

5.4.5. Incidental carcass protocol

While the ecologist is on site undertaking monitoring, carcasses may be found under turbines not selected for the formal monitoring program. In addition, wind farm personnel working at the project area may from time to time find also carcasses within the project area during commissioning, day-to-

day operations and maintenance activities. In these cases, the carcass will be handled according to the Carcass Detection Protocol outlined in Section 5.4.4. All Operation personnel will be made aware of this carcass handling protocol as part of their Site training and induction.

A Carcass Search Data Sheet (Appendix 8) will be completed for each carcass found incidentally.

This Incidental Carcass Protocol is valid for the life of the project.

5.4.6. Scavenger rates and trials

It will be important to ascertain the rate at which carcasses are removed by scavengers. This can be used to develop a 'correction factor' that informs the estimate of the project impacts on birds and bats (mortality rate). Scavengers can include ground-based animals, such as foxes, wild dogs, and rats (more likely to detect carcasses by scent), as well as aerial scavengers such as birds of prey, magpies and corvids (more likely to detect them visually). The scavenger trials described below are designed to ascertain the scavenging rate, usually expressed as the average carcass duration in the field.

An intact carcass will be defined as a carcass that does not appear to have been scavenged by a vertebrate scavenger. A partially eaten carcass will be any skeletal or flesh remains found. Feather spots for birds and fur spots for bats will be defined by their presence and the absence of any other remains (a feather spot being a cluster of five or more feathers). Intact or partial carcasses and feather/fur spots will all be recorded as a 'find'. However, the scavenger correction factor will not be applied to fur and feather spots as these are most likely to represent the remains of carcasses after they have been scavenged.

Scavenger trials will be undertaken twice during the first year of monitoring. The objective of having two trials is to account for different vegetation conditions, so one will be held when the grass is long and one when the grass is short. The two periods for scavenger trials are shown in Table 7, below.

Table 7: Timing for scavenger trials

Vegetation condition	Likely time period
Short grass	Dry season
Long grass	Wet season

Each scavenger trial will be undertaken by a trained person (see Section 5.5) to determine the rate of carcass loss by scavengers. The search area for scavenger trials will be limited to 60 metres from the base of the turbine (the inner search zone – Figure 3) and will be located at the previously randomly selected operating turbines that are searched on a regular basis.

To identify potentially different scavenging rates, three categories of carcass will be used (Table 8). Based on current mortality estimation requirements, every endeavour will be made to find all carcasses required for each category. Improvements on this described method would require an impractical and unlikely availability of required carcass numbers, and do not lead to a commensurate improvement in the statistical power of estimates. In addition, large birds (raptor size) may be substituted with data from previous grouped studies.

Table 8: Number of replicates for each scavenger trial

Micro-bat	Medium sized birds	Large birds (large raptor size)
15	10	5

For scavenger trials in each season, up to thirty carcasses in total will be randomly placed under different turbines. An infrared motion camera will be placed within 1–5 metres form carcass pointed at the carcass. The infrared camera will remain in the field for 5 days when it will be first checked. Then it will be retrieved by day 30 if the carcass still remains. The images will be downloaded and analysed.

Additional information on scavenger trials is provided below.

- The timing of searches is based on experience and regulatory approval at several other wind farms where scavenger trials have been undertaken that show almost all carcasses have been scavenged within ten days. More frequent monitoring than that proposed herein will not significantly affect the estimated scavenging rate and its impact on mortality estimates
- A mix of carcass sizes (if available) will be obtained for use in the scavenger trials. Where carcasses of a species of concern cannot be found, a similar-sized and coloured substitute will be used to reduce bias by visual predators
- Latex gloves will always be worn while handling carcasses to minimise contact with human scent, which may alter predator responses around carrion and to minimise disease risk to the handler;
- At each trial site, one carcass (or more) will be placed randomly within the 60-metre search area. Carcasses will be thrown in the air and allowed to land on the ground to simulate at least some of the fall and allow for ruffling of fur or feathers
- Carcasses used in the trials will have their coordinates recorded to ensure that they are not confused with an actual fatality found under a turbine during the trial searches
- Notes will be taken on the state of remaining carcasses in each search.

Conducting two scavenger trials at seasonally different times is designed to account for occasional seasonal changes in carrion use by some scavenger species. Previous studies have found that Red Fox are reliant on rabbits and carrion in agricultural and forested areas e.g. Brunner *et al*. 1975, Catling 1988, Molsher *et al.* 2000. Feral cats show uniform use of carrion throughout the year, whereas fox prey type is dependent on availability (Catling 1988). Catling (1988) found that foxes ate more carrion in winter/spring compared with summer/autumn, when they fed on adult rabbits. However, Molsher *et al*. (2000) found that there was no overall significant difference between seasons for carrion use by foxes. Seasonal differences only occurred in other prey types (not carrion), such as lambs, invertebrates and reptiles, as these are only available at certain times of the year.

5.4.7. Detectability (searcher efficiency) trials

As humans rely on visual cues to determine carcass location, the two seasonal visibility categories of low and high grass cover will be compared (as shown in Table 9). Only one carcass search will be required if dogs are used for carcass searches, as their sense of smell is not impaired by high grass.

To account for searcher variability in detecting carcasses, only personnel who have carried out monthly searches at the project area will be involved in the detectability (searcher efficiency) trials. Detection efficiency (percentage of carcasses detected) will then be incorporated into later analyses that derive mortality estimates. The number of carcasses to be employed in each trial is detailed in Table 9 and explained below. The carcass controller (a person not involved in monthly carcass searches) will throw each carcass into the air and allow it to land on the ground to simulate at least some of the fall and the potential ruffling of fur and feathers. The carcass controller will note the placement of carcasses (via GPS) and is free to decide where and how many are deployed under each turbine. However, all carcasses will be located within the inner 60 metre search zone.

Table 9: Number of replicates per season for detectability trials, given two factors of size and visibility

Season	Micro-bat	Medium sized birds	Large birds (large raptor size)
Wet season - Long grass / vegetated	10	5	5
Dry season - Short grass	10	5	5

Analysis of past trials from other wind farms indicates that there is a large confidence interval on the estimate of searcher efficiency, even for a high number of trials (plus or minus ten percent even with 50 replicates). This means that only relatively large seasonal changes in detection (~20- 30% or more) will be resolvable from normal background variation. Sampling will be undertaken during the two periods that represent the greatest change in vegetation cover (therefore visibility), using a number of carcasses that is logistically manageable and aligned with the number and timing of scavenger trials. Statistical confidence analysis indicates that this will result in a reasonably precise detectability estimate after one year, and optimal precision after two, although a second year of trials is not currently planned.

Any substitute carcasses for these trials will be of both similar size, colour and form to the species being represented or species of concern (e.g. brown mice rather than birds should be substituted for bats as birds do not have the same body shape, colour and appearance).

After the planned detectability trials, the need and frequency of further detectability trials will be reviewed by the suitably qualified ecologist.

5.4.8. Analysis of results and mortality estimation

The results of the carcass searches will be analysed to provide information on:

- The species, number, age and sex (if possible) of birds and bats being struck by the turbine blades;
- Results of scavenger and detectability trials;
- Separate estimated annual mortality rates for all birds and all bats (and for particular species, if required) including an estimate of the number of carcasses per turbine per year; and
- Any detected spatial or temporal variation in the number of bird and bat strikes.

The search results will be detailed in the first annual report. In addition to cumulative search results, the analysis and mortality estimates will be detailed in the second annual report. The latter will also identify if further monitoring is required.

Statistically robust projections of bird and bat mortality for the entire project area will be presented in the second-year report, based on the results of carcass searches. It is acknowledged that this is a current and dynamic aspect of research and that the outcomes from such programs may be equally dynamic. The proposed program is designed to provide an acceptably accurate and precise estimate of project related bird and bat mortality, over the first two years of operation. Example of current best practice statistical analysis are outlined in Huso *et al*. (2016; 2017).

All data will be analysed to provide the average estimated mortality of birds and bats, their standard error (variability) and ranges for the Project. The mortality rate of each species (if estimates for individual species are possible) and size class detected will be calculated. If possible, the standard error and range of these estimates will be reported. Note that it may not be possible to provide this due to the likely low number of carcasses detected and where this is an issue, it will be reported.

The estimated mortality rate will be generated by modelling the scavenger losses and results of the detectability (searcher efficiency) trials, and using sampling inference to account for the periods between turbine searches and unsearched turbines. The data from the scavenger and detectability trials will be analysed using relevant techniques based on Generalised Linear Modelling (GLM) and (censored) Survival Analysis. Censored measurements are only partially known, such as the exact time of mortality or the exact time to scavenge loss (e.g. Kaplan and Meier 1958). In addition to providing mortality estimates, this analysis will determine, where possible if any of the factors e.g. size class or habitat stratification of turbine sites are significant.

5.5. Personnel involved

This Section outlines the personnel involved in implementing the BBAMP and any training required for the field work and report writing. All personnel working on the requirements of the BBAMP will be familiar with the Plan, Site policies and procedures, and other administrative matters, e.g. OH&S and technical and field methods. ACCIONA will ensure that suitably qualified and trained people are engaged to supervise and implement the monitoring program.

Any person undertaking searches will be trained by a qualified ecologist. The searcher will receive training from the ecologist in the following areas.

- Turbine searches, including transect spacing in inner and outer zones, number and location of turbines to search and transect search methods
- Equipment usage, such as GPS
- Data recording
- Carcass storage
- Species identification.

Where a scent-dog is used to search for carcasses, this will be undertaken by a handler fully trained in this method. The same dog/s and handler will be reasonably required to undertake all carcass searches for the duration of this program. There may be more than one dog involved in these searches.

The qualified ecologist will supervise the initial carcass search to ensure that field methods are being undertaken correctly and undertake an audit after the first three months to ensure that methods are

being implemented correctly. The qualified ecologist will also be responsible for identifying any recorded carcasses from photographs or from specimens transferred to the on-site freezer after searches.

The first searcher efficiency trial will be initiated and set up by the supervising ecologist, who will, if required, train a separate person (the 'carcass controller') to run follow-up searcher efficiency trials. This training will include the following.

- Correct preparation and handling of trial carcasses
- Correct methods for the random placement of trial carcasses within a randomly selected sub-set of the search areas.

If for some reason a searcher is unable to undertake the monthly searches as planned (due to illness etc.) a back-up person will be identified in advance. If a back-up person is required to undertake searches, they will also be trained and supervised and will participate in searcher efficiency trials.

The scavenger trials will be set up by the supervising ecologist, with searches being undertaken by a trained searcher.

Analysis of mortality data will be undertaken by the supervising ecologist with support from a statistician.

Annual reports and all investigations resulting from an impact trigger (see Section 7) will be prepared by the supervising ecologist.

5.6. Injured & deceased bird and bat handling protocol

All on-site staff and consultants engaged to carry out monitoring will be trained in the correct procedure for assisting injured wildlife. Operations personnel who find injured wildlife will be required to report the find to the Project's Responsible Officer, who will organise recovery of, and treatment for the animal. If safe to do so, place the animal immediately into a dark place e.g. box or cloth bag for transfer to the nearest wildlife carer or veterinarian.

All persons who handle injured or dead animals must wear gloves and understand the applicable OH&S requirements. Special care[3] should be taken to avoid bat borne viruses (i.e. Australian Bat Lyssavirus and Hendra Virus), including that only people with appropriate vaccinations should handle bats (living or deceased).

Contact details of local veterinary staff and wildlife carers are provided in Table 10 below to ensure that if injured wildlife is found and cannot readily be released back to the wild, they are treated accordingly and in a timely manner.

[3] Queensland Government (2017) Bats and Human Health http://conditions.health.qld.gov.au/HealthCondition/condition/14/217/14/Bats-human-health, accessed 28/06/18

Table 10: Vet and wildlife carer details for the local region

Name	Phone	Location/Address	Bats (Y/N?)
Condamine Veterinary Clinic	(07) 4667 1176	185 Bracker Rd, Warwick QLD 4370	No
F.A.U.N.A.	(07) 5466 4144	90 Mount Berryman Rd, Mount Berryman QLD 4341	Yes
Warwick Veterinary Clinic	(07) 4661 1105	4 Albert St, Warwick QLD 4370	No
Currumbin Wildlife Hospital	(07) 5534 0813	27 Millers Dr, Currumbin QLD 4223	Yes
Australia Zoo Wildlife Hospital	(07) 5436 2097	1638 Steve Irwin Way, Beerwah QLD 4519	Yes

5.7. Reporting

Reports will be completed on an annual basis for the first two years with brief monthly summary reports of carcass searches to be provided to the operator of the wind farm, including information stated in condition 44 of the EPBC Act approval. Further reporting will be agreed with the regulator, for example reporting to agencies if impact triggers are met.

The first annual report will be prepared within three months of the completion of the first year of monitoring. The second annual report will present the first full analysis of data collected and will be presented within three months of the end of the second year of monitoring. Matters to be addressed in the second annual report include but will not be limited to the following.

- A brief description of the management prescriptions implemented, and identification of any modifications made to the original management and monitoring activities
- The survey methods (including list of observers, dates and times of observations)
- Results of carcass searches and incidental carcass observations including any impacts to listed bird and bat species
- Estimates of bird and bat annual mortality rates (per turbine per year) based on statistical analysis
- Seasonal and annual variation in the number and composition of bird and bat strikes, where detectable
- Any other mortality recorded on site but not during designated carcass searches i.e. incidental records by site personnel
- Assessment of significance (against the EPBC Act Significant Impact Guidelines 1.1) for any EPBC Act listed bird or bat species which was recorded in the project area within the reporting period, but which was not assessed in the pre-approval ecological assessment report (see Section 7.1 for impact triggers and responses).
- Identification of any *impact triggers*, and application of the decision-making framework and relevant adaptive management measures
- A summary of stock, feral and native animal carcass removal for the purposes of predator reduction and any management measures implemented.
- Details of any landowner feral animal control programs and their timing, where available

- A discussion of the results, including the following.
    - Bird risk reduction measures
    - Any further recommendations for reducing mortality, if necessary
    - Whether the level of mortality was unacceptable for affected listed species of birds or bats of concern
    - Usage of the project area by species of concern at more than negligible risk and factors influencing this i.e. climatic, geographical and infrastructure
    - Analysis of the effectiveness of the decision-making framework
    - Recommendations about further monitoring.

Apart from these routine reports, specific reporting will be generated in a timely way under this BBAMP in response to an impact trigger. The details are provided in Section 7. Additionally, any sightings of species recorded during the surveys will be sent to DCCEEW in accordance with the 2018 '*Guidelines for biological survey and mapped data'* (available at

https://www.dcceew.gov.au/sites/default/files/documents/guidelines-biological-survey-mapped-data.pdf).

6. Mitigation Measures to Reduce Risk

Mitigation involves the prevention, avoidance and/or reduction of the risk of an *impact trigger* occurring or continuing to occur. An *impact trigger* is defined in Section 7 as a threshold of impact on birds or bats that triggers an investigation and/or management response. This section outlines such measures.

The overall objective of mitigation measures is to ensure that the operation of the project does not lead to significant impacts on listed or protected birds and bats. Any future novel or new mitigation measures that are identified to be of potential benefit for birds and bats at the project area should be incorporated into the BBAMP as part of an adaptive management approach. Major revisions to the BBAMP shall be communicated to DSDMIP and any variation to the BBAMP needs to be applied for under the EPBC Act to the relevant Minister in accordance with Section 143A of the Act, unless the changes are not likely to result in a new or increased impact.

6.1. Carrion removal program and stock forage control

Land-use and stock management below and around turbines can influence the presence and behaviour of native birds on site. Examples that could elevate bird collision rates include the following.

- Grain feeding can attract parrots and cockatoos
- Carrion can attract raptors.

This Section proposes mitigation measures to address these matters.

A low risk to WTE has been identified for the project. The Wedge-tailed Eagle and other raptors forage for carrion (the fresh or decaying flesh of a dead animal) and on small mammals and rabbits. To reduce the risk of raptors colliding with turbine blades, a regular carrion removal program will be implemented during operations, to reduce the attractiveness of the Project area for raptors and therefore reduce the potential for fatal collisions by this group of birds. This program will focus on an area of a minimum of 200 metres around turbines, where safe, feasible and practical. The procedures below will be adopted for the project (subject to the landowners consent).

- A designated suitable person will be appointed (such as a Operations team supervisor or team leader) to perform the function of Carrion Removal Coordinator, who will ensure the activities described below occur.
    - Educate project staff to report any stock, introduced or native mammal and bird carcasses within 200 metres of any turbine (to be recorded as incidental finds) that may attract raptors e.g. kangaroos, cattle, pigs, goats, foxes, rabbits
    - Opportunistic observations by Operations personnel during normal inspections and work routines to identify and report carcasses of stock, feral or native animals so that timely collection can be undertaken to remove them, where possible
    - Any carcasses and/or remains found that are within 200 metres of turbines, will be collected and disposed of, where possible, in a manner that will avoid attracting raptors close to turbines
    - Consult with the Project's Responsible Officer in relation to the appropriate disposal of collected carrion, to be located at least 200 metres away from the closest turbine

  - Operations personnel will be required to notify the Carrion Removal Coordinator immediately following identification of carrion on site
  - Carcass occurrence and removal will be recorded in dedicated carcass removal register maintained by the Project's Responsible Officer
- In order to reduce collision risks to birds, where practical and with Landowner agreement, the practice of grain feeding of stock within 200 metres of turbines should be avoided as it attracts parrots and cockatoos, increasing collision risk with turbine blades
- Any feral animal control on the Project area should involve the timely removal and appropriate disposal of resulting carcasses
- If a large active pest animal presence is observed during monitoring surveys, it may be necessary to conduct an integrated control program (to reduce site attractiveness to Wedge-tailed Eagle). Any control program will require cooperation and agreement from the Landowners
- An annual summary of carcass removal based on the Project's 'dedicated carcass removal register' will be provided in the annual reports.

The need for continuation of the carcass removal program and effort required will be assessed after one year of operation. In general, the criteria for continuation will be based on the frequency of carcass finds. For example, if carcass frequency is particularly low e.g. one or two per quarter/turbine outside of turbine search zones (i.e. not beneath turbines) the program may be discontinued or reduced considerably. Alternatively, if peaks occur at specific times or locations where there are turbines with intervening periods of low numbers, the effort may be focussed on the peak periods and/or locations.

6.2. Artificial Lighting

It has long been known that sources of artificial light attract birds, as evidenced by night-migrating birds in North America and Europe. Lighting is probably the most important factor under human control that affects mortality rates of birds and bats colliding with all structures (Longcore, *et al*. 2008). Most bird mortality at communication towers in the Northern Hemisphere for example, occurs in poor weather with low cloud in autumn and spring, i.e. during migration periods (Longcore, *et al.* 2008). No permanent artificial lighting will be installed on the exterior of turbines.

It is postulated that bright lights may temporarily blind birds, particularly those accustomed to flying at night or in low light conditions causing them to fly toward the light source and collide with the lit structure (Gauthreaux and Belser 2006). Bats may also be attracted to the increased numbers of insects that may congregate near bright light sources.

To avoid excessive light spill building lighting will be directed towards the area requiring lighting and not skyward or laterally beyond the target area.

7. Impact Triggers and Decision-Making Framework

This section identifies the circumstances that will result in notification, further investigation, and additional mitigation for impact triggers involving both listed and non-listed birds and bats (*impact trigger*). If an impact trigger is met, there must be an investigation into the cause of the impact, additional carcass monitoring to determine if the impact is ongoing and the development of mitigation measures informed by scientific studies (see Sections 7.1 and 7.2) . Regular reporting and consultation with the relevant regulators is required under these circumstances within the context of an adaptive management framework.

The procedure to respond adaptively to impact triggers documented in this section will be implemented at any time an impact trigger is detected for the life of the project, from the commencement of operations until decommissioning. The aim is to understand how the impact happened or may have happened, and to identify and design targeted mitigation measures. If scientific uncertainty results in an incomplete understanding of whether an unacceptable impact is occurring this will not prevent the implementation of mitigation measures. Note that the approach developed in this Section is based on that approved for numerous bird and bat monitoring programs for wind farms in Queensland, New South Wales and Victoria, and up to date feedback from regulators on the implementation of approved plans (see Section 1.3 for details).

Ultimately, the Project Owner will be responsible for implementation of this BBAMP and the decision-making that goes with it, with technical support provided by a qualified ecologist.

7.1. Listed species

7.1.1. Definition of impact trigger

Under this program, the circumstances that define an *impact trigger* for threatened birds and/or bats are detailed below:

***Impact Trigger* for Listed Species** occurs if a bird or bat species (or recognisable parts thereof) listed as threatened or migratory under the Commonwealth EPBC Act (as defined within the Project approval conditions) or listed as threatened under the QLD NC Act is found dead or injured under or close to a turbine during any mortality search or incidentally during operation.

7.1.2. Decision making framework and reporting

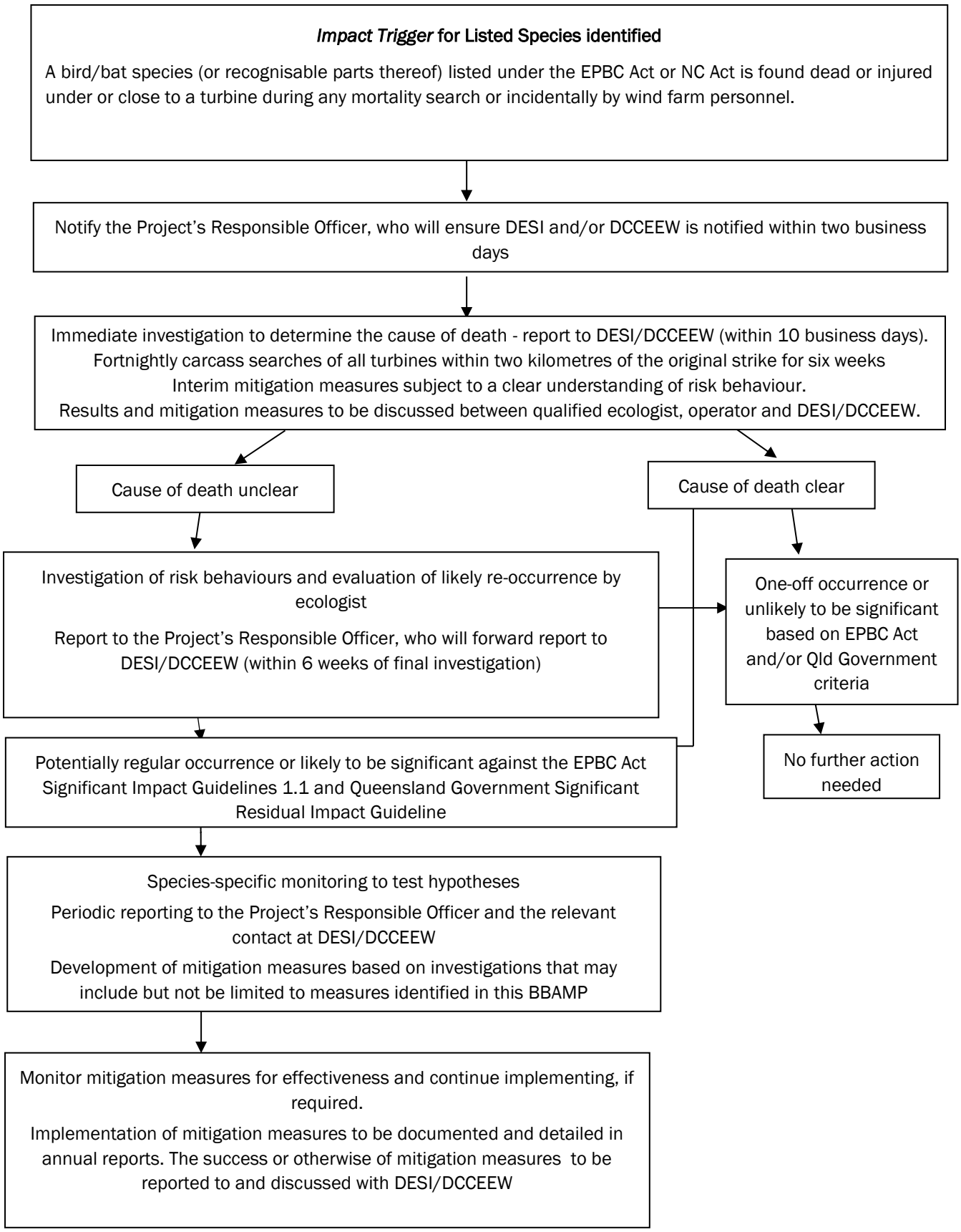
If a listed species *impact trigger* occurs, an adaptive management framework will be triggered as outlined below and in Figure 4.

- The CRM will be refined with additional data from operational phase monitoring.
- Immediate reporting of the occurrence of an *impact trigger* to the Project's Responsible Officer, who will report it to the relevant statutory planner at DESI and/or DCCEEW within two business days of the species being identified by a qualified ecologist.
- Immediate investigation (to be completed within ten business days) by an ecologist to determine, if possible, the circumstances that lead to the death or injury. If the cause of death is considered to be due to turbine blade collision, an investigation will be undertaken to identify any particular risk behaviours that could have led to the collision. The assessment will determine if the collision has had a significant impact on the population of the species at a regional and national level. The likelihood of further occurrences will be evaluated based on the information gathered.

- The investigation will identify, if possible, the most effective practicable mitigation and will ensure that the mitigation is implemented as soon as feasible. The investigation will aim to provide a clear understanding of the cause of the impact, where required, informed by on-site investigations of the occurrence of the species on the Project area.
- If, following this investigation, the fatality is deemed to be a one-off occurrence, or the ongoing impact that is unlikely to be significant at a species population scale, further action is not considered necessary. Note that the successful execution of this requirement relies upon the regulatory authority/ies providing timely and definitive input to this process.
- If the on-site investigation suggests that the *impact trigger* may represent circumstances leading to a significant impact (with reference to the EPBC Act Significant Impact Guidelines 1.1 or the relevant Queensland Government Significant Residual Impact Guideline), species-specific monitoring and mitigation will be required. During species-specific monitoring and mitigation, periodic reports may be provided by MacIntyre Wind Farm to DESI and DCCEEW (as advised).
- Responsive mitigation measures will be developed and implemented in a timely manner. Examples of mitigation measures may include but are not limited to those outlined in Sections 6 and 7.3.
- Mitigations are intended to avoid reaching a significant impact threshold. To ensure adequate implementation of mitigation measures in a timely manner, the number of fatalities will be estimated. In this case, estimates will be derived from searcher efficiency and scavenger loss rates collected and available across Australian wind farms. The outcomes of formal investigations resulting from a notifiable incident will be shared with relevant authorities.
- The decision-making framework has been developed to avoid significant residual impacts on EPBC Act listed bird and bat species and is intended to be adaptive to each specific situation.

Any required investigation, and recommended mitigation measures will be summarised in the annual reports.

Figure 4: Decision making framework for identifying and mitigating *impact triggers* for listed species



7.2. Non-listed (protected) species

7.2.1. Definition of Impact Trigger

The circumstances that define an *impact trigger* and significant impact for non-listed birds and/or bats which despite being non-threatened are still protected (NC Act) under this BBAMP is detailed below.

***Impact Trigger* for Non-listed Species:** A total of four or more bird or bat carcasses, or parts thereof, of the same non-listed species in two successive carcass searches (two or more per month for 2 months) at the same turbine.

Where population numbers are known and reported by DESI or where habitat extent is known, the **definition of a significant impact** on non-listed species is any impact that is likely to reduce the viability of the population of the affected species in the bioregion.

7.2.2. Decision making framework

In the event that an *impact trigger* for non-listed species is detected the following steps will be followed.

- DES will be **notified** of the *impact trigger* within seven days of the MWF being made aware of the event occurring.
- An **evaluation** of impacts to the non-listed species' bioregional population will be undertaken
- A **report** on the investigation will be delivered to the relevant statutory personnel at DESI within three weeks.

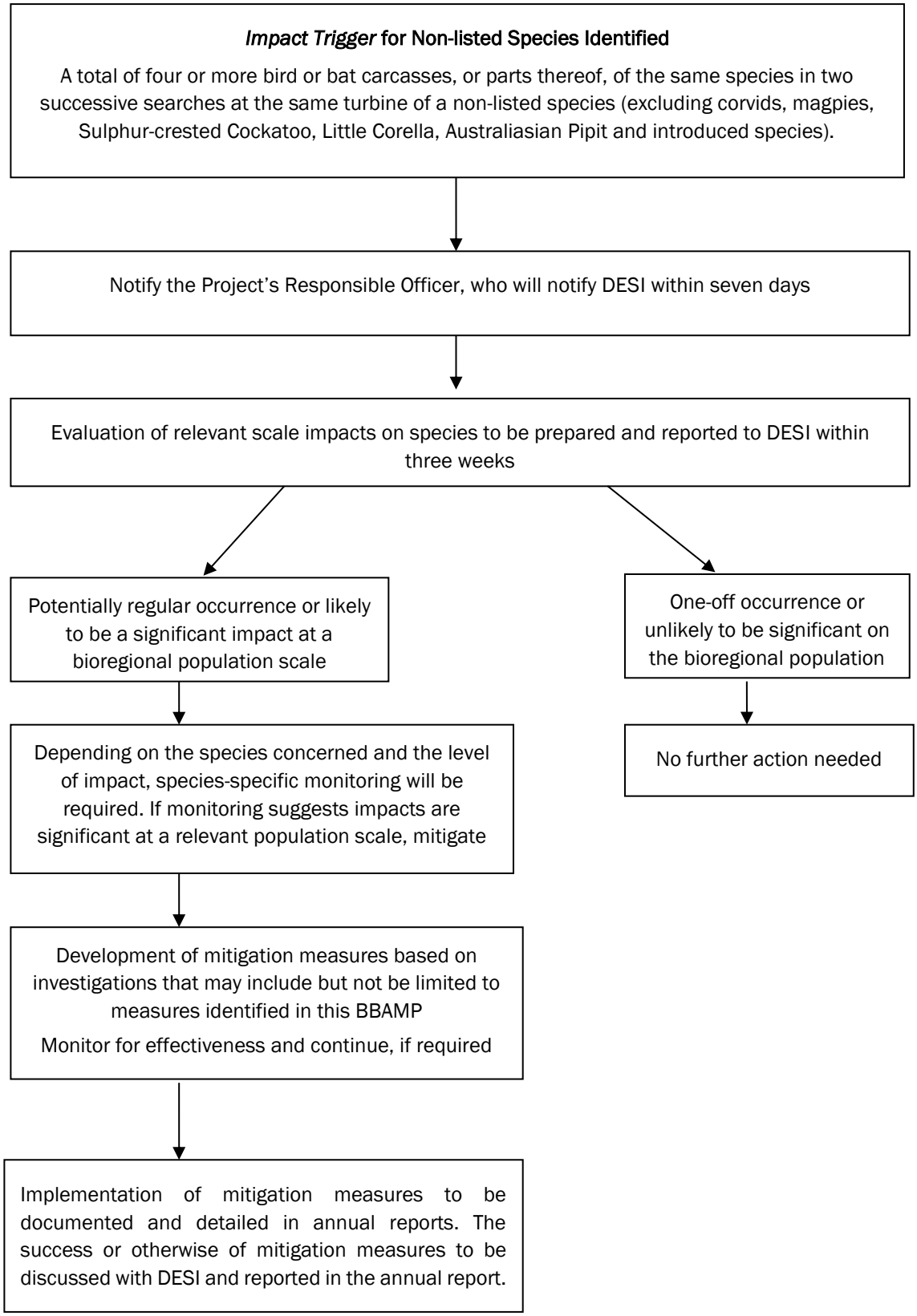
If the evaluation indicates that the event was a one-off occurrence or is unlikely to be a significant impact for the species in question, no further action will be necessary (as outlined in Figure 5).

If the event is deemed to be a potentially regular occurrence or likely to lead to a significant impact on the species in question, species-specific monitoring may be required (Figure 5). If further monitoring confirms that impacts are likely to lead to a significant impact on the species, additional mitigation measures will be required. Potential mitigation measures are outlined in Table 11, however the most effective mitigation measures will be determined based on the species involved and the outcome of investigations.

As required, if an ongoing long-term risk is identified the BBAMP measures will be implemented to reduce risks in accordance with the adaptive approach of this plan. If required risk ratings will be updated and reported in the annual reports.

Any required investigation, and recommended mitigation measures, will be detailed in annual reports.

Figure 5: Decision making framework for identifying and mitigating *impact triggers* for non-listed species



7.3. Supplementary mitigation measures

Supplementary mitigation measures may be implemented in the event that an *impact trigger* occurs and investigations indicate that additional measures are warranted. The purpose of supplementary mitigation measures will be to prevent the impact from continuing to occur at a scale that leads to a significant impact (i.e. at the bioregional population scale). Specific mitigation measures will be implemented depending on the nature, cause and significance of the impact recorded and in response to the results of investigations of the event and of the species concerned on the project area.

Although it is unknown what supplementary mitigation measures may be required in response to a particular situation, some hypothetical examples are provided in Table 11. These are examples of issues which have been encountered and addressed at other wind farms. Should these be implemented as a management response for the project, the response of birds and bats to these measures will be monitored and recorded in the annual report or, in the case of threatened species, in accordance with the reporting schedule in Figure 4.

Mitigation of confirmed significant impacts will occur using measures evaluated as being most likely to reduce impacts to an acceptable level. Measures include those presented here where they are found likely to be effective, but will not be limited to these, having regard to the evolving nature of wind farm bird and bat impact mitigation measures. Alternative mitigation and management measures supported by scientific literature developed over the life of the wind farm will also be incorporated as a part of this adaptive management framework.

7.4. Specific management objectives, activities, timing and performance criteria

Table 12 summarises specific management objectives, activities, timing and performance criteria for the implementation of this BBAMP. It can be used for monitoring and reporting.

Table 11: Supplementary mitigation measures in the event of an *impact trigger* occurring – illustrative examples only

Hypothetical cause of impact	Mitigation Measure[4]	Likelihood of impact continuing following mitigation	Time to implementation
Foraging source identified that attracts threatened species and 'at risk' species to impact areas	Consider the use of acoustics e.g. bird deterrent devices / irregular noise to discourage birds from foraging in this location where such noise would not impact neighbors	Low	Implement within two weeks of the incident
	Encourage species into alternative areas outside of the Project boundary, where available, through the use of social attraction techniques off-site (decoys and audio playback systems)		Implement within two weeks of the incident
	Remove the foraging resource proximate to turbines (in accordance with any necessary approvals)	Low	Immediately
	Pest control program – Implement rabbit or other pest control if the carrion removal program suggests such pests are an issue, (subject to Landowner consultation)		Monitor effectiveness of rabbit or other pest control, and where bird mortality is clearly related to their numbers, increase the effectiveness of control
Farming practice attracts threatened species to risky areas e.g. grain feeding of stock within 200m of turbines	Investigate whether farming practice is a contributing factor and if so, liaise with the Landowner to relocate the issue farming practice further from turbines to reduce risk	Low	Immediately
Wind/rain/fog/time of day causing low visibility	Curtailment during periods of low visibility conditions. In addition, if low visibility at the project area is identified as contributing to the repeated mortality of threatened fauna from turbine strike, carcass searches may be repeated during periods of low visibility to measure mortality rates and to validate hypothesis. Appropriate mitigation measures can be refined adaptively once further information is obtained.	Low	During specific low visibility conditions identified as the cause of significant impacts on threatened species
Reduced visibility due to rotating turbine blades	Painting one of the turbine blades as a strategy to increase visibility and reduce avian fatalities.	Low	In consultation and agreement with the regulator
Attraction to lights on the Project area	Avoid high intensity lighting within the project area e.g. consider use of light hoods or switch off lighting temporarily while species is on or near the Project area. Alternative measures include: • Use blue, green or even red rather than white or yellow lights; • Remove aviation lights, where practicable if allowed by aviation authorities; and/or • All building lights switched off except when needed for service work	Low	If lights can be switched off, this should occur immediately. Alternative measures should be implemented as soon as practicable after recording the *impact trigger*
Attraction to small dams on site	Subject to Landowner agreement, fill in dam and provide alternative stock watering arrangements (e.g. establish replacement dam further from turbines)	Low	Implement as soon as possible after recording the *impact trigger* if the dam is identified as the cause of the problem
WTNT occurring on the site	Development of predictive monitoring system to determine presence of WTNT occurring on the site. This is to include understanding site utilisation by WTNT in relation to seasonal factors including weather patterns, storm fronts, wind direction and spatial distribution across the	Low	In consultation and agreement with the regulator
Nest site close to turbine	Discourage nesting close to turbines in subsequent years	Low	Prior to breeding season
Perching/foraging close to turbines	Minimise perching opportunities near turbines	Low	Implement within two weeks of the incident

[4] Note that the mitigation measures in this table are examples of what may be possible. Ultimately, the chosen mitigation measure will be identified as part of the impact-trigger investigations shown in Figure 4 and Figure 5, and may not include any of these examples if they are not relevant.

Table 12: Specific management objectives, activities, timing and performance criteria

Management objectives	Management activities and controls	Timing	Performance criteria for measuring success of methods	Responsibility	Completed (yes/no)
Pre-construction surveys	Obtaining pre-construction baseline bird and bat utilisation data	Pre-construction ▪ Bird survey ▪ Bat survey	▪ Bird utilisation surveys undertaken as summarised in this BBAMP - see Section 2 ▪ Bat utilisation surveys undertaken as summarised in this BBAMP- see Section 2	Ecologist	
Mortality monitoring	Incidental carcass searches and records	Commissioning and operational phase – ongoing	▪ All incidental carcass finds of birds and bats recorded	Operational staff of wind farm	
	Up to 34 turbines to be surveyed each month to 120m radius, in accordance with the inner and outer zone search protocol. The same turbines will be searched each month for a period of two years.	Operational phase (once commissioning completed) monthly until end of two years in total	▪ Operational phase mortality surveys undertaken monthly at 34 turbines, for at least two years, with a review after the first year to determine if a change in methodology is required	Ecologist	
	Calculating annual mortality of birds and bats per turbine, based on monitoring activities. Mortality estimates should include correction factors from scavenger and detector efficiency trials. The need for further surveys will be reviewed based on the results of the first two years of monitoring	Operational phase, at the end of each year of mortality monitoring	▪ Scavenger and detector efficiency trials (2 of each) undertaken within the first year of monitoring	Ecologist	
Annual Reports	Preparation of Annual BBAMP Reports	Operational phase – within three months of the completion of carcass searches in years one and two, and each following year of operations	▪ Annual reports for the first two years delivered within three months of completion of yearly monitoring ▪ Annual reports to include (but not be limited to) results of monitoring surveys for that year, any *impact triggers* or significant impacts identified, mitigation measures implemented, application of the decision-making framework and recommendations for the following year ▪ Estimates of mortality for birds and bats made after 2 full years of monitoring and reported in 2nd annual report (See section 5.4.8) ▪ Further annual reports to DCCEEW as required	Project's Responsible Officer + Ecologist	
Mitigation measures to reduce risk	Carrion removal program – subject to Landowner agreement, stock and kangaroo carcasses should be removed from within 200m of turbines on a monthly basis and disposed of appropriately	During operational phase	▪ Carcasses removed ▪ Activity recorded in dedicated register ▪ Increase frequency of stock and kangaroo carcass removal and disposal if required	Project's Responsible Officer	
	Subject to Landowner agreement, restrict lambing to paddocks at least 200m from turbines if sheep are present		▪ No increase in raptor mortality during lambing season		
	Subject to Landowner agreement, stock should not be fed grain within 200m of a turbine		▪ No increase in bird mortality due to grain feeding		
Mitigation measures to reduce risk	Minimising external lighting. when required. There should only be low levels of lighting on the Project area during operation, where allowed.	During operational phase	▪ If mortality at turbines near light sources significantly exceeds that of activity at unlit turbines, type and duration of lighting will need to be reviewed, subject to security and OH&S limitations	Project's Responsible Officer	
	Avoid or minimise permanent lighting to avoid light spillage and visibility from above				
	Baffle security lighting to avoid light spillage and visibility from above				

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Appendix 1: EPBC Act threatened birds - habitat and regional assessment and targeted surveys

MacIntyre Wind Farm

EPBC Act threatened birds - habitat and regional assessment and targeted surveys

Prepared for ACCIONA Energy Australia Global Pty Ltd

August 2021
Report No. 20033 (13.5)

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Contents

1. Executive summary 1
2. Introduction 2
3. Existing information 3
3.1. Existing reporting and documentation 3
3.2. Background information 3
3.2.1. Regent Honeyeater 3
3.2.2. Painted Honeyeater 4
3.2.3. Swift Parrot 4
3.2.4. White-throated Needletail 4
4. Methodology 6
4.1. Field methods 6
4.1.1. Habitat assessment 6
4.1.2. Targeted surveys 8
4.2. Limitations 9
4.3. Habitat critical to the survival of species 9
4.4. Species database review 10
4.5. Expert input and review 10
5. Results 12
5.1. Site description 12
5.2. Habitat assessment 12
5.2.1. Regent Honeyeater 13
5.2.2. Painted Honeyeater 15
5.2.4. Swift Parrot 17
5.2.5. White-throated Needletail 20
5.3. Targeted surveys 20
6. Regional context 22
6.1. Regent Honeyeater 22
6.2. Painted Honeyeater 25
6.3. Swift Parrot 27
6.4. White-throated Needletail 29
7. Impact assessment 31
7.1. Direct impacts 31
7.1.1. Regent Honeyeater 31

7.1.2. Painted Honeyeater 31
7.1.3. Swift Parrot 32
7.1.4. White-throated Needletail 33
7.2. Indirect impacts 34
7.2.1. White-throated Needletail 34
7.3. Significant impact assessment 35
7.3.1. Regent Honeyeater 35
7.3.3. Painted Honeyeater 38
7.3.4. Swift Parrot 43
7.3.5. White-throated Needletail 48
8. Conclusions 53
9. References 54

Tables

Table 1: High quality and potential habitat assessment criteria for woodland bird species 7
Table 2: Targeted species habitat within the study area and development footprint. 12
Table 3: Significant impact assessment for Regent Honeyeater 35
Table 4: Significant impact assessment for Painted Honeyeater 38
Table 5: Significant impact assessment for Swift Parrot 43
Table 6: Significant impact assessment for White-throated Needletail 48

Figures

Figure 1: Survey Locations 11
Figure 2: Regent Honeyeater Habitat 14
Figure 3: Painted Honeyeater Habitat 16
Figure 4: Swift Parrot Habitat 19
Figure 5: Regent Honeyeater Records 24
Figure 6: Painted Honeyeater Records 26
Figure 7: Swift Parrot Records 28
Figure 8: White-throated Needletail Records 30

1. Executive summary

ACCIONA Energy Australia Global Pty Ltd engaged Nature Advisory Pty Ltd to conduct threatened bird habitat and regional assessments for Regent Honeyeater (*Anthochaera phyrgia*), Painted Honeyeater (*Grantiella picta*), Swift Parrot (*Lathamus discolor*) and White-throated Needletail (*Hirundapus caudacutus*) as well as targeted surveys for Regent Honeyeater, Painted Honeyeater and Swift Parrot for the proposed MacIntyre Wind Farm. The proposed project covers an area of 31,910 hectares in Cement Mills, QLD as shown in Figure 1 (from here on referred to as the 'study area'). The study area is located approximately 33 kilometres south-west of Warwick within the Southern Downs Regional Council and Goondiwindi Regional Council local government areas. The development footprint is the area of disturbance for the proposed MacIntyre Wind Farm (1,207 hectares) as shown in Figure 1.

The threatened birds targeted in this habitat and regional assessment are listed below, including their status under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

- Regent Honeyeater (*Anthochaera phrygia*) - Critically Endangered
- Painted Honeyeater (*Grantiella picta)* - Vulnerable
- Swift Parrot (*Lathamus discolor)* - Critically Endangered
- White-throated Needletail (*Hirundapus caudacutus*) - Vulnerable and Migratory.

This report is based on data obtained from a review of background information, including documents prepared under the EPBC Act and previous ecological reporting for the study area, as well as field surveys conducted by Nature Advisory Pty Ltd between the 22nd and 30th of May, 15th and 19th of June and 21st and 24th of July, 2020.

Previous records and reports indicate that the targeted threatened species occur in the region at times. While extensive clearing has occurred within the study area, patches of remnant vegetation remain, some of which provides habitat for some of the targeted species. The quality and extent of this habitat has been characterised and mapped, refining the initial potential habitat mapping previously prepared for each species (GHD 2020a) to provide a more accurate understanding of the possible occurrence of these species on the site and of the impacts of the project on them.

Regent Honeyeater habitat (8.060 hectares, which is also considered habitat critical to the survival of the species), Painted Honeyeater habitat (19.677 hectares) and Swift Parrot habitat (12.423 hectares) has been mapped within the development footprint. This represents a small proportion of the development footprint and study area. The removal of this habitat is considered acceptable as evidence indicates these species are likely more consistently to be utilising habitat adjacent to the study area and within the region, particularly habitat in larger forest blocks, rather than more fragmented habitat within the study area itself. It is noted that no White-throated Needletail roosting habitat is present within the development footprint or study area. Regent Honeyeater, Painted Honeyeater and Swift Parrot were also not recorded on the site during targeted surveys for the species or during or incidental to bird utilisation surveys.

Mortality and indirect impacts to Regent Honeyeater, Painted Honeyeater and Swift Parrot during construction and operation of the proposed MacIntyre Wind Farm are considered unlikely. Small numbers of White-throated Needletail may collide occasionally with wind turbines but the population consequences are unlikely to be significant.

2. Introduction

ACCIONA Energy Australia Global Pty Ltd (ACCIONA) engaged Nature Advisory Pty Ltd (Nature Advisory) to conduct threatened bird habitat and regional assessments for Regent Honeyeater (*Anthochaera phyrgia*), Painted Honeyeater (*Grantiella picta*), Swift Parrot (*Lathamus discolor)* and White-throated Needletail (*Hirundapus caudacutus*) as well as targeted surveys for Regent Honeyeater, Painted Honeyeater and Swift Parrot for the proposed MacIntyre Wind Farm which covers an area of 31,910 hectares in Cement Mills, QLD as shown in Figure 1 (from here on referred to as the study area). The study area is located approximately 33 kilometres south-west of Warwick within the Southern Downs Regional Council and Goondiwindi Regional Council local government areas. The development footprint is the area of disturbance for the proposed MacIntyre Wind Farm (1,207 hectares) as shown in Figure 1.

This report has been prepared in response to the Commonwealth Department of Agriculture, Water and the Environment (DAWE) request for further information following the referral (EPBC 2020/8756) decision that the MacIntyre Wind Farm is a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and is to be assessed through the preliminary documentation approach.

The report is divided into the following sections.

Section 3 describes the sources of information.

Section 4 describes the field methodology and information review approach for the assessment.

Section 5 presents the assessment results, including habitat mapping.

Section 6 describes the regional context for each species

Section 7 outlines the impacts on each species

Section 8 presents the conclusions of the assessment.

This assessment was undertaken by a team from Nature Advisory comprising Tom Cotter (Zoologist), Ahmad Barati (Zoologist), Candice Larkin (Zoologist), Curtis Doughty (Senior Zoologist), Bernard O'Callaghan (Director) and Brett Lane (Principal Consultant). The team is very grateful for information on the species investigated provided by Dr Stephen Debus of the University of New England.

3. Existing information

Existing information used for this investigation is described below.

3.1. Existing reporting and documentation

- National Recovery Plan for the Regent Honeyeater (*Anthochaera phrygia*) (Department of the Environment 2016)
- Conservation Advice *Anthochaera phrygia* Regent Honeyeater (Department of the Environment 2015)
- Conservation Advice *Grantiella picta* Painted Honeyeater (Department of the Environment 2015)
- National Recovery Plan for the Swift Parrot *Lathamus discolor* (Birds Australia 2011)
- Background Document - National Recovery Plan for the Swift Parrot *Lathamus discolor*. (Department of Environment, Climate Change and Water and Birds Australia 2010)
- Conservation Advice *Lathamus discolor* Swift Parrot (Threatened Species Scientific Committee 2016)
- Conservation Advice *Hirundapus caudacutus* White-throated Needletail (Threatened Species Scientific Committee 2019)
- Ecological assessment report of the MacIntyre Wind Farm (GHD 2020a)
- MacIntyre Wind Farm Project – MNES Assessment Report (GHD 2020b)
- MacIntyre and Karara Wind Farms – Threatened woodland bird assessment (Nature Advisory 2020a).

3.2. Background information

The following provides a background on the targeted bird species.

3.2.1. Regent Honeyeater

The Regent Honeyeater is listed as Critically Endangered under the EPBC Act.

The species is highly nomadic and mobile, with a patchy distribution that extends from south-east Queensland to central Victoria. Records are widely distributed across the species' range, but it is only found regularly at a few localities in NSW and Victoria where most of the sightings have been recorded (Department of the Environment 2015a). There is one record of the species within the southern portion of the study area (100 metres in from the study area boundary) and there are records to the north, south, east and west of the study area, including breeding events in the Cement Mills-Durikai region (Department of the Environment 2016; Hines 2008). The central portion of the Traprock Important Bird Area for Regent Honeyeater (BirdLife International 2020) is located within study area.

The Regent Honeyeater is most commonly associated with box-ironbark eucalypt woodlands, spotted gum-ironbark woodlands and dry sclerophyll forest and seems to prefer more fertile sites with higher soil water content, including creek flats, broad river valleys and lower slopes. Mature, large individual trees tend to be more important as they produce more nectar more reliably. The species also uses road-side remnant vegetation, remnant patches in farmland and urban areas, and travelling stock routes. Nests are typically in the canopy of mature, rough-barked trees such as ironbarks, sheoaks and Rough-barked Apple (*Angophora floribunda*) (Department of the Environment 2015a, 2016; Geering and French, 1998; Oliver et al. 1998).

Key tree and mistletoe species for the Regent Honeyeater are listed below (Department of the Environment 2015a).

- Mugga Ironbark (Eucalyptus sideroxylon)
- Yellow Box (*E. melliodora*)
- White Box (*E. albens*)
- Yellow Gum (*E. leucoxylon*)
- Spotted Gum (Corymbia maculata)
- Swamp Mahogany (*E. robusta*)
- Needle-leaf Mistletoe (*Amyema cambagei*) on River Sheoak (*Casuarina cunninghamiana*)
- Box Mistletoe (*A. miquelii*)
- Long-flower Mistletoe (*Dendrophthoe vitellina*).

Other tree species are considered regionally important for the species include Broad-leaved Ironbark (*E. fibrosa*) and Thin-leaved Stringybark (*E. eugenioides*) (Department of the Environment 2015a).

3.2.2. Painted Honeyeater

The Painted Honeyeater is listed as Vulnerable under the EPBC Act.

The species is sparsely distributed from south-eastern Australia to north-western Queensland and eastern Northern Territory, and exhibits seasonal north-south movements governed principally by the fruiting of mistletoe (Department of the Environment 2015b).

The highly specialised diet of Painted Honeyeater consists mainly of mistletoe fruit, although when there is a shortage of this food item, nectar and arthropods will also be consumed (Garnett et al. 2011, Higgins et al. 2001, Oliver et al. 2003). The species is strongly associated with the presence of mistletoe, particularly during the breeding season. The species prefers woodlands that contain a higher number of mature trees that host more mistletoe (Department of the Environment 2015b).

There are records of the species to the north of the study area outside the town of Karara and in Durikai State Forest.

3.2.3. Swift Parrot

The Swift Parrot (*Lathamus discolor)* is listed as Critically Endangered under the EPBC Act.

The Swift Parrot breeds in Tasmania in summer and the entire population migrates north and leaves the island for the winter. While on mainland Australia, the Swift Parrot typically disperses through Victoria and New South Wales, however, smaller numbers are observed in south-east Queensland on a regular basis (Saunders & Tzaros 2011). The species preferentially forages in large, mature trees in eucalypt forests and woodlands, particularly box-ironbark forest and woodlands as well as grassy woodlands (Saunders & Tzaros 2011).

In south-east Queensland, records indicate that Swift Parrot typically feed on lerp and nectar from Yellow Box, Grey Box (*Eucalyptus microcarpa*), Forest Red Gum (*E. tereticornis*) and Swamp Mahogany. There is a strong association between Swift Parrot and Mugga Ironbark, White Box and Spotted Gum elsewhere in their mainland distribution (Saunders & Tzaros 2011). The species has been recorded in Durikai State Forest to the north of the study area.

3.2.4. White-throated Needletail

The White-throated Needletail (*Hirundapus caudacutus*) is listed as Vulnerable and Migratory under the EPBC Act.

This species is widespread in eastern and south-eastern Australia and is recorded in all coastal regions of Queensland and NSW, extending inland to the western slopes of the Great Dividing Range and occasionally onto the adjacent inland plains. The species is also widespread in Victoria and Tasmania and occurs in south-eastern South Australia (Threatened Species Scientific Committee 2019).

The White-throated Needletail subspecies that occurs in Australia is *Hirundapus caudacutus caudacutus*. This subspecies is a trans-equatorial migrant that breeds in the Northern Hemisphere summer and migrates south for the Southern Hemisphere summer. The White-throated Needletail is mostly aerial in Australia, flying at heights of less than one metre up to more than 1000 metres above the ground. It has been recorded eating a wide variety of insects, including beetles, cicadas, flying ants, bees, wasps, flies, termites, moths, locusts and grasshoppers (Threatened Species Scientific Committee 2019).

The species occurs over most habitat types and is recorded most often above wooded areas, including open forest and rainforest, and may also fly below the canopy between trees or in clearings. When flying above farmland, it is more often recorded above partly cleared pasture, plantations or remnant vegetation at the edge of paddocks (Threatened Species Scientific Committee 2019).

In Australia, confirmed and high confidence records of White-throated Needletail roosting indicate the species roosts in dense foliage of canopy trees in large tracts of treed remnant vegetation along or contiguous with mountain ranges as detailed in the records below:

- very dense foliage in the crown of a eucalypt (16 metre tall) on a spur at Mt Coot-tha, Brisbane Queensland (D'Aguilar Range) (Corben et al. 1982).
- fairly thick foliage in the crown of two acacias (14 metre tall) and one banksia at Little Waterloo Bay, Wilsons Promontory, Victoria (mainland southern extremity of Great Dividing Range) (Day 1993).
- eucalypt on a spur at Nearum, Queensland (Gongiberoo Range) (Tarburton 1993).
- outer branch of a large Narrow-leaved Ironbark (*Eucalyptus crebra*) and near the top of mid-sized White Cypress Pine (*Callitris glaucophylla*) in West Pilliga, New South Wales (remnant vegetation contiguous with Warrumbungle Mountain Range and mountain range within Pilliga Nature Reserve) (Stanton 2011).
- It is also noted the species has been recorded landing in the crown of a Rough-barked Apple at Munghorn Gap New South Wales (Great Dividing Range) where the individual remained for four minutes (Quested 1982) although this is not considered a confirmed or high confidence record of the species roosting as the individual was only observed in the tree for a short period of time.

The species is also reported to roost in tree hollows (Threatened Species Scientific Committee 2019), bark on trees or rock faces and is likely to have traditional roost sites (Department of the Environment 2015c). It has been noted that the number of references to White-throated Needletail roosting in trees possibly over-emphasizes such occurrences. During extreme conditions including bushfires and cold, hot or inclement weather, the species is also known to take refuge in tree hollows, trees and stunted scrub (Department of Agriculture, Water and the Environment 2021).

White-throated Needletail has been observed in the airspace above the study area at 17 locations.

4. Methodology

4.1. Field methods

4.1.1. Habitat assessment

Habitat assessment and mapping was conducted in the study area by team members from Nature Advisory between the 22nd and 30th of May, 15th and 19th of June and the 21st and 24th of July, 2020. Habitat assessment and mapping for the study area was completed as part of a threatened woodland bird assessment (Nature Advisory 2020a).

A total of 62 habitat assessments were completed within and surrounding the study area (Figure 1). Habitat assessment locations were selected after a detailed review of the potential habitat mapping (based on field-verified Regional Ecosystem mapping) presented in the Ecological assessment report of the MacIntyre Wind Farm (GHD 2020a) and based on a review of aerial and satellite imagery to identify sections of the study area where larger trees were present . Areas with all characteristics consistent with the habitat requirements of the targeted species were identified as high quality habitat while those that had some characteristics were classed as potential habitat. Table 1 below describes the key criteria for these habitat classes for each threatened bird species. The habitat assessment criteria were derived from the Conservation Advice for Regent Honeyeater, Painted Honeyeater and Swift Parrot and the National Recovery Plans for Regent Honeyeater and Swift Parrot as listed in Section 3.1 and outlined in Section 3.2, applied to the particular vegetation and habitat on the site.

Once high quality and potential habitat was identified, it was assessed for its extent and habitat boundaries were mapped.

Habitat was characterised based on eucalypt community species composition, mistletoe community species composition, maximum canopy height, canopy crown cover, ground cover, percentage of old growth trees and proximity to riparian zones and potential disturbances. Whether eucalypts or mistletoes were in flower, was also documented and the flowering event scored. Eucalypt and mistletoe dieback was also noted.

The study area's habitat connectivity (i.e. degree of isolation/fragmentation), including linkages to other habitat in the region, was determined using field observations, recent aerial photography and previous sightings of the threatened species.

Table 1: High quality and potential habitat assessment criteria for woodland bird species

Habitat	Regent Honeyeater	Painted Honeyeater	Swift Parrot
High quality	Areas with old Growth >50-70% Abundant Mugga Ironbark *Eucalyptus sideroxylon* or White Box *E. albens* or mixed Mugga Ironbark–White Box patches, Yellow Box *E. melliodora* woodland areas, River She-oak *C. cunninghamiana* riparian zones with Angophora/Box and Blakely's Red Gum *E. blakelyi* and River Red Gum *E. camaldulensis*. Or Narrow-leaved Ironbark – Box woodlands, Abundance of Box with Drooping or Needle-leaf Mistletoe *Amyema cambagei* available. These areas were close to open patches as preferred by target species.	Areas with old Growth >50-70% Abundant Mugga Ironbark or White Box or mixed Mugga Ironbark–White Box patches, riparian woodland zones with River Red Gum and/or casuarina species and abundance of mistletoe species. White Cypress Pine woodlands with abundance of Needle-leaved Mistletoe.	Areas with old Growth >50-70% Abundant Mugga Ironbark or White Box or both species mixed, areas of Lemon-scented Gum *Corymbia citriodora* woodlands when in flower. Areas of abundant Grey Box *E. moluccana* and/or Yellow Box or River Red Gum. Areas of abundant White Box – Blackbutt with lerp infestations, Narrow-leaved Ironbark *E. crebra* woodlands with several mature high nectar-producing trees.
Potential	Old Growth < 50% Areas that have limited presence of Mugga Ironbark or White Box, Areas with Narrow-leafed Ironbark or Broad-leaved Ironbark *E. fibrosa* or Lemon-scented Gum woodlands with scattered Box eucalypts or riparian zones with River She-oak and some Angophora. At all sites Mistletoe infrequent or dying. Immature eucalypt woodland patches.	Old Growth < 50% Areas that have limited presence of Mugga Ironbark or White Box. Riparian woodland areas with casuarina species and/or River Red Gum and some mistletoe. In these zones, mistletoe totally absent or present but in low abundance or dying condition thus considered to be of lower quality.	Old Growth < 50% Areas of low density of Mugga or White Box. Areas of box woodlands lacking mature flowering trees, with scattered ironbark species. Immature eucalypt woodland patches.

Note: The habitat assessment criteria outlined above represent the habitat characteristics that are present within the study area consistent with the published habitat information . It is noted that Regent Honeyeater, Painted Honeyeater and Swift Parrot utilise other habitats with additional characteristics that are not present in the region or on the site..

Searches for White-throated Needletail were completed as part of Bird Utilisation Surveys (BUS) within the study area and Karara Wind Farm (which is immediately adjacent to the study area) between 3rd and 14th December 2020 and 1st and 12th February 2021 (Nature Advisory 2020b, Nature Advisory 2020c). During the habitat survey of the proposed MacIntyre Wind Farm transmission line corridor by Nature Advisory between the 26th and 29th of November 2020, searches for White-throated Needletail were also conducted. The number of individuals and minimum and maximum flight heights were recorded for each observation of the species.

Roosting habitat for White-throated Needletail was defined as treed remnant vegetation along or contiguous with a mountain range where the species may roost in dense foliage of canopy trees. It is also

possible that tree hollows, bark on trees or rock faces in such areas may also provide roosting habitat but this is not confirmed. High quality and potential roosting habitat categories for the species were not generated due to limited records and information on roosting habitat for the species in Australia. The habitat assessment criteria for White-throated Needletail were derived from a detailed review of the records of the species roosting in Australia and the Conservation Advice for the species as listed in Section 3.1 and outlined in Section 3.2.4.

4.1.2. Targeted surveys

The survey effort followed the survey guidelines for Australia's threatened birds (Department of the Environment, Water, Heritage and the Arts 2010). Two survey methods were adopted: a targeted point-count method; and an area-search method.

The former was modelled on survey methods typically used to monitor Regent Honeyeater, Swift Parrot and Painted Honeyeater. This method was chosen as several studies suggest that point counts may be more efficient at detecting more vocally active birds than transects or searches (Arnold 1984, Cunningham et al. 1999), and targeted surveys predefined by habitat preferences increase the probability of detecting rare and cryptic species. As the Regent Honeyeater is highly vocal and territorial in the months leading up to breeding, the species is conspicuous and can be successfully detected using the fixed-point survey technique.

The fixed-point bird survey method was used to detect the presence of Regent Honeyeater, Swift Parrot and Painted Honeyeater. This involved an observer stationed at a fixed-point for 10 minutes in high quality or potential habitat for the species and recording all bird species and numbers of individual birds heard or observed (Department of the Environment, Water, Heritage and the Arts 2010) within 100 metres of the fixed-point. Fixed-point bird survey points were completed in each patch of habitat for the targeted species except for the most southern patch of Regent Honeyeater high quality habitat along the southern boundary of the study area, where species was recorded in 1995. The majority of fixed-point bird surveys were completed along creeklines as recommended for Regent Honeyeater (Department of the Environment, Water, Heritage and the Arts 2010). Survey effort included a total of 12 hours across a total of 12 days.

The fixed-point bird surveys were completed during May, June and July 2020 which aligns with the survey guidelines for Australia's threatened birds (Department of the Environment, Water, Heritage and the Arts 2010) guideline that Regent Honeyeater surveys on the mainland be conducted between March and July. While the survey guidelines for Australia's threatened birds (Department of the Environment, Water, Heritage and the Arts 2010) do not specify a time of year for Swift Parrot surveys, the species has been recorded in the adjacent Durikai State Forest between July 2017 to September 2017 and from May 2018 to September 2018. It is noted that the survey guidelines for Australia's threatened birds (Department of the Environment, Water, Heritage and the Arts 2010) does not specify survey recommendations for Painted Honeyeater.

A total of 28 fixed-point survey locations were selected within and adjacent to the study area (Figure 1). Each fixed-point was surveyed twice during the survey period except for one site that was surveyed once as it was added later in the survey period. Targeted surveys were undertaken in areas of suitable habitat, including remnants consisting of mature growth box-ironbark or Lemon-scented Gum-ironbark, as well as riparian zones dominated by River She-oak and Rough-barked Apple, particularly in areas located nearer to historic sightings.

Fixed-point bird surveys were completed across different times throughout the day including during the morning, middle of the day and afternoon. This aligns with the recommendation for surveys to be completed preferably in the morning (but other times may also be appropriate) for Regent Honeyeater

and preferably in the early morning and afternoon when birds are most active and vocal for Swift Parrot (Department of the Environment, Water, Heritage and the Arts 2010).

In addition to fixed-point surveys, area searches were made in patches of high quality and potential habitat for the three targeted threatened bird species for an average of eight hours per day by two observers over eight days (128 person-hours).

In total, 134 hours of bird surveys were undertaken in high quality and potential habitat across the site (i.e. across several hundred hectares of such habitat). This survey effort is greater than that required for smaller areas of habitat in Department of the Environment, Water, Heritage and the Arts (2010).

If target species were recorded, an accurate count of individuals and any movements made was to be recorded, including flight distances, direction of flight, minimum and maximum heights above the ground and destination if known. Interaction between target species and other bird species was also to be documented. If nectivorous birds were observed feeding the observer recorded the number of birds feeding and the species of tree they were feeding on.

As the presence of Regent Honeyeater and Swift Parrot is best predicted by high nectar abundance (Crates et al. 2017, Department of the Environment, Water, Heritage and the Arts 2010), isolated flowering eucalypts were monitored opportunistically to confirm the presence or absence of the species during flowering events. As the presence of Painted Honeyeater is usually associated with fruiting mistletoes, areas with more abundant mistletoe were targeted for searches. It is noteworthy however that the incidence of flowering eucalypts during the surveys was low, possibly in response to recent dry climatic conditions.

Observers also documented the presence and abundance of nectar feeding species, as competition for resources with more aggressive honeyeaters, particularly the Noisy Miner (*Manorina melanocephala*) and Noisy Friarbird (*Philemon corniculatus*), may be a factor in Regent Honeyeater decline (Department of the Environment 2016, Menkhorst et al. 1999). A high abundance of nectar feeding species may limit the value and suitability of some habitat, particularly if the habitat is highly fragmented.

4.2. Limitations

Wherever appropriate, a precautionary approach has been adopted. It is noted that limited flowering of foraging tree species was occurring during field surveys which limits ability to detect the targeted woodland bird species. As a result, the precautionary approach has been adopted that any high quality or potential habitat within the study area could be utilised by the target bird species.

The targeted surveys were undertaken during winter in 2020. This is an appropriate time to undertake the surveys for Regent Honeyeater and Swift Parrot as these species may be in the region during winter.

Due to the diet of Painted Honeyeater consisting of mistletoe, and the timing of their breeding coinciding with periods of mistletoe fruit and flower abundance, surveys should be conducted in early spring to late summer (Oliver et al. 2003). In addition, this is the period when birds are more likely to gather in aggregations, engage in displays, and become highly vocal and thus, more detectable (Watson 2012).

Call playback was not undertaken as part of this assessment as the appropriate license was not approved in time for the surveys. Notwithstanding this, the three target species are vocal and detectable, either visually or by their call by the experienced observers involved.

4.3. Habitat critical to the survival of species

Based on the outcome of the field habitat assessment, the presence of habitat critical to the survival of Regent Honeyeater, Swift Parrot, Painted Honeyeater and White-throated Needletail within the study area was assessed for each species against the EPBC Act documentation as listed below.

- National Recovery Plan for the Regent Honeyeater (*Anthochaera phrygia*) (Department of the Environment 2016)
- National Recovery Plan for the Swift Parrot *Lathamus discolor* (Birds Australia 2011)
- Matters of National Environmental Significance - Significant impact guidelines 1.1 (Department of the Environment 2013).

4.4. Species database review

Records for Regent Honeyeater, Painted Honeyeater, Swift Parrot and White-throated Needletail were viewed and extracted where possible from the following databases:

- Queensland Government Department of Environment and Science WildNet
- Atlas of Living Australia
- BirdLife Australia Birdata.

4.5. Expert input and review

Dr Stephen Debus (Adjunct Lecturer at University of New England) from the BirdLife Australia Regent Honeyeater Recovery Team has also provided input to and reviewed this report. Dr Debus has extensive expertise in research and survey of threatened forest and woodland birds (particularly Regent Honeyeater, Painted Honeyeater and Swift Parrot); ecology, biology and behaviour of birds; conservation and management of threatened bird species; editing ornithological papers and the review of ornithological documents and species impact statements. Nature Advisory Pty Ltd is very grateful for Dr Debus' advice and accepts responsibility for all conclusions presented in this report.

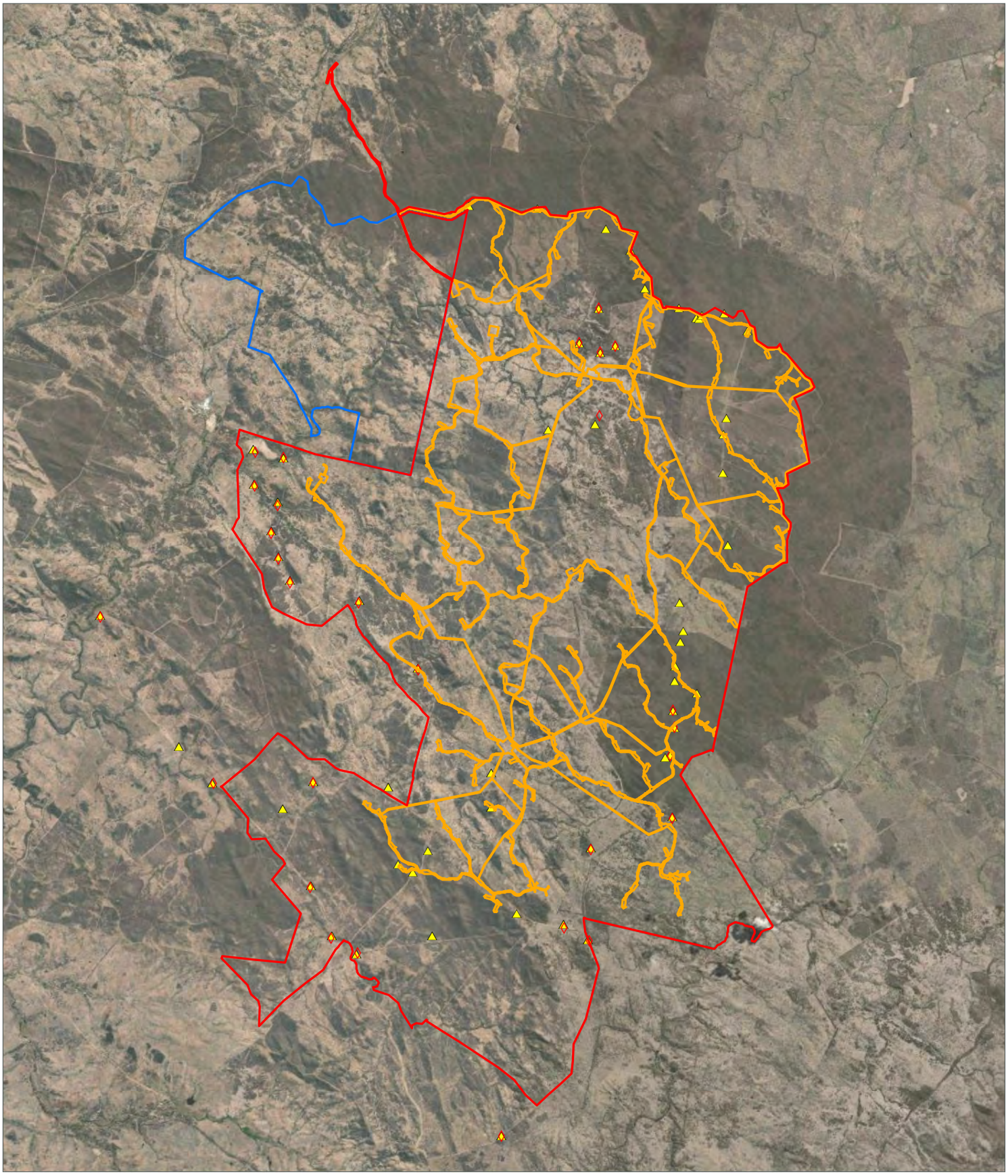

Figure 1: Survey Locations

Project: MacIntyre Wind Farm Client: ACCIONA Energy Australia Global Pty Ltd Date: 5/08/2021

- Study Area
- Development Footprint
- Karara Wind Farm
- Fixed-point Survey
- Habitat Assessment

N

Metres
0 2,600

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5. Results

5.1. Site description

The study area consists of diverse types of habitat from cleared, intensively grazed agricultural land to dense, mixed eucalypt/cypress pine forests. Overall, the vegetation structure within the study area is fragmented, open woodland with large eucalypts 25 metres tall and small grasses and shrubs. There is also a limited number of small farm dams within the study area that may provide habitat for small numbers of waterbirds.

Most of the habitat in the north and north-east section of the study area is dominated by Narrow-leaved Ironbark, White Box, Tumble-down Red Gum, Silver-leaved Ironbark and Lemon-scented Gum. Riparian zones are present in the western and southern sections of the site, typically consisting of patches of River She-oak/Yellow Box/Blakely's Red Gum and Rough-barked Apple woodland communities. Mugga Ironbark is present in smaller, scattered patches whereas Narrow–leaved Ironbark is more widespread and abundant. Two mistletoe species (an important nectar source when flowering) occur within the study area: Box Mistletoe and Drooping Mistletoe. Flowering was observed in White Box during the survey period.

During the assessments, the region was severely drought-affected, with significant canopy, low tree layer and shrub layer dieback present throughout the study area. Most of the lowlands within the study area have been cleared for cattle and sheep grazing with vegetation restricted to creek lines and scattered pasture trees. There is limited old growth treed habitat within the study area due to historical timber harvesting and thinning of the canopy for grazing throughout the lower slopes.

5.2. Habitat assessment

The study area contains habitat for the targeted species listed below.

- Regent Honeyeater
- Painted Honeyeater
- Swift Parrot

The quantity of habitat for each species within the study area and development footprint is presented in Table 2 below.

Table 2: Targeted species habitat within the study area and development footprint.

Species	Development Footprint (ha)			Study Area (ha)			Proportion impacted
	High quality	Potential	Total	High quality	Potential	Total	%
Regent Honeyeater	0.169	7.891	8.060	329.603	233.418	563.021	1.432
Painted Honeyeater	0.143	19.534	19.677	294.172	637.333	931.505	2.112
Swift Parrot	3.121	9.302	12.423	145.690	382.896	528.586	2.350
White-throated Needletail	N/A	N/A	0	N/A	N/A	0	0

5.2.1. Regent Honeyeater

Areas of high quality and potential habitat for Regent Honeyeater were identified and mapped based on the methodology described in Section 4.

High quality habitat for Regent Honeyeater occurs mostly in lowlands and riparian zones within the study area (Figure 2), particularly along tributaries of MacIntyre Brook, consisting of mature River She-oak and Blakeley's Red Gum riparian strips, with scattered Angophora, Yellow Box and White Box. These riparian zones have connection with the location of known breeding records and sightings directly adjacent to the study area, on the neighbouring property, Glenelg. Some potential habitat, consisting of Ironbark/Box/Lemon-scented Gum woodland habitat is also present.

Isolated patches of Mugga Ironbark occur within the study area and White Box was flowering sporadically across the study area during the field survey.

Habitat critical to the survival of the Regent Honeyeater includes the following (Department of the Environment 2016).

- any breeding or foraging habitat in areas where the species is likely to occur (as defined by the distribution map provided in the National Recovery Plan for the Regent Honeyeater)
- any newly discovered breeding or foraging locations.

As the high quality and potential Regent Honeyeater within the study area is within the 'likely to occur' portion of the distribution map in the National Recovery Plan for the Regent Honeyeater, the high quality and potential habitat within the study area is considered habitat critical to the survival of the species.

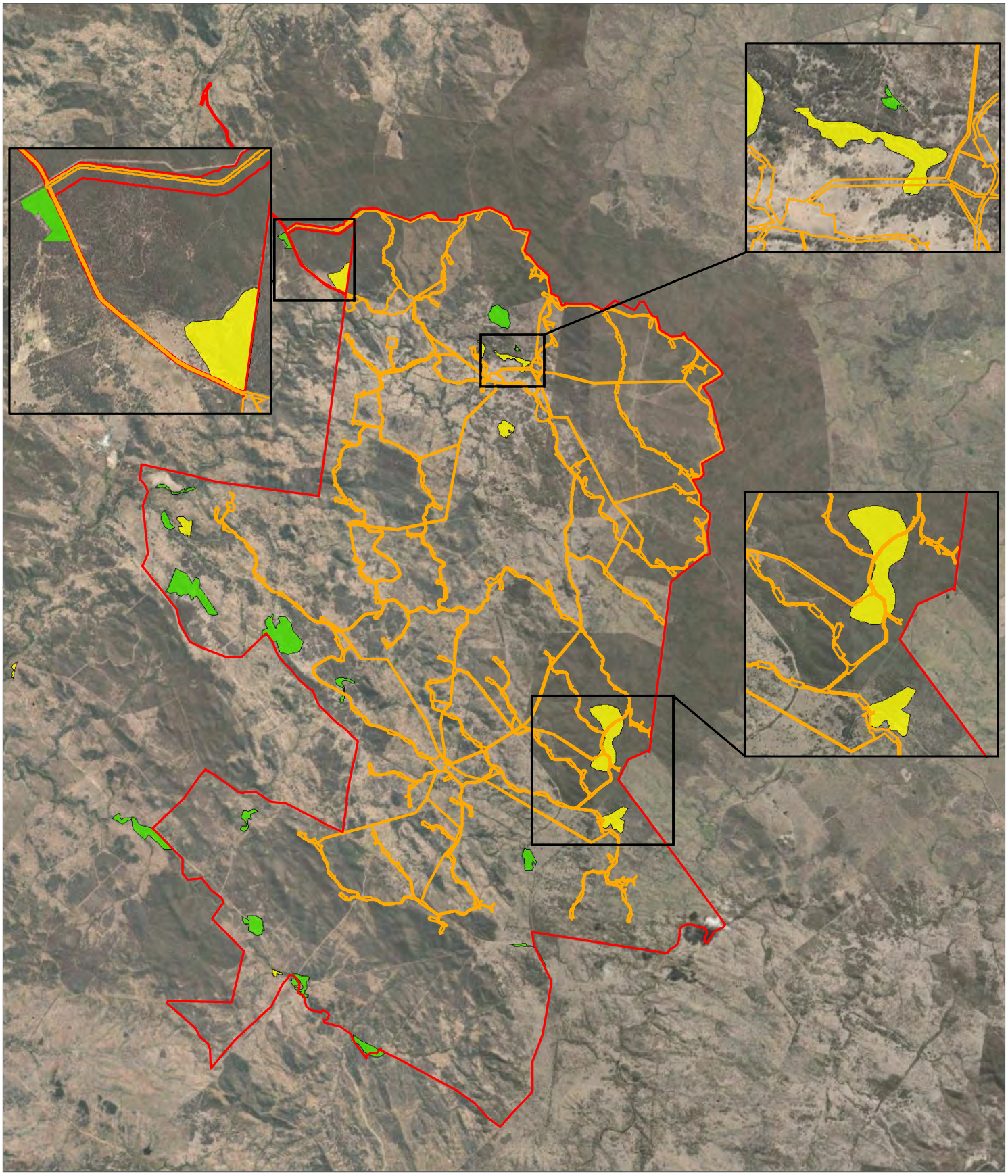

Figure 2: Regent Honeyeater Habitat

Project: MacIntyre Wind Farm Client: ACCIONA Energy Oceania Pty Ltd Date: 5/08/2021

Study Area

Development Footprint

Regent Honeyeater Habitat

High Quality

Potential

N

Metres

0 2,400

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5.2.2. Painted Honeyeater

Areas of high quality and potential habitat for Painted Honeyeater were identified and mapped based on the methodology described in Section 4. Areas of high quality habitat were mapped under the assumption that they would provide good habitat during the summer months, corresponding with mistletoe flowering and fruiting.

High quality habitat occurs mostly in lowlands and riparian zones (Figure 3), particularly along tributaries of MacIntyre Brook, consisting largely of mature River She-oak and Blakely's Red Gum with scattered Angophora, Yellow and White Box and with a higher density of Drooping and Box Mistletoe. Isolated patches of cypress pine in the eastern section of the study area also provide habitat due to their increased abundance of mistletoe, and proximity to known sightings further north in the Durikai State Forest. It is noted that Weeping Myall (*Acacia pendula*) with Grey Mistletoe (*Amyema quandang*) was not observed within the study area.

Habitat critical to the survival of Painted Honeyeater refers to areas that are necessary (Department of the Environment 2013):

- for activities such as foraging, breeding, roosting or dispersal;
- for the long-term maintenance of the species (including the maintenance of species essential to the survival of the species, such as pollinators);
- to maintain genetic diversity and long term evolutionary development; or
- for the reintroduction of populations or recovery of the species.

Areas that are considered *necessary* for the processes outlined immediately above to function in a region contain the following characteristics:

- large, continuous blocks of remnant woodland (Department of the Environment 2015b);
- contains a significant quantity of mistletoe for Painted Honeyeater; and/or
- records of the species within or adjacent to the habitat.

Examples of areas that meet the characteristics outlined immediately above are the larger tracts of remnant vegetation in the region (such as Durikai State Forest where the species has been recorded) with fruiting and flowering mistletoe. Painted Honeyeater preferentially forage and breed in these areas where and when ample mistletoe fruit and flower are available (Department of the Environment 2015b).

The Painted Honeyeater habitat mapped within the study area is not considered *necessary* for the processes outlined above to function in the region as:

- the patches of Painted Honeyeater habitat that occur within the study area are small and fragmented rather than large, continuous blocks of remnant woodland; and
- the majority of habitat within the study area does not contain a significant quantity of mistletoe for Painted Honeyeater.

As a result, Painted Honeyeater habitat within the study area is not considered habitat critical to the survival of the species.

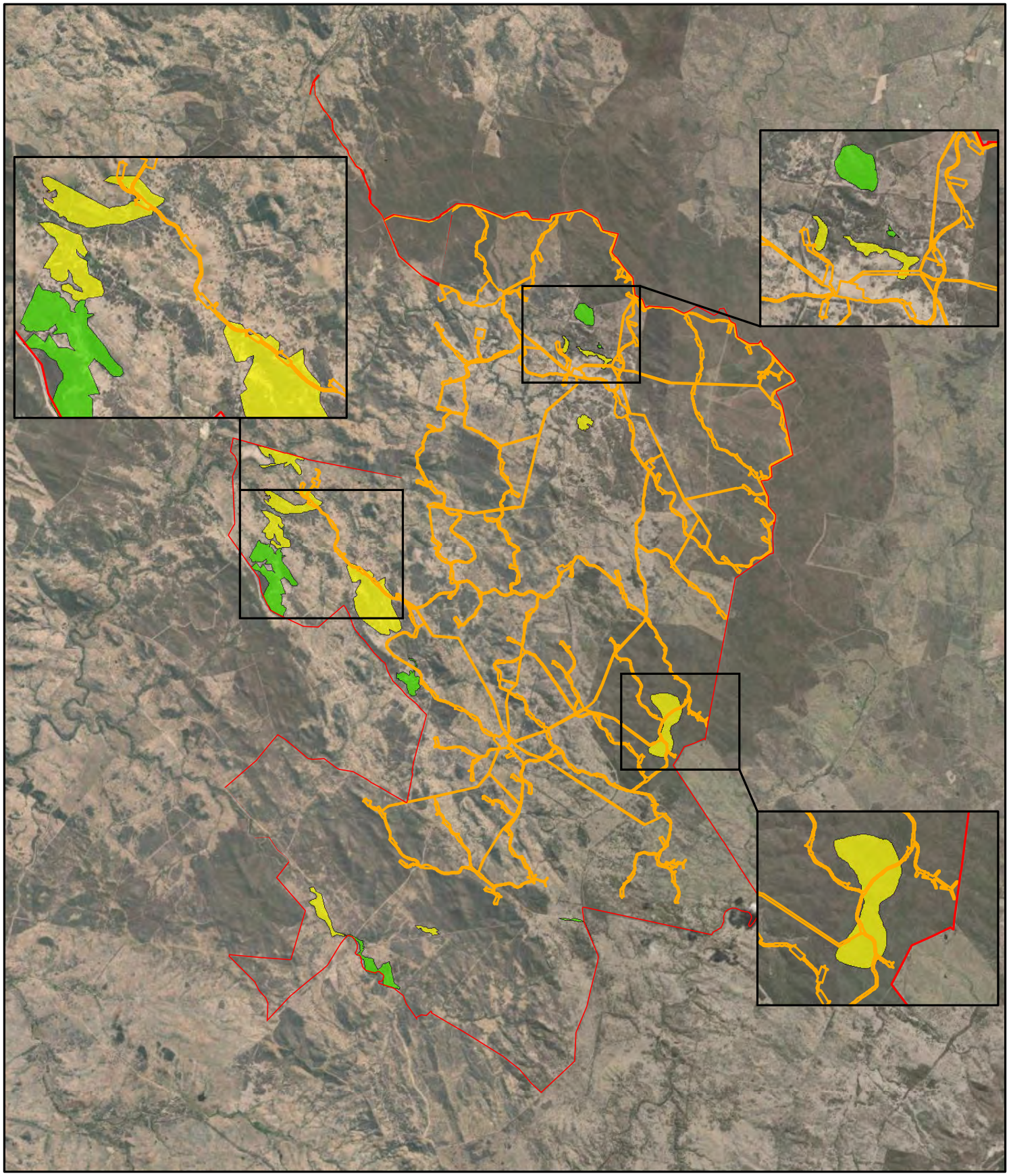

Figure 3: Painted Honeyeater Habitat

Project: MacIntyre Wind Farm Client: ACCIONA Energy Oceania Pty Ltd Date: 5/08/2021

Study Area

Development Footprint

Painted Honeyeater Habitat

High Quality

Potential

N

Metres

0 2,600

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5.2.4. Swift Parrot

Areas of high-quality and potential habitat for this species were identified and mapped based on the methodology described in Section 4.

High quality habitat was observed in patches throughout the study area (Figure 4) containing Ironbark–Lemon-scented Gum woodland as well as one patch of Swift Parrot high quality containing White Box in heavy flower with an abundance of Scaly-breasted Lorikeet (*Trichoglossus chlorolepidotus*). This patch may provide higher nectar and lerp yields. Isolated high-quality patches of Mugga Ironbark were present within the study area, however, were not flowering during the survey.

Habitat critical to the survival of the Swift Parrot includes (Saunders & Tzaros 2011):

- those areas of priority habitat for which the Swift Parrot has a level of site fidelity or possess phenological characteristics likely to be of importance to the Swift Parrot: or
- are otherwise identified by the recovery team.

Priority habitat for Swift Parrot are areas of particular importance for conservation management which are used (Saunders & Tzaros 2011):

- for nesting;
- by large proportions of the Swift Parrot population;
- repeatedly between seasons (site fidelity); or
- for prolonged periods of time (site persistence).

The Swift Parrot habitat within the study area is not considered priority habitat for the species as the patches of Swift Parrot habitat within the study area are:

- not used for nesting with nesting occurring in Tasmania (Saunders & Tzaros 2011);
- not used by large proportions of the Swift Parrot population with no records of the species within the study area from WildNet, Birdata and Atlas of Living Australia databases and following targeted surveys for the species as well as following Bird Utilisation Surveys and fauna surveys throughout the study area (GHD 2020b, Nature Advisory 2020b). It is noted there are some Swift Parrot records within the adjacent Durikai State Forest (as shown in Figure 7 and detailed in Section 6.3);
- not repeatedly used between seasons (lack of site fidelity) with no records of the species within the study area. It is noted there are some Swift Parrot records within the adjacent Durikai State Forest with records from July 2017 to September 2017, from May 2018 to September 2018 and in June 2021; and
- not used for prolonged periods of time (lack of site persistence) with no records of the species within the study area.

The Swift Parrot habitat within the study area is also not identified by the recovery team as priority habitat for the species (Saunders & Tzaros 2011). It is noted that the WildNet, Birdata and Atlas of Living Australia records for the species in the adjacent Durikai State Forest indicate a level of Swift Parrot site fidelity with records from July 2017 to September 2017, from May 2018 to September 2018 and in June 2021, and as a result these areas within Durikai State Forest are considered priority habitat and habitat critical to the survival of the species.

It is noted that the Swift Parrot habitat within the study area may possess phenological characteristics that may support Swift Parrot foraging if sufficient levels of lerp and nectar are available in winter flowering eucalypt species, however, there are no Swift Parrot records within any of these patches (noting that heavy flowering of the winter flowering species White Box was observed in one patch within the study area and outside the development footprint) and high quantities of lerp was not observed in these

patches. This indicates that these patches may not produce sufficient levels of lerp and/or nectar to allow the species to forage and are therefore not considered likely to be of importance to the Swift Parrot. If one or more of the patches of Swift Parrot habitat within the study area (or within the adjacent proposed Karara Wind Farm or proposed MacIntyre Wind Farm transmission line corridor) contained one or more records of Swift Parrot and/or high quantities of lerp or very heavy flowering in winter flowering eucalypt species had been observed within these patches, the Swift Parrot habitat within the study area would be considered to possess phenological characteristics likely to be of importance to the Swift Parrot and therefore habitat critical to the survival of the species.

As a result of the above, Swift Parrot habitat mapped within the study area is not considered habitat critical to the survival of the species.

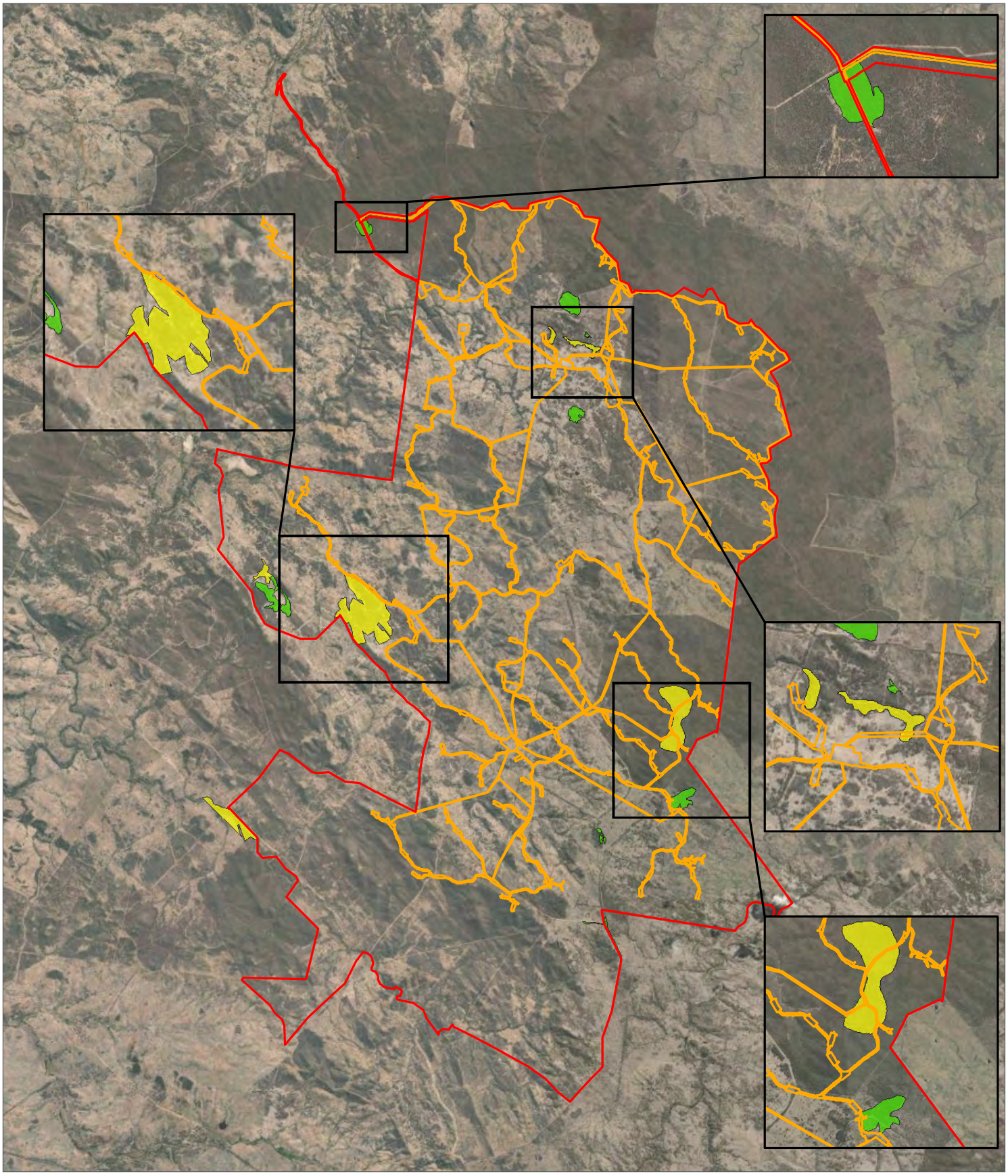

Figure 4: Swift Parrot Habitat

Project: MacIntyre Wind Farm Client: ACCIONA Energy Oceania Pty Ltd Date: 5/08/2021

Study Area

Development Footprint

Swift Parrot Habitat

High Quality

Potential

N

Metres

0 2,600

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5.2.5. *White-throated Needletail*

No roosting habitat for White-throated Needletail was present within the study area based on the methodology described in Section 4.

While treed remnant vegetation is present within the study area consisting of low eucalypt woodland on rocky rises, ironbark open woodland, mixed eucalypt woodland/forest and mixed eucalypt woodland on alluvial flats, it did not occur along or was contiguous with a mountain range. Confirmed and high confidence records of the species roosting in Australia are in treed remnant vegetation along or contiguous with a mountain range. During extreme conditions including bushfires and cold, hot or inclement weather, the species may infrequently take refuge in trees within the study area.

White-throated Needletail has been observed over the study area (Figure 8). Individuals have been recorded flying between 10 metres and 300 metres above ground level (Nature Advisory 2020b). The species is considered likely to occupy the airspace throughout the study area.

Habitat critical to the survival of White-throated Needletail refers to areas that are necessary (Department of the Environment 2013):

- for activities such as foraging, breeding, roosting, or dispersal;
- for the long-term maintenance of the species (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- to maintain genetic diversity and long term evolutionary development; or
- for the reintroduction of populations or recovery of the species.

While the airspace above the study area provides an area for White-throated Needletail to forage and disperse; will assist with the long-term maintenance of the species; will help to maintain genetic diversity and long-term evolutionary development; and provides habitat for the recovery of the species; the airspace above the study area is not considered necessary for these processes to occur. The species also breeds in the Northern Hemisphere and roosting habitat is not considered to be present within the study area. As a result, habitat critical to the survival of the species is not considered to be present within or above the study area.

5.3. Targeted surveys

No Regent Honeyeater, Painted Honeyeater or Swift Parrot were recorded during the autumn and winter survey periods. This was expected for Painted Honeyeater due to the lack of flowering and fruiting mistletoe.

Flowering trees were typically dominated by Scaly-breasted Lorikeet, Noisy Friarbird and Fuscous Honeyeater.

While much of the study area is cleared agricultural land, remnant vegetation is scattered throughout and around the perimeter of the study area, allowing for the potential movement of Regent Honeyeater, Painted Honeyeater and Swift Parrot across agricultural land between patches of habitat.

The riparian zones from the south-west to north-west portion of the study area are relatively contiguous, and would likely form the most obvious wildlife corridor for Regent Honeyeater. These lie in lower parts of the landscape and may not therefore be as exposed to turbine impacts as ridges are preferred as turbine sites.

Likely due to drought, many of the mistletoe observed were in poor condition or dying, and this may have reduced the likelihood of Painted Honeyeater utilising the study area at the time. Selective logging has occurred throughout the study area, including on properties bordering the Durikai State Forest which may

impact the quality of habitat for these species. The properties with cypress pine woodland bordering on state forest from the south-east to north-east sections of the study area support relatively continuous tree cover, and would likely form the most obvious wildlife corridor for Painted Honeyeater.

Nectivorous birds recorded in the study area included the following:

- Brown–headed Honeyeater
- Fuscous Honeyeater
- Noisy Friarbird
- Noisy Miner
- Rainbow Lorikeet
- Scaley–breasted Lorikeet
- White–plumed Honeyeater.

It is also noted that during four Bird Utilisation Surveys (BUS) completed by Nature Advisory to date within the study area in 2020 and 2021, Noisy Miner was recorded in the top four most abundant bird species (Nature Advisory 2020b, Nature Advisory 2020c). Noisy Miner benefits from smaller and fragmented patches of habitat and is a competitive excluder of Regent Honeyeater, Painted Honeyeater and Swift Parrot. The abundance of Noisy Miner is likely a key contributor to the absence of Regent Honeyeater, Painted Honeyeater and Swift Parrot from the study area (S Debus 2021, pers. comm. 10 February 2021).

6. Regional context

6.1. Regent Honeyeater

Regent Honeyeater records are widely distributed across the species' range from south-eastern Queensland to central Victoria. There is one record of the species within the southern portion of the study area (two individuals observed 100 metres in from the study area boundary in 1995) and there are records to the north, south, east and west of the study area, including breeding events in the Cement Mills-Durikai region. The species is only found regularly at a few localities in NSW and Victoria, where most of the sightings have been recorded (Department of the Environment 2015a; Department of the Environment 2016; Hines 2008).

Within 50 kilometres of the study area there are 19 records of Regent Honeyeater (18 Birdata records and one record from Dr Stephen Debus) with 14 records within the Traprock Important Bird Area for Regent Honeyeater (Figure 5). While most of the study area is within the Traprock Important Bird Area, habitat within the development footprint for the species is restricted to five smaller and fragmented patches for a total of 8.060 hectares (0.169 hectares of high quality habitat and 7.891 hectares of potential habitat) (Figure 2).

The Durikai State Forest and MacIntyre State Forest are within the Traprock Important Bird Area and contain significant tracts of selectively logged (in places) eucalypt forest and woodlands comprised mainly of Lemon-scented Gum (*Corymbia citriodora*) associations and box-ironbark associations (BirdLife International 2020). The Durikai State Forest totals 12,357 hectares and MacIntyre State Forest totals 1,002 hectares. Thirteen of the 14 records of Regent Honeyeater within the Traprock Important Bird Area are within larger tracts of Regent Honeyeater habitat within Durikai State Forest and along MacIntyre Brook. There is one record of Regent Honeyeater within the Traprock Important Bird Area and within the study area from a patch of habitat on Coopers Creek that is connected to larger tracts of Regent Honeyeater habitat along Branch Creek (tributary of MacIntyre Brook), the majority of which is outside the study area. The three Regent Honeyeater records outside the Traprock Important Bird Area and within 50 kilometres of the study area are within large tracts of Regent Honeyeater habitat within Wondul Range National Park and Connoly Dam, and immediately adjacent to Sundown National Park which are between 36 kilometres and 46 kilometres from the study area.

At times when key tree and mistletoe species are flowering within the Regent Honeyeater habitat in the study area, the species may forage in these patches. It is noted that there have been no records of the species within these smaller and fragmented patches (including after targeted surveys for the species within the study area as part of this assessment) since 1995 where two individuals were recorded 100 metres in from the southern boundary of the study area, indicating that these patches may not provide sufficient quantities of reliable nectar for the species. It is also noted there have been no records of the species within the smaller and fragmented patches within the development footprint. There is also no evidence that the Regent Honeyeater utilises these patches for roosting or breeding. These smaller and fragmented patches provide areas which may be utilised by the species, although the majority of Regent Honeyeater activity within the region is within larger tracts of Regent Honeyeater habitat within Protected Areas and along waterways. It is also noted that the species is most often recorded in a few localities in NSW and Victoria. While breeding events have been recorded in the Cement Mills-Durikai area, which has significance as the only remaining outpost of Regent Honeyeater breeding in Queensland (S Debus 2021, pers. comm. 15 January), there are no key breeding areas or other breeding areas for the species mapped within Queensland (Department of the Environment 2016).

While the 8.060 hectares of Regent Honeyeater habitat within the development footprint is considered to be habitat critical to the survival of the species, much larger tracts of habitat critical to the survival of

the species are located in the region and within the Traprock Important Bird Area including Durikai State Forest. Regent Honeyeater appear to utilise these areas preferentially rather than smaller and more fragmented patches of habitat, such as those occurring within the study area.

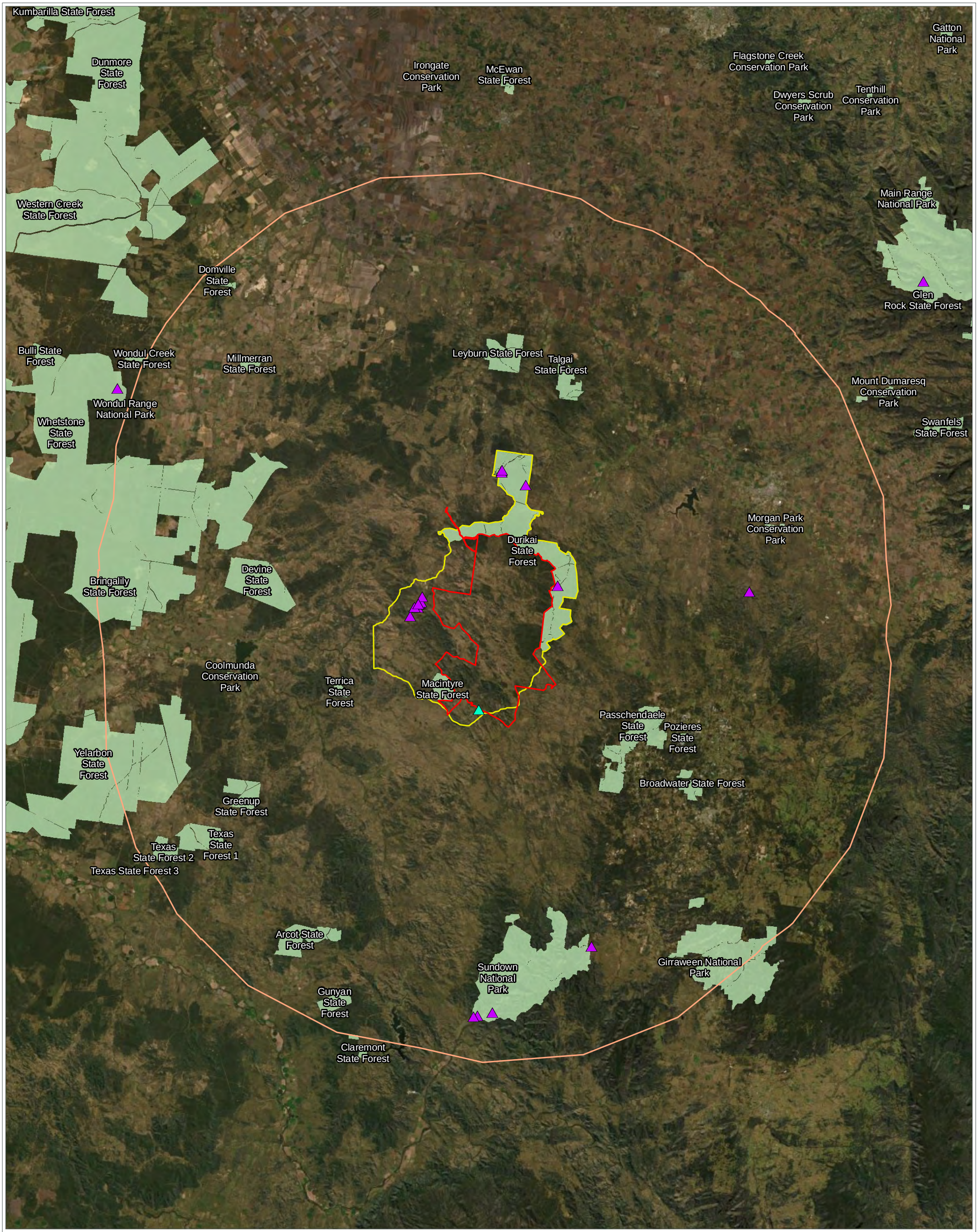

Figure 5: Regent Honeyeater Records

Project: MacIntyre Wind Farm Client: ACCIONA Energy Australia Global Pty Ltd Date: 5/08/2021

Study Area
Study Area Buffer (50km)
Traprock Important Bird Area
Protected Area

Regent Honeyeater

Birdata
Debus

N

Metres
0 9,600

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6.2. Painted Honeyeater

The Painted Honeyeater is sparsely distributed from south-eastern Australia to north-western Queensland and eastern Northern Territory. The species exhibits seasonal north-south movements governed principally by the fruiting of mistletoe, with which its breeding season is closely matched (Department of the Environment 2015b).

Within 50 kilometres of the study area there are 20 records of Painted Honeyeater (three WildNet records, six Birdata records and 11 Atlas of Living Australia records) (Figure 6). Two records of the species come from within the Traprock Important Bird Area (BirdLife International 2020) in Durikai State Forest and an additional two records of the species from Karara, to the north of the study area.

Smaller and more fragmented patches of Painted Honeyeater potential habitat occur within the study area. A total of 19.677 hectares within six of these patches are within the development footprint with the largest portion within the development footprint being 7.507 hectares. It is noted that removal of this habitat does not remove these patches. There is also a total of 15 patches of Painted Honeyeater habitat covering 931.505 hectares (294.172 high quality habitat and 637.333 hectares of potential habitat) within the study area. Only 2.112 percent of Painted Honeyeater habitat within the study area is proposed to be removed.

Painted Honeyeater is more common in more extensive blocks of remnant woodland than in narrower strips, although it breeds in quite narrow roadside strips if ample mistletoe fruit is available (Department of the Environment 2015b). The distribution of records of the species within 50 kilometres of the study area (Figure 6) demonstrates this with more records in Protected Areas (particularly noting Durikai State Forest which is the closest Protected Area to the study area and covers an area of 12,357 hectares) and larger tracts of remnant vegetation compared with one record within remnant vegetation in the Millmerran Road corridor.

At times, when mistletoe is fruiting and flowering within the smaller and more fragmented patches of Painted Honeyeater potential habitat within the study area, the species may occasionally forage in these areas. These patches contain small amounts of mistletoe and there are no records of the species within them. When mistletoe is fruiting and flowering in the larger tracts of remnant vegetation in the surrounding area (such as Durikai State Forest), the species would prefer these areas to the smaller and more fragmented areas of potential habitat within the study area. Painted Honeyeater would also preferentially breed in these areas, as well as narrow roadside remnants if ample mistletoe fruit is available (Department of the Environment 2015b) rather than within the study area.

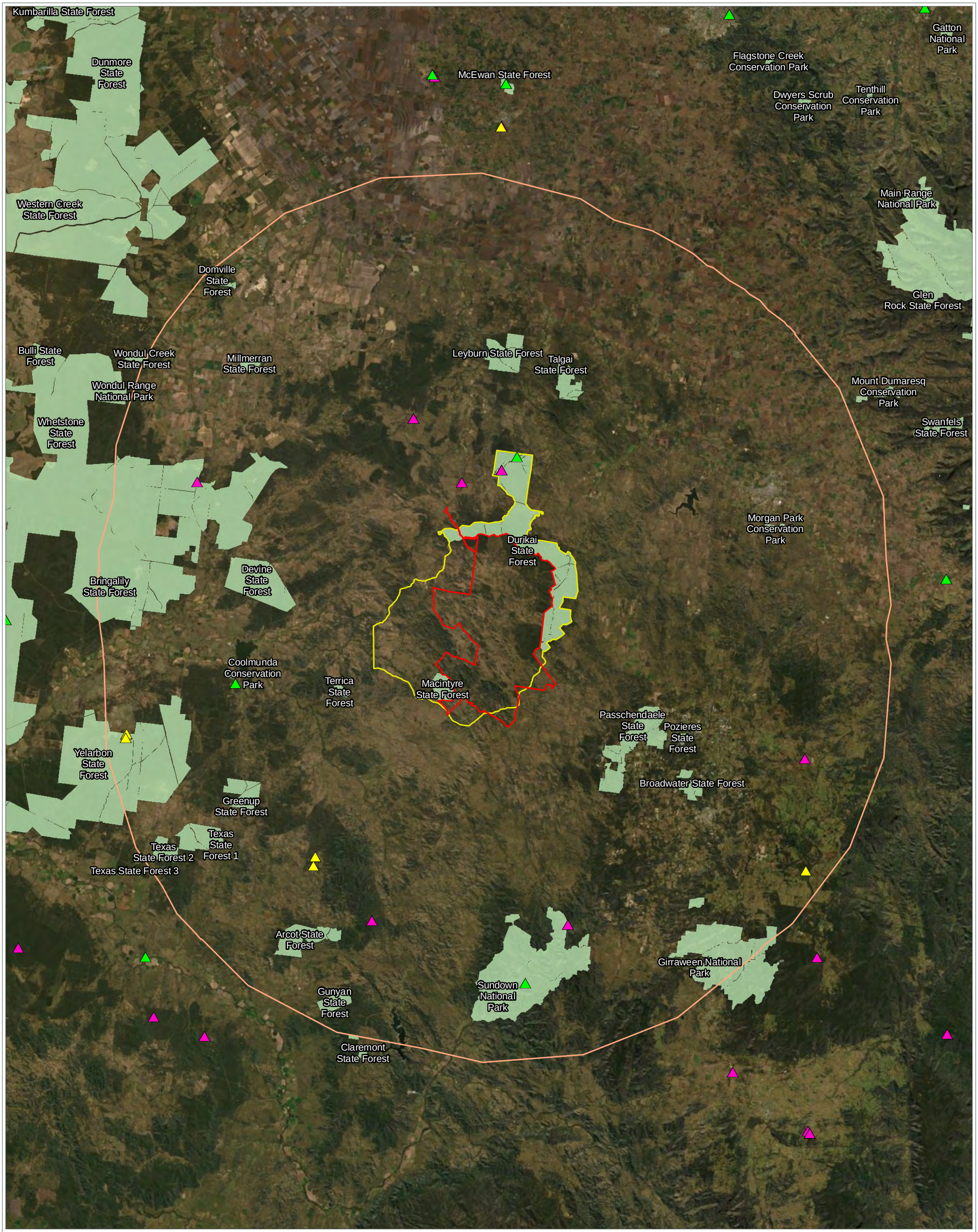

Figure 6: Painted Honeyeater Records

Project: MacIntyre Wind Farm Client: ACCIONA Energy Australia Global Pty Ltd Date: 5/08/2021

Study Area
Study Area Buffer (50km)
Traprock Important Bird Area
Protected Area

Painted Honeyeater

WildNet
Birdata
Atlas of Living Australia

N

Metres
0 9,600

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6.3. Swift Parrot

The Swift Parrot breeds in Tasmania in summer and the entire population leaves the island and migrates north for the winter. While on mainland Australia, the Swift Parrot typically disperses through Victoria and New South Wales, however, smaller numbers are observed in south-east Queensland on a regular basis (Saunders & Tzaros 2011). The species exhibits high site fidelity, returning to locations on an irregular cyclic basis (Threatened Species Scientific Committee 2016).

Within 50 kilometres of the study area there are 34 records of Swift Parrot (three WildNet record, 10 Birdata records and 21 Atlas of Living Australia records) (Figure 7). The species is reported occasionally within the Traprock Important Bird Area (BirdLife International 2020). A total of 23 records of Swift Parrot come from within the Traprock Important Bird Area, all of which are within Durikai State Forest.

The species preferentially forages in large, mature trees in eucalypt forests and woodlands, particularly box-ironbark forest and woodlands, as well as grassy woodlands (Saunders & Tzaros 2011). Within the development footprint 12.423 hectares of Swift Parrot habitat (3.121 hectares of high quality habitat and 9.302 hectares of potential habitat) has been found within five smaller and more fragmented patches. It is noted that there are no records of Swift Parrot within the patches of Swift Parrot habitat mapped within the study area.

The species exhibits high site fidelity and the production of lerp and nectar food resources are considered the main limiting factors to the species (Saunders & Tzaros 2011). At times, when sufficient levels of lerp and nectar are available, the species may occasionally forage within the smaller and more fragmented patches in the study area. It is noted though that the lack of records within these patches (including after targeted surveys for the species within the study area as part of this assessment) indicates that these patches may not produce sufficient levels of lerp and/or nectar to allow the species to forage. Based on the distribution of records in Figure 7, the species is preferentially foraging in habitat within the Durikai State Forest which covers an area of 12,357 hectares compared to the 12.423 hectares of Swift Parrot habitat within the development footprint.

Habitat characteristics of roosting sites for Swift Parrot are relatively unknown. Based on the lack of records within the study area, the Swift Parrot habitat within the study area is not considered roosting habitat. The species is likely roosting in areas such as Durikai State Forest where it has been recorded, as proximity to foraging habitat is likely to be important in roost site selection (Saunders & Tzaros 2011).

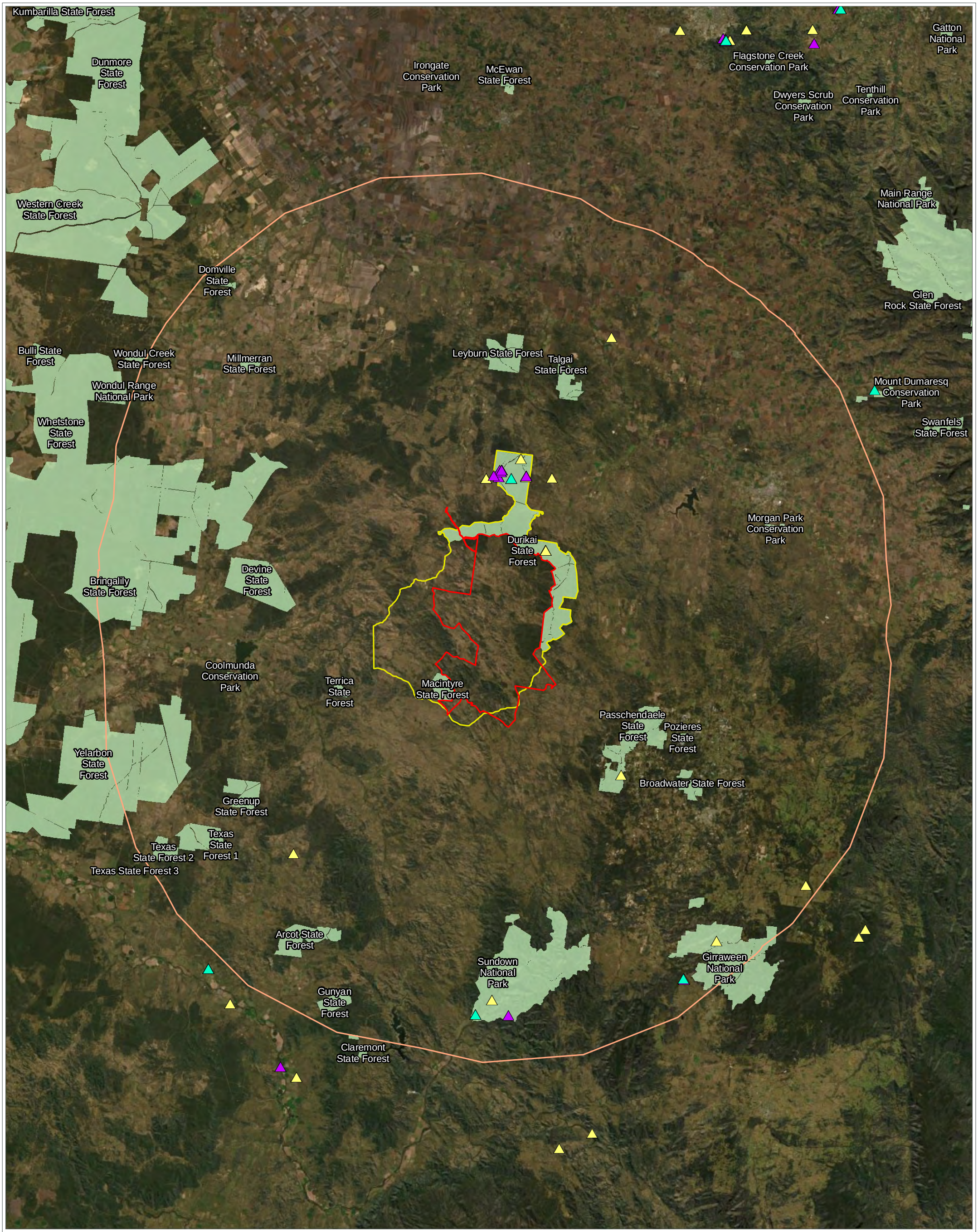

Figure 7: Swift Parrot Records

Project: MacIntyre Wind Farm Client: ACCIONA Energy Australia Global Pty Ltd Date: 5/08/2021

Study Area
Study Area Buffer (50km)
Traprock Important Bird Area
Protected Area

Swift Parrot

WildNet
Birdata
Atlas of Living Australia

N

Metres
0 9,600

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6.4. White-throated Needletail

The White-throated Needletail is widespread in eastern and south-eastern Australia with the species being mostly aerial over most habitat types while in Australia (Threatened Species Scientific Committee 2019). Within 50 kilometres of the study area, there are 274 records of White-throated Needletail (23 Nature Advisory records, one GHD record, 29 WildNet records, 96 Birdata records and 125 Atlas of Living Australia records) as shown in Figure 8. White-throated Needletail has been recorded over the study area with a total of 17 records consisting of between one to 19 individuals (Nature Advisory 2020b, Nature Advisory 2020c; GHD 2020b). Within 50 kilometres of the study area, records are generally distributed evenly, with some clustering of records over state forests. The species is considered to occupy the airspace throughout the study area.

White-throated Needletail roosting habitat is considered to be absent from the study area. The Sundown National Park is located 28 kilometres to the south of the study area and contains a large tract of treed remnant vegetation along a mountain range that has potential roosting habitat for White-throated Needletail. If the species is roosting within the region, it is most likely to be in this location.

During extreme conditions, including bushfires and cold, hot or inclement weather, the species may infrequently take refuge in trees within the study area. It is noted that there are larger tracts of treed remnant vegetation immediately adjacent to the study area in Durikai State Forest and MacIntyre State Forest where the species may preferentially seek refuge during extreme conditions rather than within the more fragmented, less sheltered patches of treed vegetation in the study area.

In addition to the 17 records over the study area, there are also eight records of the species within the immediately adjacent proposed Karara Wind Farm (Nature Advisory 2020c). Each time White-throated Needletail has been recorded by Nature Advisory (including close to dusk) over the study area and proposed Karara Wind Farm, the species has been observed foraging and it has not been recorded within the tree canopy searching for or landing at a roosting location. In locations elsewhere in Australia where roosting locations have been confirmed or there is high confidence of the species roosting at a location, the species has been observed exhibiting roost searching behaviour close to dusk which includes flying through the tree canopy and landing and leaving a location a number of times before settling to roost (Corben et al. 1982; Day 1993; Tarburton 1993; Stanton 2011).

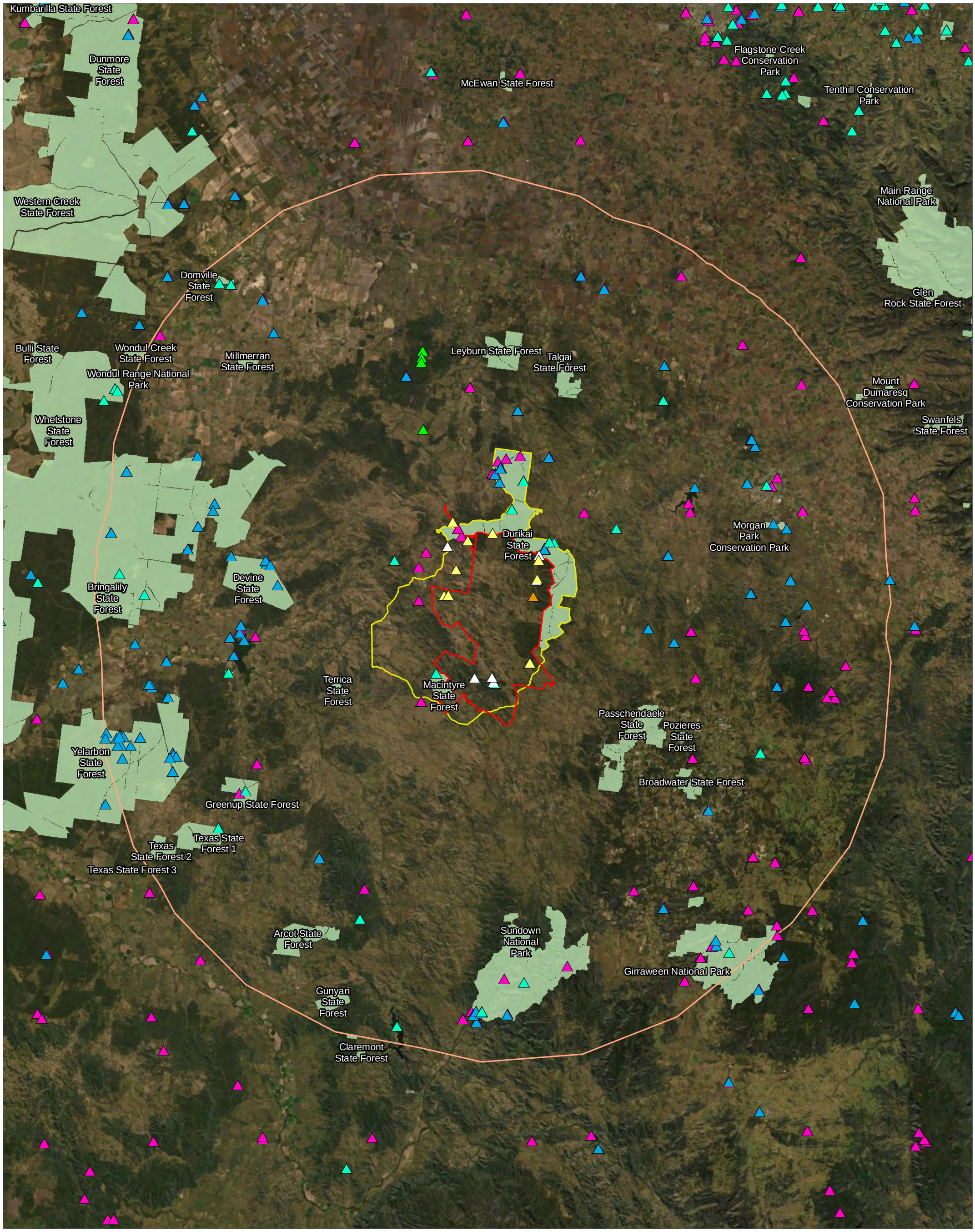

Figure 8: White-throated Needletail Records

Project: MacIntyre Wind Farm Client: ACCIONA Energy Australia Global Pty Ltd Date: 5/08/2021

- Study Area
- Study Area Buffer (50km)
- Traprock Important Bird Area
- Protected Area

White-throated Needletail

- Nature Advisory (Oct 2020)
- Nature Advisory (Dec 2020)
- Nature Advisory (Feb 2021)
- GHD (Jan 2019)
- WildNet
- Birdata
- Atlas of Living Australia

N

Metres 0 9,600

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7. Impact assessment

7.1. Direct impacts

7.1.1. Regent Honeyeater

The development footprint contains 8.060 hectares of Regent Honeyeater habitat (0.169 hectares of high quality habitat and 7.891 hectares of potential habitat) that is proposed to be removed (Figure 2). This habitat is also considered habitat critical to the survival of the species. Five patches of Regent Honeyeater habitat occur within the development footprint and the removal of part of these patches is considered acceptable for the reasons summarised below based on the detailed findings in Sections 5 and 6:

- larger tracts of Regent Honeyeater habitat that are also considered habitat critical to the survival of the species are located within Protected Areas and along waterways within close proximity to the study area, including in Durikai State Forest and along MacIntyre Brook and Branch Creek;
- habitat for the species within the development footprint is restricted to five smaller and more fragmented patches;
- the species is only found regularly at a few localities in NSW and Victoria where most of the sightings have been recorded (Department of the Environment 2015a; Department of the Environment 2016);
- the species has not been recorded within the patches of habitat within the development footprint, although when key tree and mistletoe species are flowering in the identified patches within the development footprint, the species may forage here; and
- there is no evidence that Regent Honeyeater utilise the patches of habitat within the study area for roosting or breeding.

Based on the information presented here, Regent Honeyeater preferentially utilises the larger tracts of habitat critical to the survival of the species surrounding the study area rather than smaller and more fragmented patches of habitat, such as those within the study area. It is also noted that only 1.432 percent of Regent Honeyeater habitat within the study area is proposed to be removed.

There is a very small possibility of injury or mortality of the species during clearing of these patches of habitat, although due to the likely limited Regent Honeyeater activity within the area and the smaller size of these patches, this possibility can be removed with the implementation of a Construction Management Plan (CMP), based on the Preliminary Vegetation Management and Fauna Management Plans, that ensures that the species is not present before vegetation is removed or modified.

Regent Honeyeater is principally a tree canopy species (Department of the Environment 2016). The tree canopy within the study area is between approximately 20 and 25 metres in height with the wind turbine Rotor Swept Area (RSA) height between 40 metres and 285 metres above ground level. Regent Honeyeater has not been recorded during extensive carcass searches at operational wind farm sites throughout the species' distribution in southern, eastern and south-eastern Australia (Nature Advisory, unpublished data). It is noted that the species occurs more often in NSW and Victoria than Queensland. As such and in combination with the absence of Regent Honeyeater records within the study area, mortality of this species from wind turbine strike within the study area is unlikely to occur.

7.1.2. Painted Honeyeater

The development footprint contains 19.677 hectares of Painted Honeyeater habitat (0.143 hectares of high quality habitat and 19.534 hectares of potential habitat) that is proposed to be removed (Figure 3). This habitat is not considered habitat critical to the survival of the species and the removal of this habitat

is considered acceptable for reasons summarised below based on the detailed findings in Sections 5 and 6:

- only 2.112 percent of habitat for the species within the study area is proposed to be removed;
- the majority of patches habitat for the species do not contain a significant quantity of mistletoe for Painted Honeyeater;
- the species may occasionally forage in the patches of habitat within the study area at times when mistletoe is fruiting and flowering;
- the species is more common in larger, continuous blocks of remnant woodland than in narrower strips (Department of the Environment 2015b) such as the patches of Painted Honeyeater habitat within the development footprint; and
- the distribution of records in the region demonstrates that the species is found in Protected Areas and larger tracts of remnant vegetation with one record within remnant vegetation in the Millmerran Road corridor and no records of the species within the patches of habitat within the study area.

When mistletoe is fruiting and flowering in the larger tracts of remnant vegetation in the surrounding area (such as Durikai State Forest) Painted Honeyeater would preferentially forage and breed in these areas as well as narrow roadside strips, where and when ample mistletoe fruit and flower is available (Department of the Environment 2015b), rather than within the smaller and more fragmented patches of habitat within the study area.

There is a very small possibility of injury or mortality of the species during clearing of these patches of habitat, although due to the limited Painted Honeyeater activity within the area and the smaller size of these patches, this possibility can be removed with the implementation of a Construction Management Plan (CMP), based on the Preliminary Vegetation Management and Fauna Management Plans, that ensures that the species is not present before vegetation is removed or modified.

Painted Honeyeater is a woodland bird species and is largely found in trees. The tree canopy within the study area is between approximately 20 and 25 metres in height and the wind turbine Rotor Swept Area (RSA) height between 40 metres and 285 metres above ground level. Painted Honeyeater has not been recorded during extensive carcass searches at operational wind farm sites throughout the species' distribution in southern, eastern and south-eastern Australia (Nature Advisory, unpublished data). As such and in combination with the absence of Painted Honeyeater records within the study area, mortality of this species from wind turbine strike within the study area is unlikely to occur.

7.1.3. Swift Parrot

The development footprint contains 12.423 hectares of Swift Parrot habitat (3.121 hectares of high quality habitat and 9.302 hectares of potential habitat) that is proposed to be removed (Figure 4). This habitat is not considered habitat critical to the survival of the species and the removal of this habitat is considered acceptable for the reasons summarised below based on detailed information in Sections 5 and 6:

- the species typically disperses through Victoria and New South Wales, however, smaller numbers are observed in south-east Queensland on a regular basis (Saunders & Tzaros 2011);
- 23 of the 34 records of Swift Parrot within 50 kilometres of the study area are within the Traprock Important Bird Area, all of which are within the Durikai State Forest where the species is foraging and likely roosting; and
- there are no records of the species within the patches of Swift Parrot habitat mapped in the study area. The species exhibits high site fidelity, returning to locations on an irregular cyclic basis (Threatened Species Scientific Committee 2016). The lack of records indicates that these

patches may not produce sufficient levels of lerp and/or nectar to allow the species to forage regularly.

Based on the distribution of records in Figure 7 and the smaller and more fragmented patches of habitat within the study area, the Swift Parrot is likely to be foraging preferentially and likely roosting in habitat within the Durikai State Forest, which covers an area of 12,357 hectares and would contain more extensive high quality and potential habitat compared with the 12.423 hectares of habitat for the species within the development footprint.

There is a very small possibility of injury or mortality of the species during clearing of these patches of habitat, although due to the limited Swift Parrot activity within the area and the smaller size of these patches, this possibility can be removed with the implementation of a Construction Management Plan (CMP), based on the Preliminary Vegetation Management and Fauna Management Plans, that ensures that the species is not present before vegetation is removed or modified.

It has been reported that the construction of wind energy turbines in south-eastern Australia may have implications for the conservation of the Swift Parrot where they are poorly sited (Saunders & Tzaros 2011). While there is limited information on the flight heights of Swift Parrot, flight height data for a variety of parrot species of south-eastern Australia indicates that parrot species fly within RSA at times, although most flight heights are recorded below RSA. While foraging, Swift Parrots generally fly within the tree canopy, although while flying between feeding and roosting locations and on migration, the species may fly higher (Smales 2005). Given the species is expected to fly more often below RSA, mortality of the species from wind turbine strike within the study area is considered unlikely to occur.

7.1.4. White-throated Needletail

The development footprint does not contain White-throated Needletail roosting habitat, as such no roosting habitat for this species is proposed to be removed. If White-throated Needletail are roosting within the region, it is most likely to be within Sundown National Park (28 kilometres south of the study area) which contains treed remnant vegetation along a mountain range. The airspace over the study area is not of particular significance to the species as there is generally an even distribution of records of the species over the study area as there is within 50 kilometres of the study area.

There is a very small possibility of injury or mortality of the species during clearing within the development footprint, although due to the absence of White-throated Needletail roosting habitat within the study area, this possibility is considered remote. Any residual risk of impacts can be removed with the implementation of a Construction Management Plan (CMP), based on the Preliminary Vegetation Management and Fauna Management Plans, that ensures that the species is not present before vegetation is removed or modified.

White-throated Needletail mortality from collision with overhead wires within Australia is known to occur, although is a low severity threat and affects a small number of birds (Hull et al. 2013). A threshold of mortality of 10 individuals annually can be considered a significant impact on the species (Department of the Environment 2015c). Given there are not extensive records of the species within the study area and that overhead wires affect a small number of individuals, this threshold is not expected to be exceeded with the construction of aboveground power lines for the proposed MacIntyre Wind Farm.

White-throated Needletail mortality from collision with wind turbines within Australia is known to occur, although is a low severity threat and affects a small number of birds (Hull et al. 2013, Nature Advisory, unpublished data). It is noted the species has been recorded flying at RSA within and adjacent to the study area at times. A threshold of mortality of ten individuals annually can be considered a significant impact to the species (Department of the Environment 2015c). Given there are not extensive records of the species within the study area and that wind turbine strike affects a small number of individuals, this

threshold is not expected to be exceeded with the construction and operation of the proposed MacIntyre Wind Farm. Ongoing Bird Utilisation Surveys will inform a Before-After-Control-Impact (BACI) bird assessment for the proposed MacIntyre Wind Farm to confirm this.

7.2. Indirect impacts

The removal of Regent Honeyeater, Painted Honeyeater and Swift Parrot habitat for the proposed MacIntyre Wind Farm will result in the fragmentation of some patches with a clearing of approximately 38 metres wide on average through these patches. This minor level of habitat fragmentation is considered to have minimal impact on each species, given the availability of larger tracts of habitat adjacent to the study area and elsewhere in the region. The removal of the habitat within the development footprint will also result in an inconsequential reduction in habitat connectivity, particularly considering these species are highly mobile. It is noted that this clearing will not completely remove these patches of habitat.

The construction of the proposed MacIntyre Wind Farm may indirectly impact Regent Honeyeater, Painted Honeyeater, Swift Parrot and White-throated Needletail as listed below, although each of these impacts can be sufficiently mitigated through the implementation of a CMP, especially considering that the species are expected to utilise the habitat within the study area very infrequently (if at all):

- Disturbance from increased light, noise and vibration;
- Habitat degradation through increased dust, run-off and sedimentation;
- Introduction and spread of invasive fauna species; and
- Introduction and spread of weed species.

7.2.1. White-throated Needletail

The loss of forest and woodland habitats may have resulted in the decline of invertebrate prey for White-throated Needletail, which may be contributing to the decline of the species (Threatened Species Scientific Committee 2019). While 209 hectares of treed remnant vegetation may be removed for the proposed MacIntyre Wind Farm, approximately 26,700 hectares of treed remnant vegetation occurs within five kilometres of the study area. This is not considered a significant reduction in treed remnant vegetation that would reduce invertebrate prey to an extent that would impact the capacity for the airspace over the study area to provide foraging habitat for the species.

Given the long-ranging daily movements and flight height range of White-throated Needletail, the construction of the MacIntyre Wind Farm is not considered to create a barrier for the species to access the airspace over or adjacent to the study area.

The use of insecticides, particularly organochlorines, has been identified as a possible cause of decline of White-throated Needletails, either through a decrease in the abundance of invertebrates from wide use of insecticides or from secondary poisoning by insecticides accumulated as sublethal doses in prey (Threatened Species Scientific Committee 2019). The use of insecticides is not expected to increase as a consequence of the proposed wind farm.

7.3. Significant impact assessment

7.3.1. Regent Honeyeater

An assessment against the significant impact criteria outlined in the Matters of National Environmental Significance Significant impact guidelines 1.1 (Department of the Environment 2013) is provided for Regent Honeyeater in Table 3 and identifies that the action is likely to significantly impact the species.

Table 3: Significant impact assessment for Regent Honeyeater

An action is likely to have a significant impact on a critically endangered species if there is a real chance or possibility that it will:	
Criteria	*Likelihood*
Lead to a long-term decrease in the size of a population.	**Unlikely** The removal of 8.060 hectares of Regent Honeyeater habitat (0.169 hectares of high quality habitat and 7.891 hectares of potential habitat) that is also considered habitat critical to the survival of the species is unlikely to lead to a long-term decrease in the size of the population as: ▪ only 1.432 percent of Regent Honeyeater habitat within the study area is proposed to be removed; ▪ larger tracts of Regent Honeyeater habitat that are also considered habitat critical to the survival of the species (and is habitat where the species has been recorded) are located within Protected Areas and along waterways within close proximity to the study area, including in Durikai State Forest and along MacIntyre Brook and Branch Creek; ▪ habitat for the species within the development footprint is restricted to five smaller and more fragmented patches; ▪ the species is only found regularly at a few localities in NSW and Victoria where most of the sightings have been recorded (Department of the Environment 2015a; Department of the Environment 2016); ▪ the species has not been recorded within the patches of habitat within the development footprint, although when key tree and mistletoe species are flowering in the identified patches within the development footprint, the species may forage here; ▪ there is no evidence that Regent Honeyeater utilise the patches of habitat within the study area for roosting or breeding; ▪ the species preferentially utilises the larger tracts of habitat critical to the survival of the species surrounding the study area rather than smaller and more fragmented patches of habitat, such as those within the study area; and ▪ there is only a very small possibility of injury or mortality of the species during clearing of these patches of habitat, and due to the limited Regent Honeyeater activity within the area and the smaller size of these patches, this possibility can be removed with the implementation of a Construction Management Plan (CMP), based on the Preliminary Vegetation Management and Fauna Management Plans, that ensures that the species is not present before vegetation is removed or modified. Regent Honeyeater mortality from wind turbine strike within the study area is unlikely to occur as the species is principally found within the tree canopy (Department of the Environment 2016). The tree canopy within the study area is between approximately 20

An action is likely to have a significant impact on a critically endangered species if there is a real chance or possibility that it will:	
Criteria	*Likelihood*
	and 25 metres in height with the wind turbine Rotor Swept Area (RSA) height between 40 metres and 285 metres above ground level.
Reduce the area of occupancy of the species.	**Unlikely** The removal of 8.060 hectares of Regent Honeyeater habitat (0.169 hectares of high quality habitat and 7.891 hectares of potential habitat) will not completely remove these patches of habitat. Fragmentation of these patches will occur with a clearing approximately 38 metres wide on average through these patches. This minor level of habitat fragmentation is considered to have minimal impact on Regent Honeyeater, given the availability of larger tracts of habitat adjacent to the study area and elsewhere in the region. The removal of the habitat within the development footprint will also result in an inconsequential reduction in habitat connectivity, particularly considering the species is highly mobile. As the removal of habitat will not completely remove patches of habitat, will result in only minor levels of habitat fragmentation and an inconsequential reduction in habitat connectivity, the area of occupancy of the species is unlikely to be reduced.
Fragment an existing population into two or more populations.	**Unlikely** The Regent Honeyeater comprises a single population (Garnett et al. 2011) and is not severely fragmented (Department of the Environment 2015a). The removal of only 8.060 hectares of Regent Honeyeater habitat (0.169 hectares of high quality habitat and 7.891 hectares of potential habitat) will not fragment the existing population into two or more populations. The species is highly mobile and only 1.432 percent of Regent Honeyeater habitat within the study area is proposed to be removed.
Adversely affect habitat critical to the survival of a species.	**Likely** A total of 8.060 hectares of Regent Honeyeater habitat (0.169 hectares of high quality habitat and 7.891 hectares of potential habitat) is proposed to be removed. This habitat is considered to be habitat critical to the survival of the species. The proposed removal of this habitat is considered to adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of a population.	**Unlikely** Regent Honeyeater breeding events have been recorded in the Cement Mills-Durikai region (Department of the Environment 2016) including adjacent to the study area. The species has not been recorded breeding within the study area and has not been recorded in the study area since 1995 where two individuals were recorded 100 metres in from the southern boundary of the study area (S Debus 2021, pers. comm. 8 February 2021). It is also noted there are no key breeding areas or other breeding areas for the species mapped within Queensland (Department of the Environment 2016). As a result, the action is unlikely to disrupt the breeding cycle of the Regent Honeyeater population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	**Unlikely** The removal of only 8.060 hectares of Regent Honeyeater habitat (0.169 hectares of high quality habitat and 7.891 hectares of potential habitat) that is also considered habitat critical to the survival of the species is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline as: ▪ only 1.432 percent of Regent Honeyeater habitat within the study area is proposed to be removed; ▪ larger tracts of Regent Honeyeater habitat that are also considered habitat critical to the survival of the species (and are also where the species has been recorded)

An action is likely to have a significant impact on a critically endangered species if there is a real chance or possibility that it will:	
Criteria	*Likelihood*
	are located within Protected Areas and along waterways within close proximity to the study area, including in Durikai State Forest and along MacIntyre Brook and Branch Creek; ▪ habitat for the species within the development footprint is restricted to five smaller and more fragmented patches; ▪ the species is only found regularly at a few localities in NSW and Victoria where most of the sightings have been recorded (Department of the Environment 2015a; Department of the Environment 2016); ▪ the species has not been recorded within the patches of habitat within the development footprint, although when key tree and mistletoe species are flowering in the identified patches within the development footprint, the species may forage here; ▪ there is no evidence that Regent Honeyeater utilise the patches of habitat within the study area for roosting or breeding; and ▪ the species preferentially utilises the larger tracts of habitat critical to the survival of the species surrounding the study area rather than smaller and more fragmented patches of habitat, such as those within the study area.
Result in invasive species that are harmful to a critically endangered species becoming established in the critically endangered species' habitat.	**Unlikely** Invasive weeds and rabbits cause degradation of Regent Honeyeater habitat and have been identified as a threat to the species (Department of the Environment 2015a). Invasive weeds and rabbits have been recorded throughout the study area and the removal of 8.060 hectares of Regent Honeyeater habitat (0.169 hectares of high quality habitat and 7.891 hectares of potential habitat) is not considered to increase the likelihood of invasive species that are harmful to the species becoming established in the species habitat throughout the study area. It is noted that a project-specific Preliminary Vegetation and Fauna Management Plans includes measures to reduce the impact of invasive species on all biota, including on the Regent Honeyeater.
Introduce disease that may cause the species to decline.	**Unlikely** Due to the small size of the population, the species is at greater risk from the potential impact of stochastic events including disease (Department of the Environment 2016). The action is not considered likely to introduce disease during construction and operation that may cause Regent Honeyeater to decline.
Interfere with the recovery of the species.	**Likely** Strategy 1 of the National Recovery Plan of the Regent Honeyeater is to improve the extent and quality of Regent Honeyeater habitat (Department of the Environment 2016). The removal of 8.060 hectares of Regent Honeyeater habitat (0.169 hectares of high quality habitat and 7.891 hectares of potential habitat) that is also considered habitat critical to the survival of the species will marginally reduce the extent of Regent Honeyeater habitat and marginally interfere with the recovery of the species.

7.3.3. Painted Honeyeater

An assessment against the significant impact criteria outlined in the Matters of National Environmental Significance Significant impact guidelines 1.1 (Department of the Environment 2013) is provided for Painted Honeyeater in Table 4 and identifies that the action is unlikely to significantly impact the species.

Table 4: Significant impact assessment for Painted Honeyeater

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
Criteria	*Likelihood*
Lead to a long-term decrease in the size of an important population of a species.	**Unlikely** Painted Honeyeater important populations have not been identified in the species' conservation advice (Department of the Environment 2015b). Considering its dispersive habits, the species is considered to have a single population (Garnett et al. 2011). The removal of 19.677 hectares of Painted Honeyeater habitat (0.143 hectares of high quality habitat and 19.534 hectares of potential habitat) is unlikely to lead to a long-term decrease in the size of the population as: ▪ only 2.112 percent of habitat for the species within the study area is proposed to be removed; ▪ the majority of patches habitat for the species do not contain a significant quantity of mistletoe for Painted Honeyeater; ▪ the species may occasionally forage in the patches of habitat within the study area at times when mistletoe is fruiting and flowering; ▪ the species is more common in larger, continuous blocks of remnant woodland than in narrower strips (Department of the Environment 2015b) such as the patches of Painted Honeyeater habitat within the development footprint; ▪ the distribution of records in the region demonstrates that the species is found in Protected Areas and larger tracts of remnant vegetation with one record within remnant vegetation in the Millmerran Road corridor and no records of the species within the patches of habitat within the study area; ▪ when mistletoe is fruiting and flowering in the larger tracts of remnant vegetation in the surrounding area (such as Durikai State Forest) Painted Honeyeater would preferentially forage and breed in these areas as well as narrow roadside strips, where and when ample mistletoe fruit and flower is available (Department of the Environment 2015b), rather than within the smaller and more fragmented patches of habitat within the study area; ▪ the habitat within the study area is not considered important habitat for the species as the patches are smaller and more fragmented, the species may only occasionally forage in these patches and the majority of patches habitat for the species do not contain a significant quantity of mistletoe for Painted Honeyeater; and ▪ there is only a very small possibility of injury or mortality of the species during clearing of these patches of habitat, and due to the limited Painted Honeyeater activity within the area and the smaller size of these patches, this possibility can be removed with the implementation of a Construction Management Plan (CMP), based on the Preliminary Vegetation Management and Fauna Management Plans, that ensures that the species is not present before vegetation is removed or modified. Painted Honeyeater is a woodland bird species and is largely found in trees. The tree canopy within the study area is between approximately 20 and 25 metres in height and the

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
Criteria	*Likelihood*
	wind turbine Rotor Swept Area (RSA) height between 40 metres and 285 metres above ground level. Given this, mortality of this species from wind turbine strike within the study area is unlikely to occur.
Reduce the area of occupancy of an important population.	**Unlikely** The removal of 19.677 hectares of Painted Honeyeater habitat (0.143 hectares of high quality habitat and 19.534 hectares of potential habitat) will not completely remove these patches of habitat. Fragmentation of these patches will occur with a clearing of approximately 38 metres wide on average through these patches. This minor level of habitat fragmentation is considered to have minimal impact on Painted Honeyeater, given the availability of larger tracts of habitat adjacent to the study area and elsewhere in the region. The removal of the habitat within the development footprint will also result in an inconsequential reduction in habitat connectivity, particularly considering the species is highly mobile. As the removal of habitat will not completely remove patches of habitat, will result in only minor levels of habitat fragmentation and an inconsequential reduction in habitat connectivity, the area of occupancy of the species is unlikely to be reduced.
Fragment an existing important population into two or more populations.	**Unlikely** The Painted Honeyeater is considered to have a single population (Garnett et al. 2011) and is not severely fragmented (Department of the Environment 2015a). The removal of only 19.677 hectares of Painted Honeyeater habitat (0.143 hectares of high quality habitat and 19.534 hectares of potential habitat) will not fragment the existing population into two or more populations. The species is highly mobile and only 2.112 percent of Painted Honeyeater habitat within the study area is proposed to be removed.
Adversely affect habitat critical to the survival of a species.	**Unlikely** A total of 19.677 hectares of Painted Honeyeater habitat (0.143 hectares of high quality habitat and 19.534 hectares of potential habitat) is proposed to be removed. This habitat is not considered to be habitat critical to the survival of the species and subsequently, the proposed removal of this habitat is not considered to adversely affect habitat critical to the survival of the species. Habitat critical to the survival of Painted Honeyeater refers to areas that are necessary (Department of the Environment 2013): ▪ for activities such as foraging, breeding, roosting or dispersal; ▪ for the long-term maintenance of the species (including the maintenance of species essential to the survival of the species, such as pollinators); ▪ to maintain genetic diversity and long term evolutionary development; or ▪ for the reintroduction of populations or recovery of the species. Areas that are considered necessary for the processes outlined immediately above to function in a region contain the following characteristics: ▪ large, continuous blocks of remnant woodland (Department of the Environment 2015b); ▪ contains a significant quantity of mistletoe for Painted Honeyeater; and/or ▪ records of the species within or adjacent to the habitat. Examples of areas that meet the characteristics outlined immediately above are the larger tracts of remnant vegetation in the region (such as Durikai State Forest where the species has been recorded) with fruiting and flowering mistletoe. Painted Honeyeater

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
Criteria	*Likelihood*
	preferentially forage and breed in these areas where and when ample mistletoe fruit and flower is available (Department of the Environment 2015b). The Painted Honeyeater habitat mapped within the study area is not considered necessary for the processes outlined above to function in the region as: ▪ the patches of Painted Honeyeater habitat that occur within the study area are small and fragmented rather than large, continuous blocks of remnant woodland; ▪ the majority of habitat within the study area does not contain a significant quantity of mistletoe for Painted Honeyeater; and ▪ the species has not been recorded within the study area. As a result, Painted Honeyeater habitat within the study area is not considered habitat critical to the survival of the species and the proposed removal of this habitat is not considered to adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population.	**Unlikely** The species exhibits seasonal north-south movements governed principally by the fruiting of mistletoe, with which its breeding season is closely matched (Department of the Environment 2015b). It is likely that numbers of Painted Honeyeaters breeding in southern and central Queensland are extremely low (Department of the Environment 2015b). Painted Honeyeater would preferentially breed in in the larger tracts of remnant vegetation in the surrounding area (such as Durikai State Forest) when mistletoe is fruiting and flowering these areas (Department of the Environment 2015b) rather than within the smaller and more fragmented patches of Painted Honeyeater potential habitat within the study area. As a result, the action is unlikely to disrupt the breeding cycle of the Painted Honeyeater population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	**Unlikely** The removal of only 19.677 hectares of Painted Honeyeater habitat (0.143 hectares of high quality habitat and 19.534 hectares of potential habitat) is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline as: ▪ only 2.112 percent of habitat for the species within the study area is proposed to be removed; ▪ the majority of patches habitat for the species do not contain a significant quantity of mistletoe for Painted Honeyeater; ▪ the species may occasionally forage in the patches of habitat within the study area at times when mistletoe is fruiting and flowering; ▪ the species is more common in larger, continuous blocks of remnant woodland than in narrower strips (Department of the Environment 2015b) such as the patches of Painted Honeyeater habitat within the development footprint; ▪ the distribution of records in the region demonstrates that the species is found in Protected Areas and larger tracts of remnant vegetation with one record within remnant vegetation in the Millmerran Road corridor and no records of the species within the patches of habitat within the study area; ▪ when mistletoe is fruiting and flowering in the larger tracts of remnant vegetation in the surrounding area (such as Durikai State Forest) Painted Honeyeater would preferentially forage and breed in these areas as well as narrow roadside strips,

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
Criteria	*Likelihood*
	where and when ample mistletoe fruit and flower is available (Department of the Environment 2015b), rather than within the smaller and more fragmented patches of habitat within the study area; and ▪ the habitat within the study area is not considered important habitat for the species as the patches are smaller and more fragmented, the species may only occasionally forage in these patches and the majority of patches habitat for the species do not contain a significant quantity of mistletoe for Painted Honeyeater.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	**Unlikely** Painted Honeyeater predation by invasive species (e.g. black rat *Rattus rattus*) has been identified as a threat to the species. Grazing from rabbits results in an uneven age structure of mistletoe host trees and promotion of future collapse of mistletoe resources and has also been identified as a threat to the species (Department of the Environment 2015b). Rabbits have been recorded throughout the study area and the removal of 19.677 hectares of Painted Honeyeater habitat (0.143 hectares of high quality habitat and 19.534 hectares of potential habitat) is not considered to increase the likelihood of invasive species that are harmful to the species becoming established or further established in the species habitat throughout the study area. It is noted that a project-specific Preliminary Vegetation and Fauna Management Plans includes measures to reduce the impact of invasive species on all biota, including on the Painted Honeyeater.
Introduce disease that may cause the species to decline.	**Unlikely** Disease is not identified as a threat to Painted Honeyeater (Department of the Environment 2015b). The action is not considered likely to introduce disease during construction and operation that may cause Painted Honeyeater to decline, particularly given the species has not been recorded within the study area and is preferentially foraging in habitat within Durikai State Forest. It is noted that a project-specific Preliminary Vegetation and Fauna Management Plans include measures that will reduce the likelihood of disease introduction.
Interfere substantially with the recovery of the species.	**Unlikely** The removal of only 19.677 hectares of Painted Honeyeater habitat (0.143 hectares of high quality habitat and 19.534 hectares of potential habitat) is unlikely to interfere substantially with the recovery of the species as: ▪ only 2.112 percent of habitat for the species within the study area is proposed to be removed; ▪ the majority of patches habitat for the species do not contain a significant quantity of mistletoe for Painted Honeyeater; ▪ the species may occasionally forage in the patches of habitat within the study area at times when mistletoe is fruiting and flowering; ▪ the species is more common in larger, continuous blocks of remnant woodland than in narrower strips (Department of the Environment 2015b) such as the patches of Painted Honeyeater habitat within the development footprint; ▪ the distribution of records in the region demonstrates that the species is found in Protected Areas and larger tracts of remnant vegetation with one record within remnant vegetation in the Millmerran Road corridor and no records of the species within the patches of habitat within the study area; ▪ when mistletoe is fruiting and flowering in the larger tracts of remnant vegetation in the surrounding area (such as Durikai State Forest) Painted Honeyeater would

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
Criteria	*Likelihood*
	preferentially forage and breed in these areas as well as narrow roadside strips, where and when ample mistletoe fruit and flower is available (Department of the Environment 2015b), rather than within the smaller and more fragmented patches of habitat within the study area; ▪ the habitat within the study area is not considered important habitat for the species as the patches are smaller and more fragmented, the species may only occasionally forage in these patches and the majority of patches habitat for the species do not contain a significant quantity of mistletoe for Painted Honeyeater; and ▪ there is only a very small possibility of injury or mortality of the species during clearing of these patches of habitat, and due to the limited Painted Honeyeater activity within the area and the smaller size of these patches, this possibility can be removed with the implementation of a Construction Environmental Management Plan (CMP), based on Preliminary Vegetation and Fauna Management Plans, that ensures that the species is not present before vegetation is removed or modified. Painted Honeyeater is a woodland bird species and is largely found in trees. The tree canopy within the study area is between approximately 20 and 25 metres in height and the wind turbine Rotor Swept Area (RSA) height between 40 metres and 285 metres above ground level. Given this and considering the absence of Painted Honeyeater records within the study area, mortality of this species from wind turbine strike within the study area is unlikely to occur.

7.3.4. Swift Parrot

An assessment against the significant impact criteria outlined in the Matters of National Environmental Significance Significant impact guidelines 1.1 (Department of the Environment 2013) is provided for Swift Parrot in Table 5 and identifies that the action is unlikely to significantly impact the species.

Table 5: Significant impact assessment for Swift Parrot

An action is likely to have a significant impact on a critically endangered species if there is a real chance or possibility that it will:	
Criteria	*Likelihood*
Lead to a long-term decrease in the size of a population.	**Unlikely** The removal of only 12.423 hectares of Swift Parrot habitat (3.121 hectares of high quality habitat and 9.302 hectares of potential habitat) is unlikely to lead to a long-term decrease in the size of the population as: ▪ only 2.350 percent of Swift Parrot habitat within the study area is proposed to be removed; ▪ the species typically disperses through Victoria and New South Wales, with smaller numbers observed in south-east Queensland on a regular basis (Saunders & Tzaros 2011); ▪ 23 of the 34 records of Swift Parrot within 50 kilometres of the study area are within the Traprock Important Bird Area, all of which are within the Durikai State Forest where the species is preferentially foraging and likely roosting in important habitat for the species; ▪ there are no records of the species within the patches of Swift Parrot habitat mapped in the study area. The species exhibits high site fidelity, returning to locations on an irregular cyclic basis (Threatened Species Scientific Committee 2016). The lack of records indicates that the habitat patches within the study area may not produce sufficient levels of lerp and/or nectar to allow the species to forage regularly; ▪ the patches of Swift Parrot habitat within the study area are not considered important habitat for the species as the patches may not produce sufficient levels of lerp and/or nectar to allow the species to forage regularly, are smaller and more fragmented and do not contain records of the species; ▪ the species does not breed on mainland Australia (Saunders & Tzaros 2011); and ▪ there is only a very small possibility of injury or mortality of the species during clearing of these patches of habitat, and due to the limited Swift Parrot activity within the area and the smaller size of these patches, this possibility can be removed with the implementation of a Construction Management Plan (CMP) that ensures that the species is not present before vegetation is removed or modified. It has been reported that the construction of wind energy turbines in south-eastern Australia may have implications for the conservation of the Swift Parrot where they are poorly sited (Saunders & Tzaros 2011). While foraging, Swift Parrots generally fly within the tree canopy, although while flying between feeding and roosting locations and on migration, the species may fly higher (Smales 2005). Given the species is expected to fly more often below RSA (i.e. longer-distance movements are less frequent that routine foraging flights within the tree canopy), mortality of the species from wind turbine strike within the study area is considered unlikely to occur.
Reduce the area of occupancy of the species.	**Unlikely** The removal of only 12.423 hectares of Swift Parrot habitat (3.121 hectares of high quality habitat and 9.302 hectares of potential habitat) will not completely remove these

An action is likely to have a significant impact on a critically endangered species if there is a real chance or possibility that it will:	
Criteria	*Likelihood*
	patches of habitat. Fragmentation of these patches will occur with a clearing of approximately 38 metres wide on average through these patches. This minor level of habitat fragmentation is considered to have minimal impact on Swift Parrot, given the availability of larger tracts of habitat adjacent to the study area and elsewhere in the region. The removal of the habitat within the development footprint will also result in an inconsequential reduction in habitat connectivity, particularly considering the species is highly mobile. As the removal of habitat will not completely remove patches of habitat, will result in only minor levels of habitat fragmentation and an inconsequential reduction in habitat connectivity, the area of occupancy of the species is unlikely to be reduced.
Fragment an existing population into two or more populations.	**Unlikely** The Swift Parrot comprises a single population (Garnett et al. 2011). The removal of only 12.423 hectares of Swift Parrot habitat (3.121 hectares of high quality habitat and 9.302 hectares of potential habitat) will not fragment the existing population into two or more populations. The species is highly mobile and only 2.350 percent of Swift Parrot habitat within the study area is proposed to be removed.
Adversely affect habitat critical to the survival of a species.	**Unlikely** A total of 12.423 hectares of Swift Parrot habitat (3.121 hectares of high quality habitat and 9.302 hectares of potential habitat) is proposed to be removed. This habitat is not considered to be habitat critical to the survival of the species. Habitat critical to the survival of the Swift Parrot includes (Saunders & Tzaros 2011): ▪ those areas of priority habitat for which the Swift Parrot has a level of site fidelity or possess phenological characteristics likely to be of importance to the Swift Parrot: or ▪ are otherwise identified by the recovery team. Priority habitat for Swift Parrot are areas of particular importance for conservation management which are used (Saunders & Tzaros 2011): ▪ for nesting; ▪ by large proportions of the Swift Parrot population; ▪ repeatedly between seasons (site fidelity); or ▪ for prolonged periods of time (site persistence). The Swift Parrot habitat within the study area is not considered priority habitat for the species as the patches of Swift Parrot habitat within the study area are: ▪ not used for nesting with nesting occurring in Tasmania (Saunders & Tzaros 2011); ▪ not used by large proportions of the Swift Parrot population with no records of the species within the study area from WildNet, Birdata and Atlas of Living Australia databases and following targeted surveys for the species as well as following Bird Utilisation Surveys and fauna surveys throughout the study area (GHD 2020b, Nature Advisory 2020b). It is noted there are some Swift Parrot records within the adjacent Durikai State Forest (as shown in Figure 7 and detailed in Section 6.3); ▪ not repeatedly used between seasons (lack of site fidelity) with no records of the species within the study area. It is noted there are some Swift Parrot records within the adjacent Durikai State Forest with records from July 2017 to September 2017, from May 2018 to September 2018 and in June 2021; and

An action is likely to have a significant impact on a critically endangered species if there is a real chance or possibility that it will:	
Criteria	*Likelihood*
	▪ not used for prolonged periods of time (lack of site persistence) with no records of the species within the study area. The Swift Parrot habitat within the study area is also not identified by the recovery team as priority habitat for the species (Saunders & Tzaros 2011). It is noted that the WildNet, Birdata and Atlas of Living Australia records for the species in the adjacent Durikai State Forest indicate a level of Swift Parrot site fidelity with records from July 2017 to September 2017, from May 2018 to September 2018 and in June 2021, and as a result these areas within Durikai State Forest are considered priority habitat and habitat critical to the survival of the species. It is noted that the Swift Parrot habitat within the study area may possess phenological characteristics that may support Swift Parrot foraging if sufficient levels of lerp and nectar are available in winter flowering eucalypt species, however, there are no Swift Parrot records within any of these patches (noting that heavy flowering of the winter flowering species White Box was observed in one patch within the study area and outside the development footprint) and high quantities of lerp was not observed in these patches. This indicates that these patches may not produce sufficient levels of lerp and/or nectar to allow the species to forage and are therefore not considered likely to be of importance to the Swift Parrot. If one or more of the patches of Swift Parrot habitat within the study area (or within the adjacent proposed Karara Wind Farm or proposed MacIntyre Wind Farm transmission line corridor) contained one or more records of Swift Parrot and/or high quantities of lerp or very heavy flowering in winter flowering eucalypt species had been observed within these patches, the Swift Parrot habitat within the study area would be considered to possess phenological characteristics likely to be of importance to the Swift Parrot and therefore habitat critical to the survival of the species. As a result of the above, Swift Parrot habitat mapped within the study area is not considered habitat critical to the survival of the species.
Disrupt the breeding cycle of a population.	**Unlikely** The Swift Parrot breeds in Tasmania in summer and the entire population migrates north and leaves the island for the winter. While on mainland Australia, the Swift Parrot typically disperses through Victoria and New South Wales, however, smaller numbers are observed in south-east Queensland on a regular basis (Saunders & Tzaros 2011). As the species does not breed on mainland Australia, the action will not disrupt the breeding cycle of the Swift Parrot population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	**Unlikely** The removal of only 12.423 hectares of Swift Parrot habitat (3.121 hectares of high quality habitat and 9.302 hectares of potential habitat) is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline as: ▪ only 2.350 percent of Swift Parrot habitat within the study area is proposed to be removed; ▪ the species typically disperses through Victoria and New South Wales, with smaller numbers observed in south-east Queensland on a regular basis (Saunders & Tzaros 2011); ▪ 23 of the 34 records of Swift Parrot within 50 kilometres of the study area are within the Traprock Important Bird Area, all of which are within the Durikai State Forest where the species is preferentially foraging and likely roosting in important habitat for the species;

An action is likely to have a significant impact on a critically endangered species if there is a real chance or possibility that it will:	
Criteria	*Likelihood*
	▪ there are no records of the species within the patches of Swift Parrot habitat mapped in the study area. The species exhibits high site fidelity, returning to locations on an irregular cyclic basis (Threatened Species Scientific Committee 2016). The lack of records indicates that the habitat patches within the study area may not produce sufficient levels of lerp and/or nectar to allow the species to forage regularly; ▪ the patches of Swift Parrot habitat within the study area are not considered important habitat for the species as the patches may not produce sufficient levels of lerp and/or nectar to allow the species to forage regularly, are smaller and more fragmented and do not contain records of the species; and ▪ the species does not breed on mainland Australia (Saunders & Tzaros 2011).
Result in invasive species that are harmful to a critically endangered species becoming established in the critically endangered species' habitat.	**Unlikely** Resource competition with the introduced European Honeybee (*Apis mellifera*) is likely to pose a threat to the Swift Parrot and the potential introduction of the invasive Large Earth Bumblebee (*Bombus terrestris*) to mainland Australia also poses a threat to over-wintering foraging habitat for Swift Parrot (Saunders & Tzaros 2011). The action is not considered to increase the likelihood of European Honeybee and Large Earth Bumblebee becoming established in the Swift Parrot habitat throughout the study area. It is noted that project-specific Preliminary Vegetation and Fauna Management Plans includes measures to reduce the impact of invasive species on all biota, including on the Swift Parrot.
Introduce disease that may cause the species to decline.	**Unlikely** Psittacine Beak and Feather Disease (PBFD) is a common and potentially deadly disease of parrots (Saunders & Tzaros 2011) and is known to occur in Swift Parrots (Sarker et al. 2013). This disease could potentially have serious implications for the Swift Parrot population should the general health of these birds be reduced from stress associated with competition for food resources (Saunders & Tzaros 2011). The proposed removal of only 12.423 hectares of Swift Parrot habitat (3.121 hectares of high quality habitat and 9.302 hectares of potential habitat) within the study area is not considered to increase the stress associated with the competition for food resources, particularly given the species has not been recorded within the study area and is preferentially foraging in habitat within Durikai State Forest. Considering the way in which the project will be implemented, it is unlikely that this disease will be introduced or spread by the project.
Interfere with the recovery of the species.	**Unlikely** The removal of only 12.423 hectares of Swift Parrot habitat (3.121 hectares of high quality habitat and 9.302 hectares of potential habitat) that is not considered habitat critical to the survival of the species will not interfere with the recovery of the species as: ▪ only 2.350 percent of Swift Parrot habitat within the study area is proposed to be removed; ▪ the species typically disperses through Victoria and New South Wales, with smaller numbers observed in south-east Queensland on a regular basis (Saunders & Tzaros 2011); ▪ 23 of the 34 records of Swift Parrot within 50 kilometres of the study area are within the Traprock Important Bird Area, all of which are within the Durikai State

An action is likely to have a significant impact on a critically endangered species if there is a real chance or possibility that it will:	
Criteria	*Likelihood*
	Forest where the species is preferentially foraging and likely roosting in important habitat for the species; ▪ there are no records of the species within the patches of Swift Parrot habitat mapped in the study area. The species exhibits high site fidelity, returning to locations on an irregular cyclic basis (Threatened Species Scientific Committee 2016). The lack of records indicates that the habitat patches within the study area may not produce sufficient levels of lerp and/or nectar to allow the species to forage regularly; ▪ the patches of Swift Parrot habitat within the study area are not considered important habitat for the species as the patches may not produce sufficient levels of lerp and/or nectar to allow the species to forage regularly, are smaller and more fragmented and do not contain records of the species; ▪ the species does not breed on mainland Australia (Saunders & Tzaros 2011); and ▪ there is only a very small possibility of injury or mortality of the species during clearing of these patches of habitat, and due to the likely limited Swift Parrot activity within the area and the smaller size of these patches, this possibility can be removed with the implementation of a Construction Management Plan (CMP) , based on project-specific Preliminary Vegetation and Fauna Management Plans, that ensures that the species is not present before vegetation is removed or modified. It has been reported that the construction of wind energy turbines in south-eastern Australia may have implications for the conservation of the Swift Parrot where they are poorly sited (Saunders & Tzaros 2011). While foraging, Swift Parrots generally fly within the tree canopy, although while flying between feeding and roosting locations and on migration, the species may fly higher (Smales 2005). Given the species is expected to fly more often below RSA (i.e. longer-distance movements are less frequent that routine foraging flights within the tree canopy), mortality of the species from wind turbine strike within the study area is considered unlikely to occur.

7.3.5. White-throated Needletail

An assessment against the significant impact criteria outlined in the Matters of National Environmental Significance Significant impact guidelines 1.1 (Department of the Environment 2013) is provided for White-throated Needletail in Table 6 and identifies that the action is unlikely to significantly impact the species.

Table 6: Significant impact assessment for White-throated Needletail

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
Criteria	*Likelihood*
Lead to a long-term decrease in the size of an important population of a species.	**Unlikely** White-throated Needletail important populations have not been identified in the species' conservation advice (Threatened Species Scientific Committee 2019). Though the two subspecies of White-throated Needletails breed in separate populations in the Northern Hemisphere, only one occurs in Australia, where they do not occur as smaller populations (Department of Agriculture, Water and the Environment 2021). As a result, the White-throated Needletail subspecies that occurs in Australia is considered a single population. The action is unlikely to lead to a long-term decrease in the size of the population as: ▪ No roosting habitat for White-throated Needletail is present within the study area and no White-throated Needletail habitat is proposed to be removed; ▪ The airspace over the study area is not of particular significance to the species as there is generally an even distribution of records of the species over the study area as there is within 50 kilometres of the study area; ▪ There is a very small possibility of injury or mortality of the species during clearing within the development footprint, although due to the absence of White-throated Needletail roosting habitat within the study area, this possibility is considered remote. Any residual risk of impacts can be removed with the implementation of a Construction Management Plan (CMP), based on Preliminary Vegetation and Fauna Management Plans, that ensures that the species is not present before vegetation is removed or modified; ▪ White-throated Needletail mortality from collision with overhead wires within Australia is known to occur, although is a low severity threat and affects a small number of birds (Hull et al. 2013). A threshold of mortality of 10 individuals annually can be considered a significant impact on the species (Department of the Environment 2015c). Given there are not extensive records of the species within the study area and that overhead wires affect a small number of individuals, this threshold is not expected to be exceeded with the construction of above ground power lines for the action; ▪ White-throated Needletail mortality from collision with wind turbines within Australia is known to occur, although is a low severity threat and affects a small number of birds (Hull et al. 2013, Nature Advisory). It is noted the species has been recorded flying at RSA within and adjacent to the study area at times. A threshold of mortality of ten individuals annually (i.e. 0.1% or more of the flyway population) can be considered a significant impact to the species (Department of the Environment 2015c). Given there are not extensive records of the species within the study area and that wind turbine strike affects a small number of individuals, this threshold is not expected to be exceeded with the construction and operation of the proposed MacIntyre Wind Farm. Ongoing Bird Utilisation Surveys will inform a Before-After-Control-Impact (BACI) bird assessment for the proposed MacIntyre Wind Farm to confirm this.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
Criteria	*Likelihood*
	▪ The loss of forest and woodland habitats may have resulted in the decline of invertebrate prey for White-throated Needletail, which may be contributing to the decline of the species (Threatened Species Scientific Committee 2019). While 209 hectares of treed remnant vegetation may be removed for the action, approximately 26,700 hectares of treed remnant vegetation occurs within five kilometres of the study area. This is not considered a significant reduction in treed remnant vegetation that would reduce invertebrate prey to an extent that would impact the capacity for the airspace over the study area to provide foraging habitat for the species. ▪ The use of insecticides, particularly organochlorines, has been identified as a possible cause of decline of White-throated Needletails, either through a decrease in the abundance of invertebrates from wide use of insecticides or from secondary poisoning by insecticides accumulated as sublethal doses in prey (Threatened Species Scientific Committee 2019). The project will not lead to an increase in the use of these chemicals on the project site so impacts on insect abundance are not anticipated.
Reduce the area of occupancy of an important population.	**Unlikely** The action is unlikely to reduce the area of occupancy of the White-throated Needletail population as: ▪ the action is not considered to create a barrier for the species to access the airspace over or adjacent to the study area given the long-ranging daily movements and flight height range of White-throated Needletail; and ▪ no roosting habitat for White-throated Needletail is present within the study area and no White-throated Needletail habitat is proposed to be removed.
Fragment an existing important population into two or more populations.	**Unlikely** The action is unlikely fragment the White-throated Needletail population into two or more populations as: ▪ the action is not considered to create a barrier for the species to access the airspace over or adjacent to the study area given the long-ranging daily movements and flight height range of White-throated Needletail; and ▪ no roosting habitat for White-throated Needletail is present within the study area and no White-throated Needletail habitat is proposed to be removed.
Adversely affect habitat critical to the survival of a species.	**Unlikely** Habitat critical to the survival of the species is not considered to be present within or above the study area, as such the action is unlikely to adversely affect habitat critical to the survival of the species. Habitat critical to the survival of White-throated Needletail refers to areas that are necessary (Department of the Environment 2013): ▪ for activities such as foraging, breeding, roosting, or dispersal; ▪ for the long-term maintenance of the species (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators); ▪ to maintain genetic diversity and long term evolutionary development; or ▪ for the reintroduction of populations or recovery of the species.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
Criteria	*Likelihood*
	While the airspace above the study area provides an area for White-throated Needletail to forage and disperse; will assist with the long-term maintenance of the species; will help to maintain genetic diversity and long-term evolutionary development; and provides habitat for the recovery of the species; the airspace above the study area is not considered necessary for these processes to occur. The species also breeds in the Northern Hemisphere and roosting habitat is not considered to be present within the study area. As a result, habitat critical to the survival of the species is not considered to be present within or above the study area.
Disrupt the breeding cycle of an important population.	**Unlikely** The White-throated Needletail subspecies that occurs in Australia is *Hirundapus caudacutus caudacutus*. This subspecies is a trans-equatorial migrant that breeds in the Northern Hemisphere summer and migrates south for the Southern Hemisphere summer (Threatened Species Scientific Committee 2019). As the species does not breed in Australia, the action will not disrupt the breeding cycle of the species' population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	**Unlikely** The action is unlikely to lead to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline as: ▪ no roosting habitat for White-throated Needletail is present within the study area and no White-throated Needletail habitat is proposed to be removed; ▪ the airspace over the study area is not of particular significance to the species as there is generally an even distribution of records of the species over the study area as there is within 50 kilometres of the study area; ▪ the loss of forest and woodland habitats may have resulted in the decline of invertebrate prey for White-throated Needletail, which may be contributing to the decline of the species (Threatened Species Scientific Committee 2019). While 209 hectares of treed remnant vegetation may be removed for the action, approximately 26,700 hectares of treed remnant vegetation occurs within five kilometres of the study area. This is not considered a significant reduction in treed remnant vegetation that would reduce invertebrate prey to an extent that would impact the capacity for the airspace over the study area to provide foraging habitat for the species. ▪ the use of insecticides, particularly organochlorines, has been identified as a possible cause of decline of White-throated Needletails, either through a decrease in the abundance of invertebrates from wide use of insecticides or from secondary poisoning by insecticides accumulated as sublethal doses in prey (Threatened Species Scientific Committee 2019). The project will not lead to an increase in the use of these chemicals on the project site so impacts on insect abundance are not anticipated.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	**Unlikely** Invasive species have not been identified as a threat to White-throated Needletail (Threatened Species Scientific Committee 2019). The action is unlikely to result in invasive species that are harmful to the species becoming established in the species' habitat. It is noted that a project-specific Preliminary Vegetation and Fauna Management Plans have been prepared to reduce the impact of invasive species on habitats in the project site.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
Criteria	*Likelihood*
Introduce disease that may cause the species to decline.	**Unlikely** Disease is not identified as a threat to White-throated Needletail. The action is not considered likely to introduce disease during construction and operation that may cause White-throated Needlatail to decline, particularly given the species is mostly aerial in Australia (Threatened Species Scientific Committee 2019). The execution of the project combined with the way the species uses the landscape will not create opportunities for disease to spread.
Interfere substantially with the recovery of the species.	**Unlikely** The action is unlikely to interfere substantially with the recovery of the species as: ▪ No roosting habitat for White-throated Needletail is present within the study area and no White-throated Needletail habitat is proposed to be removed; ▪ The airspace over the study area is not of particular significance to the species as there is generally an even distribution of records of the species over the study area as there is within 50 kilometres of the study area. ▪ There is a very small possibility of injury or mortality of the species during clearing within the development footprint, although due to the absence of White-throated Needletail roosting habitat within the study area, this possibility is considered remote. Any residual risk of impacts can be removed with the implementation of a Construction Management Plan (CMP), based on Preliminary Vegetation and Fauna Management Plans, that ensures that the species is not present before vegetation is removed or modified. ▪ White-throated Needletail mortality from collision with overhead wires within Australia is known to occur, although is a low severity threat and affects a small number of birds (Hull et al. 2013). A threshold of mortality of 10 individuals annually can be considered a significant impact on the species (Department of the Environment 2015c). Given there are not extensive records of the species within the study area and that overhead wires affect a small number of individuals, this threshold is not expected to be exceeded with the construction of aboveground power lines for the action. ▪ White-throated Needletail mortality from collision with wind turbines within Australia is known to occur, although is a low severity threat and affects a small number of birds (Hull et al. 2013, Nature Advisory, unpublished data). It is noted the species has been recorded flying at RSA within and adjacent to the study area at times. A threshold of mortality of ten individuals annually (0.1% of the flyway population) can be considered a significant impact to the species (Department of the Environment 2015c). Given there are not extensive records of the species within the study area and that wind turbine strike affects a small number of individuals, this threshold is not expected to be exceeded with the construction and operation of the proposed MacIntyre Wind Farm. Ongoing Bird Utilisation Surveys will inform a Before-After-Control-Impact (BACI) bird assessment for the proposed MacIntyre Wind Farm to confirm this. ▪ The loss of forest and woodland habitats may have resulted in the decline of invertebrate prey for White-throated Needletail, which may be contributing to the decline of the species (Threatened Species Scientific Committee 2019). While 209 hectares of treed remnant vegetation may be removed for the action, approximately 26,700 hectares of treed remnant vegetation occurs within five kilometres of the study area. This is not considered a significant reduction in treed remnant vegetation that would reduce invertebrate prey to an extent that

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
Criteria	*Likelihood*
	would impact the capacity for the airspace over the study area to provide foraging habitat for the species. ▪ The use of insecticides, particularly organochlorines, has been identified as a possible cause of decline of White-throated Needletails, either through a decrease in the abundance of invertebrates from wide use of insecticides or from secondary poisoning by insecticides accumulated as sublethal doses in prey (Threatened Species Scientific Committee 2019). The project will not lead to any change in the sue of these chemicals on the project site so impacts on the insect food supply of this species are not anticipated.

8. Conclusions

This investigation provides detailed information on habitat for the Regent Honeyeater, Painted Honeyeater, Swift Parrot and White-throated Needletail within the study area and refines the original predicted habitat mapping (based on field-verified Regional Ecosystem mapping) presented for these species in the Ecological assessment report of the MacIntyre Wind Farm (GHD 2020a).

Regent Honeyeater habitat (8.060 hectares, which is also considered habitat critical to the survival of the species), Painted Honeyeater habitat (19.677 hectares) and Swift Parrot habitat (12.423 hectares) within the development footprint represent relatively small areas compared with the study area, which totals 31,910 hectares and the total development footprint, which totals 1,207 hectares. The removal of this habitat is considered acceptable as these species are understood to utilise the habitat adjacent to the study area and within the wider region rather than being dependent on the habitat within the study area. It is noted that no White-throated Needletail roosting habitat is present within development footprint or study area. Regent Honeyeater, Painted Honeyeater and Swift Parrot were also not recorded during targeted surveys, bird utilisation surveys or incidentally during bird and fauna surveys since 2018.

Mortality and indirect impacts to Regent Honeyeater, Painted Honeyeater and Swift Parrot during construction and operation of the proposed MacIntyre Wind Farm are considered unlikely. A Construction Management Plan, based on Preliminary Vegetation and Fauna Management Plans, will be implemented to reduce this very low residual risk of an impact further. Small numbers of White-throated Needletail may collide occasionally with operational wind turbines but the population consequences are unlikely to be significant.

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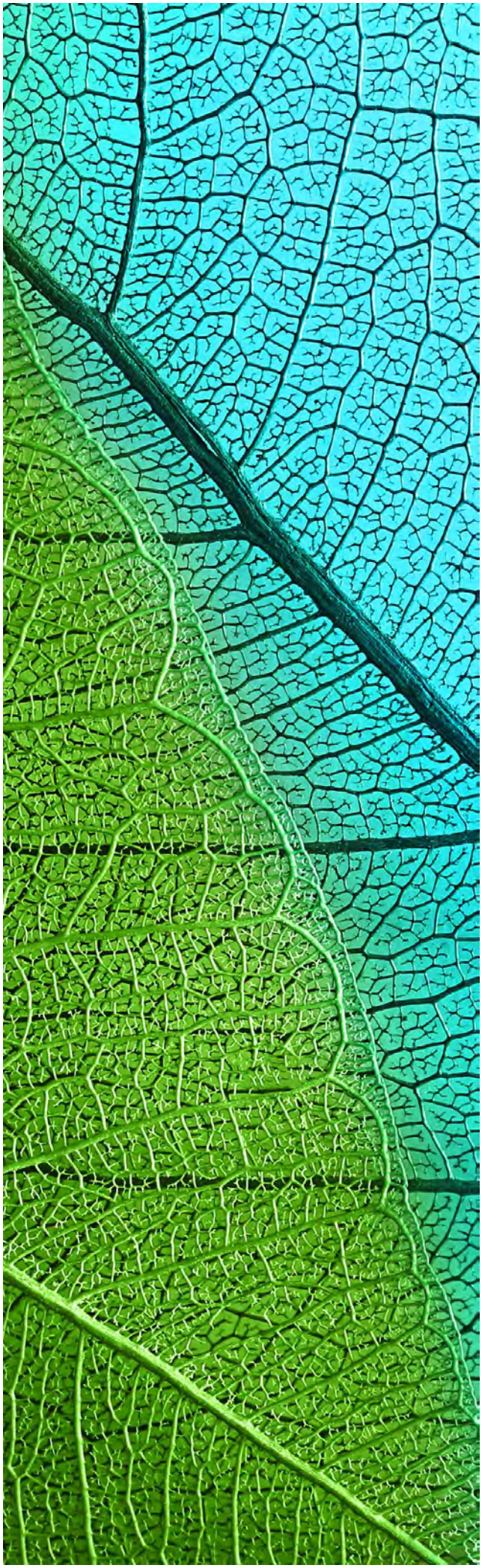
Appendix 2: Bird Utilisation Survey Baseline Report Year Two



MacIntyre Wind Farm

Bird Utilisation Survey Baseline Report - Year Two

Prepared for ACCIONA Energy Australia Global Pty Ltd

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Report No. 20033.12 (5.1)

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Contents

1. Executive summary 4
2. Introduction 5
3. Methods 6
3.1. Fixed-point count 6
3.2. Locations of BUS points 8
3.3. Incidental observations 10
3.4. Collision risk modelling 10
3.5. Limitations 10
4. Results 12
4.1. Survey suitability 12
4.2. Species and abundance 13
4.3. Flight heights 17
4.4. Threatened and migratory species 17
4.4.1. White-throated Needletail 18
4.4.2. Squatter Pigeon (Southern) 19
4.5. Raptors 20
4.6. Waterbirds 20
5. Conclusions 22
6. References 24

Tables

Table 1. Example of a BUS schedule during a survey period. 7

Table 2 Habitat descriptions for BUS points. 8

Table 3. The five most common bird species recorded at BUS points at MacIntyre Wind Farm. 13

Table 4. Count and height distribution of bird species at BUS points during eight survey periods at MacIntyre Wind Farm 14

Table 5. Summary of birds recorded at the three flight height classes. 17

Table 6. The five most abundant species recorded flying at RSA height at MacIntyre Wind Farm. 17

Table 7. Summary of White-throated Needletail counts during BUS completed. 18

Table 8. Raptor species recorded at impact points during the survey periods at MacIntyre Wind Farm. 21

Table 9. Waterbird species recorded at impact points during the survey periods at MacIntyre Wind Farm. 21

Figures

Figure 1. BUS and Threatened Species Locations. 11

Figure 2. The cumulative number of bird species recorded during consecutive counts at impact points at MacIntyre Wind Farm 12

Appendix

Appendix 1. Bird species recorded 25

Appendix 2. BUS data - fixed-point counts 26

1. Executive summary

ACCIONA Energy Australia Global Pty Ltd (ACCIONA) engaged Nature Advisory Pty Ltd to conduct pre-construction bird utilisation surveys (BUS) at the proposed MacIntyre Wind Farm in Cement Mills, Queensland.

This investigation provides baseline data on birds that utilise the study area in accordance with a Before-After-Control-Impact (BACI) design as detailed in the MacIntyre Wind Farm Bird and Bat Adaptive Management Plan (Draft BBAMP) (Nature Advisory 2021).

Eight pre-construction BUS were undertaken by experienced zoologists during 2020, 2021 and 2022 across the dry and wet seasons, with four in each season to account for seasonal differences in bird activity and migration.

The method used for the BUS was based on the standards for assessing the risks to birds from wind farms in Australia, outlined in the Best Practice Guidelines for the Implementation of Wind Energy Projects in Australia (Clean Energy Council 2018).

A total of 149 bird species were recorded during the combined survey periods. Of these, 135 species were recorded at impact points and 110 at reference points. Species recorded were predominantly farmland and woodland species with some observations of threatened species, raptors and waterbirds.

The proportion of flights recorded at rotor swept area (40 to 285 metres above ground) were 8.28 percent of counts at impact points and 13.17 percent of counts at reference points. The study area supports average numbers of raptors and lower numbers of waterbirds, bird groups considered more likely to collide with operating wind turbines.

Two threatened bird species were observed during the fixed-point counts and as incidentals as listed below.

- White-throated Needletail (*Hirundapus caudacutus*) - Vulnerable and Migratory under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and Vulnerable under the *Queensland Nature Conservation Act 1992* (NC Act).
- Squatter Pigeon (Southern) (*Geophaps scripta scripta*) - Vulnerable under the EPBC Act and Vulnerable under the NC Act.

White-throated Needletail mortality from collision with wind turbines within Australia is known to occur, although is a low severity threat and affects a small number of birds (Hull et al. 2013, Nature Advisory data).

Squatter Pigeon (Southern) is a ground-dwelling bird and each observation was below RSA height. As a result, there is not considered to be a collision risk for the species with wind turbines within the study area.

2. Introduction

ACCIONA Energy Australia Global Pty Ltd (ACCIONA) engaged Nature Advisory Pty Ltd to conduct pre-construction bird utilisation surveys (BUS) at the proposed MacIntyre Wind Farm in Cement Mills, Queensland (from herein to be referred to as the "study area") as shown in Figure 1.

The BUS were undertaken consistent with the requirements for a "Level One" bird risk assessment in accordance with Wind Farms and Birds - Interim Standards for Risk Assessment issued by the Australian Wind Energy Association (AusWEA 2005). The surveys focused on the assessment of the potential impact on birds from the project given the specifications of the turbines planned to be installed. This report does not consider interaction between other infrastructure and birds for the proposed MacIntyre Wind Farm.

This investigation provides baseline data on birds that utilise the study area in accordance with a Before-After-Control-Impact (BACI) design as detailed in the MacIntyre Wind Farm Bird and Bat Adaptive Management Plan (Draft BBAMP) Report No. 20033 (2.3) (Nature Advisory 2021).

A total of eight pre-construction BUS were undertaken by experienced zoologists during 2020, 2021 and 2022 across the dry and wet seasons to account for seasonal differences in bird activity and migration.

This report is divided into the following sections:

Section 3 describes the methods of the BUS.

Section 4 provides the results of the BUS.

Section 5 outlines the conclusions.

This investigation was undertaken by a team from Nature Advisory comprising Tom Cotter (Senior Zoologist), Deborah Metters (Zoologist), Braden McDonald (Zoologist), Ahmad Barati (Zoologist), Candice Larkin (Zoologist), Curtis Doughty (Senior Zoologist), Bernard O'Callaghan (Senior Ecologist and Project Manager) and Brett Lane (Principal Consultant).

3. Methods

The BUS methods were consistent with the requirements for a "Level One" bird risk assessment in accordance with Wind Farms and Birds - Interim Standards for Risk Assessment issued by the Australian Wind Energy Association (AusWEA 2005). This approach has been endorsed in the latest Best Practice Guidelines for the Implementation of Wind Energy Projects in Australia (Clean Energy Council 2018). The methodology conforms with State Code 23: Wind Farm development Planning Guidelines - Appendix 3 (Department of Infrastructure, Local Government and Planning 2017).

The BUS is the most commonly applied method for generating quantitative data on bird use at a proposed wind farm. The results of the baseline BUS provide a ranked abundance of species use of the site at varying heights, including wind turbine rotor swept area (RSA) height. The method provides the following information:

- Bird species (diversity) utilising the study area;
- The relative frequency of activity and density of birds on site;
- Flight patterns and heights in relation to wind turbine heights; and
- The broad distribution of bird species across the wind farm site.

The pre-construction BUS were undertaken by experienced zoologists and were designed to collect baseline data to allow for bird utilisation comparisons with post-construction data (BACI design). The BUS at the study area were conducted at the same time as the BUS for the adjacent proposed Karara Wind Farm.

The survey design has been reviewed by Symbolix (2020) and was concluded to be statistically valid and will allow for BACI analysis, and therefore is in accordance with State Code 23: Wind farm development (Department of Infrastructure, Local Government and Planning 2017).

A total of eight pre-construction BUS were undertaken by experienced zoologists during 2020, 2021 and 2022 across the dry and wet seasons, with two in each season in each of two years to account for seasonal differences in bird activity and migration as detailed below.

- Early dry season: 22nd May to 30th May 2020
- Late dry season: 22nd September to 1st October 2020
- Mid wet season: 3rd December to 14th December 2020
- Late wet season: 1st February to 12th February 2021
- Late dry season: 17th August to 28th August 2021
- Late dry season: 21st September to 2nd October 2021
- Mid wet season: 14th December to 20th December 2021
- Late wet season: 1st February to 6th February 2022

3.1. Fixed-point count

The fixed-point count method involved an observer stationed at a point for 15 minutes. A length of 15 minutes for fixed-point counts meets the time length requirement for BUS as outlined in the Wind Farms and Birds - Interim Standards for Risk Assessment (AusWEA 2005) as well as the time length requirement for bird point surveys as outlined in the Commonwealth Survey guidelines for Australia's threatened birds (Department of the Environment, Water, Heritage and the Arts 2010). The adequacy of 15 minutes as an interval to record the presence of birds during BUS was also

investigated in an earlier study at another wind farm site (Nature Advisory data). This showed that 82 to 100 percent (average 88 percent) of species seen in one hour of surveying were seen in the initial 15 minutes of observation. The period of 15 minutes adopted for the fixed-point counts is considered adequate to generate representative data on the bird species in the study area during the surveys.

During the 15 minutes, all bird species and numbers of individual birds observed within 200 metres were recorded. The species, the number of birds and the height of the bird when first observed was documented. For species of concern (threatened species, raptors and waterbirds), the minimum and maximum heights were recorded.

Flight height was then categorised as below, at or above RSA height.

A = Below RSA (< 40 metres above ground).

B = At RSA (40 to 285 metres above ground).

C = Above RSA (> 285 metres above ground).

Table 1 below provides an example of when each point was counted during a survey period. Scheduling ensured that all points were visited equally at different times of day to allow for time-of-day differences in bird movements and activity. A fixed-point count at each point (impact and reference) was completed eight times during each of the eight survey periods (Figure 1).

Table 1. Example of a BUS schedule during a survey period.

Time and Day	1	2	3	4	5	6	7	8	9	10	11	12
7:00-7:30				R1								
7:30-8:00							M6	M4		M7	M8	
8:00-8:30					R1					R2	M9	R2
8:30-9:00							M5	M3				
9:00-9:30			M10	M10	M1	M2		M4	M3		M8	M9
9:30-10:00					M2	M1	M6		M5	M7		
10:00-10:30							M5	M3			M9	M7
10:30-11:00				M10	R1	M2			M6	R2	M8	
11:00-11:30					M1	M1	M6	M4		M7	M9	
11:30-12:00					M2	R1				R2	M8	
12:00-12:30		M10					M5	M3	M4			
12:30-13:00			M10	M10		M2		M4	M3	M7	M9	
13:00-13:30					R1		M6			R2	M8	
13:30-14:00					M1	M1		M3	M5	M7	M9	
14:00-14:30						M2	M5				M8	
14:30-15:00				R1			M6	M4		R2		

Time and Day	1	2	3	4	5	6	7	8	9	10	11	12
15:00-15:30					M1			M3		M7	M9	
15:30-16:00				M1	R1		M5				M8	
16:00-16:30						M6	M4	M4	M7		M9	
16:30-17:00				M2		M5				M8		
17:00-17:30	M10		M2			M6		M3	R2			
17:30-18:00		M10		R1						R2		

Note: Prefix 'M' refers to MacIntyre and prefix 'R' refers to reference point.

3.2. Locations of BUS points

Over the eight survey periods, 12 fixed points were established: 10 impact points and two reference points. Impact points were located near proposed turbine locations and reference points were located at least 500 metres away from proposed turbine locations and outside the wind farm development footprint in areas of similar habitat.

The points were distributed as evenly as possible across the wind farm (subject to access constraints) to maximise coverage in areas where wind turbines are likely to be sited (Figure 1). Impact points were positioned as far as possible on elevated ground, allowing a clear view in all directions.

Table 2 below provides a description of the habitats at each point. The points were located in a selection of habitat types representative of those across the study area.

Table 2 Habitat descriptions for BUS points.

BUS point	Habitat
M1	Mixed native grass and herb pasture (sheep) dominated by *Cynodon dactylon*, *Sclerolaena* sp. And *Cheilanthes* sp. With scattered *Eucalyptus crebra*, *E. albens* and *Corymbia intermedia* (median height 16 m) on rocky granite hill. *Opuntia tomentosa* and *O. stricta* present.
M2	Mixed native grass and herb pasture (sheep) dominated by *Aristida* sp., *Sclerolaena* sp., *Dichondra* sp. And *Chrysocephalum apiculatum* with scattered *E. crebra* and *E. albens* (median height 16 m) and *E. dealbata* regrowth (median height 0.75 m) on rocky granite hill. *E. dealbata* and *E. crebra* regrowth to south (median height 8 m). *E. albens* regrowth to east (median height 10 m). *O. tomentosa* present.
M3	*E. dealbata* and *E. melanophloia* low woodland (median height 8 m) on granite ridge top with *Callitris glaucophylla* low tree layer, *Dodonaea* sp. Shrub layer with significant dieback, (likely drought-induced) and native grass and native herb ground cover. *E sideroxylon* woodland (median height 12 m) present to north-east. Adjacent to clearing along fence line.
M4	*C. glaucophylla*, *E. dealbata* and E. *melanophloia* low woodland (median height 7 m and crown cover 40 %) with *C. glaucophylla* low tree layer (medium dense) and shrub layer and *Panicum* sp. Ground cover on rocky slope. Adjacent to pasture.

BUS point	Habitat
M5	Open grassland paddock with dam and is frequently grazed by sheep. Scattered *E. crebra* and *E. dealbata* regrowth throughout.
M6	Grassy woodland hilltop with *E. crebra*, *Corymbia citriodora*, *E. melliodora, E. albens* and *E. sideroxylon* open woodland towards base of hill.
M7	*E. crebra*, *E. sideroxylon*, *Corymbia citriodora*, *E. dealbata*, *E. moluccana* and *E. albens* open woodland (median height 22 m and crown cover 15 %) on gentle clay slope. *Allocasuarina littoralis* low tree layer (median height 10 m and crown cover 40 %) with mixed native grass and native herb ground cover. Clearing for access tracks present, canopy dieback 60 % and low tree layer dieback 10 % throughout (likely drought-induced).
M8	*E. dealbata, C. endlicheri*, *E. moluccana* and *E. crebra* regrowth (median height 4 m) with *Dodonaea* sp. And *Acacia* spp. Shrub layer and native grass and other native herb groundcover on rocky granite and sandy clay moderate slope. Clearing for access track and *Dodonaea* sp. Shrub layer dieback of 80 % (likely drought-induced) to south.
M9	*E. sideroxylon*, *Corymbia citriodora*, *E. melliodora* and *E. dealbata* regrowth with *C. endlicheri* and *Acacia* spp. shrub layer and native grass and herb ground cover on gentle gravelly clay slope. Clearing for access track and dam present, regrowth layer dieback 10 % (likely drought-induced).
M10	*Dodonaea* sp. And *Acacia* spp. Shrubland with *E. melanophloia*, *E. dealbata* and *C. endlicheri* open woodland. Sheep and goat grazing present.
R1	Mixed native grass and herb pasture (sheep) dominated by *Aristida* sp., *Sclerolaena* sp., *Dichondra* sp. With scattered *E. melliodora* and *E tereticornis* (median height 10 m), *E. melliodora* and *E tereticornis* open woodland (median height 18 m and crown cover 15 %) with *E. melliodora* and *E. tereticornis* low tree layer (median height 10 m) and native grass and other native and non-native herbs ground cover *and E. melliodora* and *E. tereticornis* regrowth (median height 6 m) on gentle gravelly clay slope. Creek to south-west. Thinning of canopy layer and low tree layer throughout, clearing for road and quarry, minimal *O. tomentosa* and *O. aurantiaca* present.
R2	Mixed native grass and herb pasture (sheep and cattle) with *E. tereticornis* and *E melliodora* open woodland (median height 18m and crown cover 30 %) along creek to south, *E. tereticornis* and *E. melliodora* regrowth (median height 12 m) along creek and upslope to west and north-west, *E. crebra*, *E. albens*, Corymbia citriodora and *Angophora floribunda* open woodland (median height 14 m and crown cover 25 %) on rocky granite slope to east and dams to east and north-east. Road present.

3.3. Incidental observations

In addition to bird observations during fixed-point counts, incidental bird observations were recorded while travelling throughout the study area. Emphasis was placed on observations of birds of concern (threatened species, raptors and waterbirds) as well as birds moving through the study area at RSA height.

3.4. Collision risk modelling

The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) Policy Statement 2.3 - Wind Farm Industry (Department of the Environment, Water, Heritage and the Arts 2009) lists collision risk modelling (CRM) as a tool to avoid or mitigate impacts to Matters of National Environmental Significance (MNES) (including threatened and/or migratory bird species listed under the EPBC Act) when collision appears to present a significant risk. The Queensland Wind Farm State Code Planning Guideline requires CRM for birds to be part of the fauna impact assessment for wind farms (Department of Infrastructure, Local Government and Planning 2017). Collision risk modelling under the Queensland Wind Farm State Code Planning Guideline is generally used to test potential impacts on significant bird species including listed threatened species and species particularly at risk of collision (raptors and waterbirds).

An important input to CRM is an estimate of the number of bird flights at risk across a wind farm site, a proportion of which can be assumed to be at turbine height (based on recorded flight heights), and estimated density. This data is generated through BUS, the method used in this survey.

3.5. Limitations

The BUS was undertaken during four different seasons in 2020, 2021 and 2022. This was undertaken to collect a range of data and include migratory birds that occur at certain times of the year. Four BUS were undertaken during the wet season when listed migratory bird species are likely to be present in the region.

The flight height data used for this assessment was generated from the height the bird was flying when the observer first sighted the bird. In some instances, the bird would then ascend or descend.

The utilisation rates recorded are representative of the study area for two whole years, as time of day and seasonal changes in bird activity and occurrence have been incorporated into the sampling design. The risk to birds associated with the MacIntyre Wind Farm can be confidently assessed based on the baseline data collected.

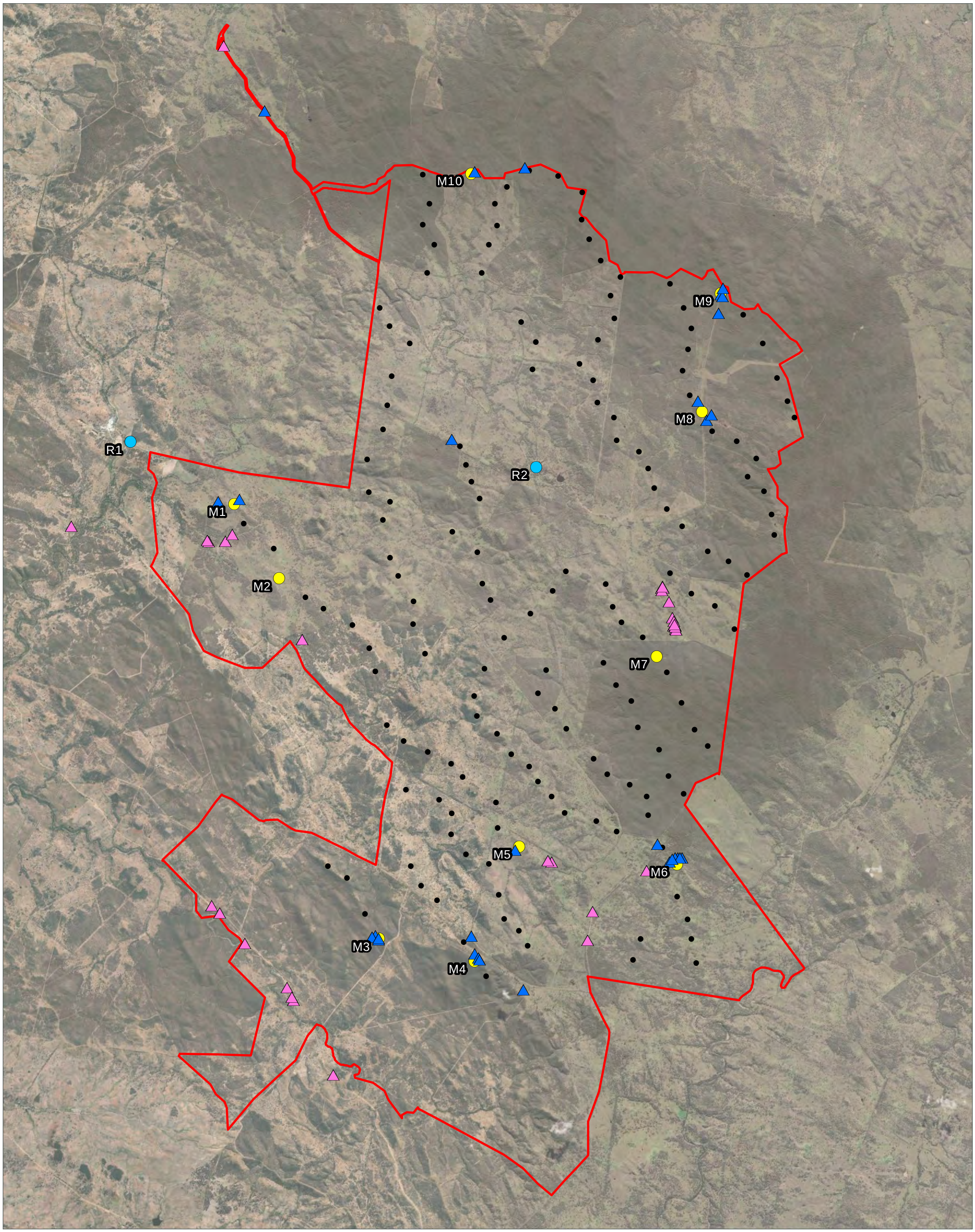

Figure 1: BUS and Threatened Species Locations

Project: MacIntyre Wind Farm Client: ACCIONA Energy Australia Global Pty Ltd Date: 5/05/2022

Study Area

- Wind Turbine (Proposed)

BUS

Impact

Reference

Threatened Species

Squatter Pigeon (Southern)

White-throated Needletail

N

Metres

0 1,800

Nature Advisory

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4. Results

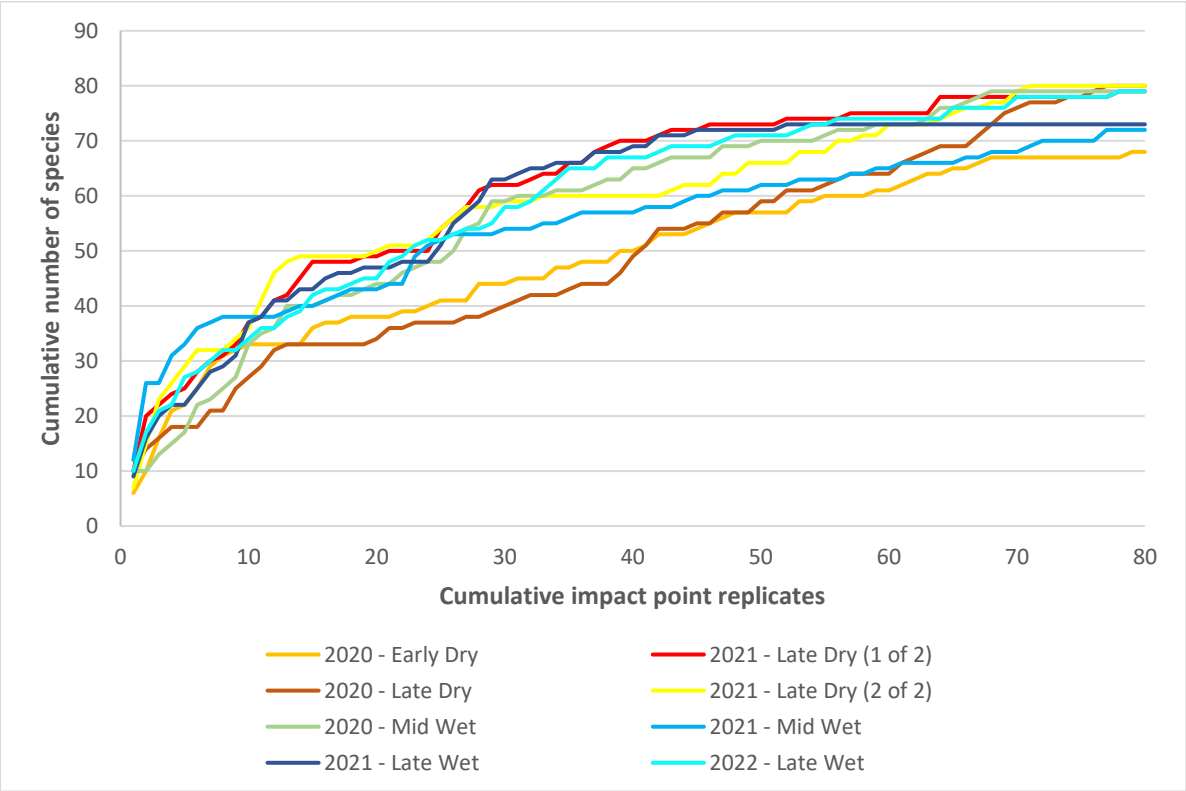
4.1. Survey suitability

The cumulative number of species observed from consecutive impact points conducted during the eight survey periods has been plotted (Figure 2). This indicates that the cumulative number of species recorded levelled off for each survey period as detailed below.

- 2020 early dry season appears to be commencing to level off at 79 replicates .
- 2020 late dry season appears to be commencing to level off at 77 replicates.
- 2020 mid wet season at 68 replicates.
- 2021 late wet season at 52 replicates.
- 2021 late dry season (1 of 2) appears to be commencing to level off at 78 replicates.
- 2021 late dry season (2 of 2) at 71 replicates.
- 2021 mid wet season appears to be commencing to level off at 77 replicates.
- 2022 late wet season appears to be commencing to level off at 78 replicates.

This supports the adequacy of completing eight replicates for impact points to generate representative data on the bird species in the study area during the survey periods.

Figure 2. The cumulative number of bird species recorded during consecutive counts at impact points at MacIntyre Wind Farm.



4.2. Species and abundance

A total of 149 bird species were recorded during the combined survey periods. Of these, 135 species were recorded at impact points and 110 at reference points (Appendix 1). An additional 20 species were recorded as incidentals only while travelling during the BUS. Species recorded were predominantly farmland and woodland species with some observations of threatened species, raptors and waterbirds.

Species richness at impact points was consistent during most survey periods. The 2020 late dry season and 2021 late dry season survey periods both recorded a species richness at impact points of 80 and the 2020 mid wet season, 2021 late dry season and 2022 late wet season survey periods each recorded a species richness at impact points of 79. The 2020 early dry season, 2021 mid wet season and 2021 late wet season survey periods recorded the lowest species richness at impact points of 68, 72 and 73 respectively. Total abundance at impact points was relatively consistent across most survey periods with counts ranging from 1,090 and 968 except for the 2021 late dry season survey periods (one and two) that recorded higher counts of 1,325 and 1,361 respectively.

Bird species and abundance recorded during BUS can often differ between months and years due to seasonal changes in presence and abundance, activity, changes in foraging behaviour and seasonal distribution of birds among various habitats.

The five most common species at impact and reference points are presented below in Table 3. The five most common species recorded at impact points comprised 25 percent of all counts at impact points and at reference points the five most common birds comprised 30 percent of all counts at reference points.

Table 3. The five most common bird species recorded at BUS points at MacIntyre Wind Farm.

Impact points	Reference points
Weebill	White-browed Woodswallow
Noisy Miner	Noisy Friarbird
Noisy Friarbird	Noisy Miner
Yellow-faced Honeyeater	Torresian Crow
Superb Fairy-wren	Scaly-breasted Lorikeet

The total number of birds observed at each impact point varied between 1,328 at point M6, to 645 at point M3 (Table 4). The total number of birds observed across the combined survey periods was higher on average at reference points (2,063 counts per reference point) than at impact points (880 counts per impact point).

Table 4. Count and height distribution of bird species at BUS points during eight survey periods at MacIntyre Wind Farm.

	M1			M2			M3			M4			M5			M6			M7			M8			M9			M10			R1			R2			TOTAL
Species	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
Apostlebird	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	-	-	46	-	-	**69**
Australasian Darter	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	**1**
Australasian Figbird	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	**6**
Australasian Grebe	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31	-	-	**32**
Australasian Pipit	17	-	-	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	5	-	-	-	-	-	-	-	-	-	-	-	4	-	-	**41**
Australian Hobby	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	**1**
Australian King-parrot	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	6	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**8**
Australian Magpie	55	2	-	38	-	-	14	-	-	30	-	-	41	-	-	46	-	-	13	-	-	9	-	-	12	-	-	44	-	-	52	-	-	56	-	-	**412**
Australian Owlet-nightjar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**3**
Australian Pelican	-	-	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	**4**
Australian Raven	22	17	-	54	12	-	16	4	-	16	5	-	19	4	-	27	5	-	9	1	-	14	-	-	24	-	-	21	-	-	27	7	-	2	12	-	**318**
Australian White Ibis	-	-	-	-	-	-	-	-	-	-	-	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**8**
Australian Wood Duck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17	-	-	**17**
Bar-shouldered Dove	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	**1**
Black Kite	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1**
Black-chinned Honeyeater	2	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	2	-	-	-	-	-	2	-	-	1	-	-	**12**
Black-faced Cuckoo-shrike	27	-	-	13	-	-	4	-	-	14	-	-	18	-	-	22	-	-	14	-	-	4	-	-	6	-	-	8	-	-	19	-	-	23	-	-	**172**
Black-faced Woodswallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	**15**
Black-fronted Dotterel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	-	-	**8**
Black-shouldered Kite	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1**
Blue-faced Honeyeater	3	-	-	6	-	-	2	-	-	1	-	-	16	7	-	10	-	-	-	-	-	-	-	-	1	-	-	1	-	-	49	-	-	60	-	-	**156**
Brown Falcon	1	1	-	3	2	-	-	-	-	-	2	-	-	-	-	2	-	-	1	-	-	2	1	-	1	-	-	1	-	-	-	1	-	-	-	-	**18**
Brown Goshawk	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	1	-	-	1	-	1	-	-	-	-	-	2	-	1	1	2	-	-	-	-	**11**
Brown Honeyeater	2	-	-	-	-	-	9	-	-	20	-	-	25	-	-	11	-	-	8	-	-	10	-	-	9	-	-	32	-	-	36	-	-	-	-	-	**162**
Brown Quail	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	1	-	-	3	-	-	**8**
Brown Thornbill	-	-	-	-	-	-	5	-	-	1	-	-	-	-	-	-	-	-	2	-	-	1	-	-	9	-	-	17	-	-	-	-	-	-	-	-	**35**
Brown Treecreeper	4	-	-	-	-	-	1	-	-	4	-	-	-	-	-	16	-	-	4	-	-	1	-	-	-	-	-	-	-	-	1	-	-	45	-	-	**76**
Brown-headed Honeyeater	-	-	-	-	-	-	2	-	-	-	-	-	2	-	-	10	-	-	-	-	-	1	-	-	13	-	-	-	-	-	7	-	-	40	-	-	**75**
Brush Cuckoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	**2**
Buff-rumped Thornbill	-	-	-	-	-	-	17	-	-	20	-	-	-	-	-	15	-	-	50	-	-	2	-	-	-	-	-	15	-	-	-	-	-	-	-	-	**119**
Channel-billed Cuckoo	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	**3**
Cicadabird	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-	14	-	-	2	-	-	5	-	-	2	-	-	1	-	-	4	-	-	8	-	-	**46**
Cockatiel	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**4**
Collared Sparrowhawk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	-	-	**10**
Common Bronzewing	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	2	-	-	1	-	-	-	-	-	3	-	-	-	-	-	-	-	-	1	-	-	**9**
Common Myna	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	23	-	-	**26**
Crested Pigeon	5	-	-	4	-	-	3	-	-	3	-	-	3	-	-	1	-	-	-	-	-	4	-	-	1	-	-	1	-	-	10	-	-	16	-	-	**51**
Diamond Dove	-	-	-	-	-	-	3	-	-	-	-	-	1	-	-	-	-	-	1	-	-	2	-	-	7	-	-	6	-	-	-	-	-	-	-	-	**20**
Dollarbird	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	-	-	3	-	-	**19**
Double-barred Finch	-	-	-	-	-	-	-	-	-	-	-	-	20	-	-	-	-	-	-	-	-	2	-	-	24	-	-	24	-	-	-	-	-	-	-	-	**70**
Dusky Moorhen	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	**1**
Dusky Woodswallow	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	3	28	-	-	3	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	**39**
Eastern Koel	1	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	4	-	-	**9**
Eastern Rosella	6	-	-	5	-	-	1	-	-	7	-	-	-	-	-	19	-	-	6	-	-	-	-	-	2	-	-	2	-	-	-	-	-	11	-	-	**59**
Eastern x Pale-headed Rosella (hybrid)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	**1**
Eastern Yellow Robin	-	-	-	-	-	-	1	-	-	3	-	-	-	-	-	-	-	-	5	-	-	-	-	-	10	-	-	-	-	-	-	-	-	-	-	-	**19**
Fairy Martin	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	21	1	16	17	-	**64**
Fan-tailed Cuckoo	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	7	-	-	2	-	-	-	-	-	-	-	-	1	-	-	1	-	-	**12**
Forest Kingfisher	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	-	-	**6**
Fuscous Honeyeater	3	-	-	-	-	-	1	-	-	-	-	-	42	-	-	10	-	-	3	-	-	-	-	-	27	-	-	-	-	-	1	-	-	-	-	-	**87**
Galah	3	6	-	2	-	-	-	-	-	-	-	-	1	-	-	3	-	-	-	2	-	-	-	-	4	-	-	4	-	-	19	-	-	27	-	-	**71**
Golden Whistler	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	**3**
Golden-headed Cisticola	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	**2**
Grey Butcherbird	10	-	-	34	-	-	9	-	-	6	-	-	21	-	-	29	-	-	6	-	-	5	-	-	6	-	-	6	-	-	26	-	-	44	-	-	**202**
Grey Fantail	-	-	-	-	-	-	8	-	-	3	-	-	1	-	-	15	-	-	5	-	-	8	-	-	32	-	-	14	-	-	2	-	-	-	-	-	**88**
Grey Shrike-thrush	9	-	-	3	-	-	6	-	-	11	-	-	8	-	-	24	-	-	19	-	-	21	-	-	36	-	-	25	-	-	14	-	-	43	-	-	**219**
Grey Teal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	-	-	**12**

	M1			M2			M3			M4			M5			M6			M7			M8			M9			M10			R1			R2			TOTAL
Species	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
Grey-crowned Babbler	9	-	-	8	-	-	-	-	-	3	-	-	6	-	-	19	-	-	-	-	-	4	-	-	3	-	-	1	-	-	40	-	-	27	-	-	**120**
Ground Cuckoo-shrike	2	-	-	9	-	-	1	-	-	-	-	-	2	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	2	-	-	-	-	-	**18**
Hooded Robin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	**3**
Horsfield's Bronze-cuckoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	**3**
Horsfield's Bushlark	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1**
Inland Thornbill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	1	-	-	-	-	-	-	-	-	**3**
Jacky Winter	15	-	-	2	-	-	-	-	-	-	-	-	10	-	-	27	-	-	-	-	-	2	-	-	12	-	-	-	-	-	-	-	-	11	-	-	**79**
Laughing Kookaburra	4	-	-	2	-	-	1	-	-	-	-	-	-	-	-	5	-	-	2	-	-	2	-	-	4	-	-	1	-	-	17	-	-	6	-	-	**44**
Leaden Flycatcher	5	-	-	1	-	-	11	-	-	-	-	-	-	-	-	10	-	-	26	-	-	6	-	-	3	-	-	4	-	-	-	-	-	-	-	-	**66**
Little Corella	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	9	-	-	-	-	-	64	2	-	2	-	-	**88**
Little Eagle	1	-	-	1	2	-	-	1	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	2	-	1	-	-	2	-	-	-	-	-	**12**
Little Friarbird	32	-	-	34	-	-	3	-	-	2	-	-	2	-	-	1	-	-	-	-	-	1	-	-	-	-	-	3	-	-	52	-	-	24	-	-	**154**
Little Lorikeet	6	3	-	2	-	-	1	-	-	1	-	-	3	-	-	36	18	-	-	-	-	6	2	-	7	2	-	4	-	-	32	1	-	42	81	-	**247**
Little Pied Cormorant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	**1**
Magpie-lark	71	3	-	40	1	-	4	-	-	2	-	-	16	-	-	38	-	-	6	-	-	6	-	-	2	-	-	10	-	-	64	-	-	94	-	-	**357**
Masked Lapwing	5	-	-	2	-	-	-	-	-	-	-	-	3	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19	-	-	**34**
Mistletoebird	19	-	-	6	-	-	7	-	-	12	-	-	7	-	-	17	-	-	1	-	-	-	-	-	2	-	-	2	1	-	11	-	-	8	-	-	**93**
Musk Lorikeet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	**5**
Nankeen Kestrel	-	1	-	1	-	-	-	-	-	-	1	-	-	-	-	-	1	-	-	1	-	1	-	-	-	2	-	1	-	-	5	1	-	1	2	-	**18**
Noisy Friarbird	45	3	-	55	1	-	18	-	-	26	-	-	25	-	-	93	-	-	48	-	-	34	-	-	27	-	-	92	1	-	82	-	-	201	-	-	**751**
Noisy Miner	67	-	-	112	-	-	32	-	-	20	-	-	81	-	-	132	1	-	6	-	-	8	-	-	9	-	-	2	-	-	156	-	-	108	-	-	**734**
Olive-backed Oriole	1	-	-	4	-	-	-	-	-	1	-	-	6	-	-	7	-	-	1	-	-	3	-	-	2	-	-	-	-	-	10	-	-	22	-	-	**57**
Pacific Baza	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	**2**
Pacific Black Duck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	12	-	-	**15**
Painted Button-quail	-	-	-	-	-	-	1	-	-	3	-	-	9	-	-	2	-	-	1	-	-	1	-	-	3	-	-	-	-	-	-	-	-	1	-	-	**21**
Pale-headed Rosella	3	-	-	7	-	-	-	-	-	1	-	-	-	-	-	2	-	-	1	-	-	-	-	-	-	-	-	-	-	-	7	-	-	7	-	-	**28**
Pallid Cuckoo	-	-	-	4	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**5**
Peaceful Dove	7	-	-	3	-	-	5	-	-	2	-	-	-	-	-	4	-	-	4	-	-	-	-	-	6	-	-	19	-	-	3	-	-	6	-	-	**59**
Peregrine Falcon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	**1**
Pied Butcherbird	13	-	-	14	-	-	2	-	-	9	-	-	11	-	-	20	-	-	-	-	-	7	-	-	1	-	-	12	-	-	6	-	-	10	-	-	**105**
Pied Currawong	5	1	-	-	-	-	12	-	-	33	-	-	3	3	-	29	2	-	43	1	-	15	-	-	17	1	-	36	-	-	16	-	-	46	2	-	**265**
Plum-headed Finch	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	5	-	-	**42**
Purple-backed Fairy-wren	-	-	-	-	-	-	28	-	-	2	-	-	-	-	-	-	-	-	-	-	-	5	-	-	16	-	-	14	-	-	-	-	-	-	-	-	**65**
Rainbow Bee-eater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	2	-	-	2	-	-	1	-	-	1	-	**10**
Rainbow Lorikeet	-	-	-	2	-	-	1	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	55	-	-	-	-	-	**63**
Red Wattlebird	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	7	-	-	**12**
Red-browed Finch	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**5**
Red-rumped Parrot	-	-	-	7	-	-	-	-	-	-	-	-	2	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	-	-	32	-	-	**54**
Red-winged Parrot	1	-	-	2	-	-	-	-	-	-	-	-	2	-	-	8	-	-	-	-	-	1	-	-	-	-	-	-	-	-	7	-	-	13	-	-	**34**
Restless Flycatcher	2	-	-	1	-	-	1	-	-	3	-	-	2	-	-	32	-	-	1	-	-	-	-	-	6	-	-	-	-	-	7	-	-	5	-	-	**60**
Rufous Songlark	53	-	-	25	-	-	-	-	-	3	-	-	13	-	-	2	-	-	-	-	-	16	-	-	6	-	-	-	-	-	10	-	-	46	-	-	**174**
Rufous Whistler	2	-	-	3	-	-	19	-	-	12	-	-	28	-	-	26	-	-	26	-	-	37	-	-	50	-	-	33	-	-	11	-	-	10	-	-	**257**
Sacred Kingfisher	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	1	-	-	-	-	-	**4**
Scaly-breasted Lorikeet	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	11	2	-	-	-	-	-	-	-	11	-	-	2	-	-	143	2	-	43	4	-	**220**
Scarlet Honeyeater	-	-	-	-	-	-	12	-	-	10	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	10	-	-	6	-	-	-	-	-	**40**
Shining Bronze-cuckoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1**
Silvereye	-	-	-	-	-	-	26	-	-	33	-	-	3	-	-	-	-	-	16	-	-	25	-	-	34	-	-	13	-	-	-	-	-	-	-	-	**150**
Southern Whiteface	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1**
Spangled Drongo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	**1**
Speckled Warbler	-	-	-	-	-	-	7	-	-	1	-	-	47	-	-	1	-	-	6	-	-	17	-	-	14	-	-	11	-	-	-	-	-	-	-	-	**104**
Spiny-cheeked Honeyeater	4	-	-	4	-	-	2	-	-	6	-	-	10	-	-	-	-	-	-	-	-	3	-	-	-	-	-	6	-	-	-	-	-	1	-	-	**36**
Spotted Dove	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1**
Spotted Pardalote	-	-	-	1	-	-	21	-	-	15	-	-	-	-	-	16	-	-	49	-	-	21	-	-	26	-	-	16	-	-	3	-	-	7	-	-	**175**
Square-tailed Kite	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1**
Squatter Pigeon (Southern)	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1**
Straw-necked Ibis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	-	1	-	-	**8**
Striated Pardalote	55	-	-	22	-	-	9	-	-	15	-	-	30	-	-	37	-	-	7	-	-	-	-	-	16	-	-	4	-	-	47	-	-	49	-	-	**291**
Striated Thornbill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1**
Striped Honeyeater	8	-	-	8	-	-	3	-	-	10	-	-	1	-	-	3	-	-	1	-	-	7	-	-	4	-	-	10	-	-	6	-	-	10	-	-	**71**

	M1			M2			M3			M4			M5			M6			M7			M8			M9			M10			R1			R2			TOTAL
Species	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
Sulphur-crested Cockatoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	-	-	-	-	-	5	-	-	9	5	-	2	-	-	5	-	-	9	-	-	**41**
Superb Fairy-wren	-	-	-	-	-	-	42	-	-	5	-	-	31	-	-	8	-	-	16	-	-	81	-	-	60	-	-	89	-	-	45	-	-	44	-	-	**421**
Tawny Frogmouth	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1**
Torresian Crow	62	19	-	79	25	-	3	7	-	35	-	-	24	3	-	6	-	-	2	2	-	1	3	-	-	-	-	12	2	-	107	1	-	79	10	-	**482**
Tree Martin	5	5	-	2	3	-	1	1	-	-	-	-	-	4	-	8	14	-	-	4	-	-	1	-	6	3	-	1	1	-	-	25	-	32	26	-	**142**
Turquoise Parrot	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	**6**
Varied Sittella	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-	2	-	-	-	-	-	-	-	-	8	-	-	-	-	-	-	-	-	**19**
Wedge-tailed Eagle	-	2	-	-	2	-	1	8	2	-	7	2	4	1	-	-	11	-	-	6	1	-	1	1	-	4	-	2	1	-	-	-	-	-	-	-	**56**
Weebill	14	-	-	44	-	-	74	-	-	72	-	-	84	-	-	29	-	-	44	-	-	62	-	-	55	-	-	83	1	-	86	-	-	2	-	-	**650**
Welcome Swallow	-	-	-	-	-	-	-	-	-	1	1	-	8	-	-	22	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	155	13	-	**209**
Whistling Kite	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	1	-	-	1	1	-	-	-	-	-	3	-	-	1	-	-	1	-	1	-	1	**12**
White-bellied Cuckoo-shrike	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	**3**
White-browed Babbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	-	-	-	-	-	-	-	-	-	-	-	**8**
White-browed Scrubwren	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	3	-	-	-	-	-	-	-	-	-	-	-	**4**
White-browed Woodswallow	7	12	2	-	23	2	-	-	-	-	1	-	-	1	-	1	29	-	-	3	-	-	60	-	-	14	1	-	21	-	-	5	-	-	291	1	**474**
White-eared Honeyeater	13	-	-	15	-	-	13	-	-	47	-	-	20	-	-	2	-	-	5	-	-	44	-	-	3	-	-	35	-	-	-	-	-	2	-	-	**199**
White-faced Heron	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	2	-	-	**6**
White-naped Honeyeater	-	-	-	-	-	-	-	-	-	1	-	-	2	-	-	-	-	-	24	-	-	2	-	-	44	-	-	1	-	-	12	-	-	1	-	-	**87**
White-necked Heron	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	**3**
White-plumed Honeyeater	4	-	-	-	-	-	-	-	-	1	-	-	5	-	-	2	-	-	1	-	-	6	-	-	7	-	-	3	-	-	31	-	-	29	-	-	**89**
White-throated Gerygone	-	-	-	1	-	-	-	-	-	-	-	-	3	-	-	18	-	-	1	-	-	1	-	-	1	-	-	-	-	-	38	-	-	5	-	-	**68**
White-throated Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	**2**
White-throated Needletail	-	11	-	-	-	-	1	23	-	-	42	1	-	15	-	-	63	-	-	-	-	-	12	-	-	38	-	3	-	-	-	-	-	-	-	-	**209**
White-throated Treecreeper	-	-	-	1	-	-	52	-	-	31	-	-	1	-	-	48	-	-	75	-	-	19	-	-	36	-	-	47	-	-	7	-	-	4	-	-	**321**
White-winged Chough	6	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	6	-	-	-	-	-	15	-	-	31	-	-	22	-	-	14	-	-	**96**
White-winged Triller	16	-	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	5	-	-	4	-	-	1	-	-	1	-	-	**29**
Willie Wagtail	43	-	-	11	-	-	5	-	-	7	-	-	13	-	-	35	-	-	10	-	-	8	-	-	28	-	-	8	-	-	49	-	-	75	-	-	**292**
Wonga Pigeon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	**1**
Yellow Thornbill	-	-	-	2	-	-	-	-	-	42	-	-	2	-	-	13	-	-	5	-	-	54	-	-	48	-	-	27	-	-	31	-	-	4	-	-	**228**
Yellow-faced Honeyeater	1	-	-	1	-	-	59	-	-	40	-	-	4	-	-	12	-	-	55	-	-	41	-	-	59	-	-	75	-	-	8	-	-	2	-	-	**357**
Yellow-rumped Thornbill	48	-	-	5	1	-	-	-	-	-	-	-	16	-	-	29	-	-	-	-	-	8	-	-	-	-	-	14	-	-	10	-	-	15	-	-	**146**
Yellow-tailed Black-cockatoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	1	-	-	-	-	-	-	-	-	-	3	-	**6**
Yellow-tufted Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	41	-	-	2	-	-	-	-	-	-	-	-	**46**
TOTAL	**868**	**93**	**2**	**731**	**72**	**2**	**592**	**51**	**2**	**660**	**59**	**5**	**772**	**50**	-	**1139**	**189**	-	**668**	**25**	**1**	**672**	**83**	**1**	**972**	**76**	**1**	**985**	**31**	**1**	**1648**	**79**	**1**	**1931**	**464**	**2**	**12928**

Notes: A = Below RSA height; B = At RSA height; C = above RSA height; R = Reference; - no observation.

4.3. Flight heights

Bird heights were classified as below (< 40 metres), at (40 to 285 metres) and above (> 285 metres) RSA height. An outline of the number of birds recorded at the different flight height classes is presented in Table 5.

Table 5. Summary of birds recorded at the three flight height classes.

Flight Height	Impact points		Reference points	
	Counts	Percentage of all birds	Counts	Percentage of all birds
A (below RSA)	8,059	91.55	3,579	86.76
B (at RSA)	729	8.28	543	13.17
C (above RSA)	15	0.17	3	0.07
TOTAL	**8,803**	**100**	**4,125**	**100**

The total bird count at RSA height at impact points was greatest during the 2021 late dry season and 2022 late wet season survey periods with counts of 191 and 135 respectively followed by relatively consistent counts during the 2021 mid wet season, 2020 late dry season and 2021 late dry season survey periods with counts of 97, 92 and 86 respectively. The lowest counts at RSA height at impacts points were recorded during the 2021 late wet, 2020 mid wet and 2020 early dry season survey periods with counts of 66, 46 and 16 respectively.

The number of species recorded at RSA height at impact points was highest during the 2021 late dry season survey period at 18 followed by relatively consistent numbers of species during the 2021 mid wet, 2021 late wet, 2020 late dry and 2021 late dry season survey periods of 14, 13, 12 and 12. The lowest number of species at RSA height at impact points was recorded during the 2020 mid wet, 2022 late wet and 2020 early dry season survey periods with 10, seven and four respectively.

The five most abundant species recorded flying at RSA are detailed in Table 6.

Table 6. The five most abundant species recorded flying at RSA height at MacIntyre Wind Farm.

Impact points	Reference points
White-throated Needletail*	White-browed Woodswallow
White-browed Woodswallow	Little Lorikeet
Torresian Crow	Tree Martin
Australian Raven	Fairy Martin
Wedge-tailed Eagle	Australian Raven

* listed as Vulnerable and Migratory under the EPBC Act and Vulnerable under the NC Act.

4.4. Threatened and migratory species

Most birds observed within the study area were common, widespread birds. Two threatened bird species were observed during the fixed-point counts as listed below.

- White-throated Needletail – Vulnerable and Migratory under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and Vulnerable under the Queensland *Nature Conservation Act 1992* (NC Act).
- Squatter Pigeon (Southern) – Vulnerable under the EPBC Act and Vulnerable under the NC Act.

4.4.1. White-throated Needletail

White-throated Needletail is widespread in eastern and south-eastern Australia. The subspecies that occurs in Australia is *Hirundapus caudacutus caudacutus*. This subspecies is a trans-equatorial migrant that breeds in the Northern Hemisphere summer and migrates south for the Southern Hemisphere summer. The species is mostly aerial in Australia, flying at heights of less than one metre up to more than 1,000 metres above the ground (Threatened Species Scientific Committee 2019).

The species occurs over most habitat types and is recorded most often above wooded areas, including open forest and rainforest, and may also fly below the canopy between trees or in clearings. When flying above farmland, it is more often recorded above partly cleared pasture, plantations or remnant vegetation at the edge of paddocks (Threatened Species Scientific Committee 2019). White-throated Needletail often forages along the edges of low pressure systems and in updrafts at ridges, both of which lift their food resource (aerial insects) and assist with the species' flight (Department of Agriculture, Water and the Environment 2022).

White-throated Needletail was observed during each wet season survey period at impact points M1, M3, M4, M5, M6, M8, M9 and M10 (Figure 1) with a total of 20 observations consisting of a total count of 209 as shown in Table 7. The species was observed in counts ranging from one to 51 with an average count of 10. At impact points White-throated Needletail was observed at heights between 10 metres and 350 metres with seventeen of the twenty observations (85 percent) first seen at RSA height (total count of 204). White-throated Needletail was not observed at reference points.

The species was also observed incidental to formal BUS during each wet season survey period (Figure 1) with a total of 10 observations, with counts ranging from one to 19 with an average count of four and a total count of 43. Incidental observations ranged in height between 10 metres and 300 metres with eight of the ten observations (80 percent) first seen at RSA height (total count of 34).

White-throated Needletail was observed during 15 of the 36 days of BUS (42 percent) completed during the wet season within the study area (noting that the species is most likely to be present within the study area during the wet season rather than the dry season given its migratory habits). It is also noted that a total White-throated Needletail count of 89 has been recorded in the adjacent proposed Karara Wind Farm during the wet season BUS completed there, including a count of 66 during the 2022 late wet season survey period.

Table 7. Summary of White-throated Needletail counts during BUS completed.

Season and Observation	2020	2021		2022	TOTAL
	Mid Wet	Late Wet	Mid Wet	Late Wet	
Impact	19	26	47	117	**209**
Reference	-	-	-	-	-
Incidental	5	23	4	11	**43**
TOTAL	**24**	**49**	**51**	**128**	**252**

Note: - no observation.

During the 2020 mid wet, 2021 mid wet and 2022 late wet season survey periods, all observations of the species recorded both during the fixed-point counts and as incidentals coincided with the following weather events observed within the study area:

- up to 3.8 days prior to a storm

- up to 4.6 days after a storm
- as a strong south-easterly wind change came through.

During the 2021 late wet season survey period only one of the seven observations of White-throated Needletail coincided with a weather event (light precipitation within 45 minutes of observation).

White-throated Needletail occurrence is sporadic and numbers vary greatly, with flocks ranging from several birds to tens of birds and, elsewhere, up to several hundred birds. Mapping flight paths of this species does not provide reliable information on the location of flyways as the species can fly over any part of the landscape when in an area. The great spatial and temporal variability in White-throated Needletail occurrence is not amenable to developing a valid estimate of the number of individuals passing through a study area in a year (i.e. during the wet season when the species is most likely to be present in Australia) and therefore meaningful collision risk model (CRM) outputs (i.e. error is likely to be high).

White-throated Needletail mortality from collision with wind turbines within Australia is known to occur, although is a low severity threat that affects a small number of birds (Hull et al. 2013, Nature Advisory data). Observations elsewhere in Australia indicate that the species occasionally collides with wind farms with 11 collisions recorded at Bluff Point Wind Farm Tasmania (37 wind turbines) from August 2002 to December 2010 and 11 collisions recorded at Studland Bay Wind Farm Tasmania (25 turbines) from April 2007 to December 2010 (Hull et al. 2013). White-throated Needletail collisions have also been recorded once or twice at about half the 18 wind farms monitored for bird impacts (for at least a year and up to three years) by Nature Advisory in the last decade or so. Nature Advisory investigations indicate that the potential number of White-throated Needletail affected by a wind farm increases with increasing number of turbines, not unexpectedly; projects of 150 or more turbines are more likely to lead to annual mortality of 10 or more individuals, depending on their location and White-throated Needletail activity. It is noted the proposed MacIntyre Wind Farm has been granted EPBC Act approval for the construction of up to 169 wind turbines.

4.4.2. Squatter Pigeon (Southern)

Squatter Pigeon (Southern) is a ground-dwelling bird that occurs on the inland slopes of the Great Dividing Range. The species inhabits the grassy understorey of open eucalypt woodland, and less often savannas. It is nearly always found near permanent water such as rivers, creeks and waterholes. Sandy areas dissected by gravel ridges, which have open and short grass cover allowing easier movement, are preferred (Threatened Species Scientific Committee 2015).

The species was observed once during fixed-point counts in the 2020 early dry season survey period at impact point M1 (Figure 1). During each survey period the species was also recorded as an incidental with 32 observations and 66 birds counted. The species was observed at an initial height of ground level for each observation except three where the species was observed at 10 metres above ground level. During nineteen of the observations the species flew to a maximum height of 10 metres. Given that Squatter Pigeon (Southern) is a ground-dwelling bird and each observation was below RSA height, the species is not considered to be at risk of collision with wind turbines within the study area.

4.5. Raptors

Nine raptor species were recorded during the fixed-point counts at impacts points, comprising 112 counts in total (Table 8). None of the raptor species observed are listed as threatened and/or migratory under the Commonwealth EPBC Act or the Queensland NC Act.

During the eight survey periods, raptor counts were observed to be highest during the 2020 early dry season survey period with a total of 22 counts at impact points and lowest during the 2022 late wet season survey period with a total of 8 counts at impact points.

Raptors can account for a high percentage of birds recorded at RSA height. Raptors formed 10.01 percent of all birds observed at RSA height at impact points (Table 8). The number of raptors was low in relation to the total number of birds recorded at impact points (112 of 8,803 observations or 1.27 percent). Based on the utilisation rate by raptors at the impact points, risks to raptor populations within and immediately surrounding the study area are considered to be low.

Wedge-tailed Eagle was the most counted raptor species at impact points and was observed throughout the study area. At impact points a total of 45 observations of the species were made with a total count of 56. The species often flies at RSA height with 76.79 percent of Wedge-tailed Eagle at impact points observed at RSA height.

Wedge-tailed Eagles are at higher risk of collision with operating turbines because of their soaring habits while foraging. Wedge-tailed Eagles have been recorded colliding with wind turbines at most wind farms in Australia. Most of the affected individuals are sub-adult birds between one and two years old. Once sub-adult Wedge-tailed Eagle leave their natal territory (usually expelled by their parents before the next breeding season commences), they wander long distances, up to one to two thousand kilometres based on banding records and recent satellite-tracking results (Cherriman 2018). This indicates that the population operates at a continental scale and numbers at least tens of thousands (Olsen 2005) and given observed breeding densities (Marchant & Huggins 1993), likely over 100,000.

4.6. Waterbirds

Six waterbird species were observed during impact point surveys, comprising a total of 18 observations (0.20 percent of all birds at impact points). None of the waterbird species observed during impact point surveys are listed as threatened and/or migratory under the Commonwealth EPBC Act or the Queensland NC Act.

The study 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 sheep and cattle.

Table 8. Raptor species recorded at impact points during the survey periods at MacIntyre Wind Farm.

Raptors	2020 - Early Dry			2020 - Late Dry			2020 - Mid Wet			2021 - Late Wet			2021 - Late Dry			2021 - Late Dry			2021 - Mid Wet			2022 - Late Wet			Grand Total	Total at RSA	Total Raptor Flights (%)	Flights at RSA (%)	Flights recorded at RSA compared with all bird flights at RSA (%)	Flights recorded at RSA compared with all bird flights observed (%)
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C						
Black Kite	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	0	0.89	0.00	0.00	0.00
Black-shouldered Kite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	0	0.89	0.00	0.00	0.00
Brown Falcon	3	-	-	-	1	-	-	1	-	1	-	-	2	3	-	2	1	-	2	-	-	1	-	-	17	6	15.18	5.36	0.82	0.07
Brown Goshawk	1	-	-	-	3	-	-	-	-	-	-	-	1	-	-	2	-	1	-	-	-	-	-	-	8	3	7.14	2.68	0.41	0.03
Little Eagle	-	-	-	1	1	-	-	-	-	1	-	-	-	2	-	-	-	-	1	2	-	-	2	-	10	7	8.93	6.25	0.96	0.08
Nankeen Kestrel	3	3	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	9	6	8.04	5.36	0.82	0.07
Square-tailed Kite	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	0.89	0.89	0.14	0.01
Wedge-tailed Eagle	4	6	-	-	6	1	-	9	-	-	6	2	-	1	1	3	3	-	-	7	2	-	5	-	56	43	50.00	38.39	5.90	0.49
Whistling Kite	2	-	-	-	1	-	-	3	-	-	-	-	-	1	-	-	-	-	-	2	-	-	-	-	9	7	8.04	6.25	0.96	0.08
TOTAL	**13**	**9**	-	**1**	**12**	**1**	-	**14**	-	**2**	**7**	**2**	**4**	**7**	**1**	**7**	**5**	**1**	**4**	**12**	**2**	**1**	**7**	**0**	**112**	**73**	**100.00**	**65.18**	**10.01**	**0.83**

Notes: A=below RSA; B= at RSA; C= above RSA.

Table 9. Waterbird species recorded at impact points during the survey periods at MacIntyre Wind Farm.

Waterbirds	2020 - Early Dry			2020 - Late Dry			2020 - Mid Wet			2021 - Late Wet			2021 - Late Dry			2021 - Late Dry			2021 - Mid Wet			2022 - Late Wet			Grand Total	Total at RSA	Total Waterbird Flights (%)	Flights at RSA (%)	Flights recorded at RSA compared with all bird flights at RSA (%)	Flights recorded at RSA compared with all bird flights observed (%)
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C						
Australasian Grebe	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	0	5.56	0.00	0.00	0.00
Australian Pelican	1	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	3	0	16.67	0.00	0.00	0.00
Australian White Ibis	-	-	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	8	44.44	44.44	1.10	0.09
Pacific Black Duck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	3	3	16.67	16.67	0.41	0.03
White-faced Heron	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	11.10	5.56	0.14	0.01
White-necked Heron	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	5.56	5.56	0.14	0.01
TOTAL	**2**	-	-	-	**8**	-	-	-	-	-	**2**	**2**	-	-	-	-	-	-	-	-	-	**1**	**3**	-	**18**	**13**	**100.00**	**72.23**	**1.79**	**0.14**

Notes: A=below RSA; B= at RSA; C= above RSA.

5. Conclusions

The conclusions from the baseline BUS of the MacIntyre Wind Farm are presented below.

- The majority of the study area consists of agricultural land that has been cleared for grazing with scattered eucalypts and patches of eucalypt woodland present, as well as some riparian areas and small farm dams. These habitat types support common, predominantly open country and woodland adapted bird species within the study area.
- Species richness at impact points was consistent during most survey periods. The 2020 late dry season and 2021 late dry season survey periods both recorded a species richness of 80 and the 2020 mid wet season, 2021 late dry season and 2022 late wet season survey periods each recorded a species richness of 79. The 2020 early dry season, 2021 mid wet season and 2021 late wet season survey periods recorded the lowest species richness of 68, 72 and 73 respectively.
- Total abundance at impact points was relatively consistent across most survey periods with counts ranging from 1,090 and 968 except for the 2021 late dry season survey periods (one and two) that recorded higher counts of 1,325 and 1,361 respectively.
- The proportion of flights recorded at rotor swept area (40 to 285 metres above ground) were 8.28 percent of counts at impact points and 13.17 percent of counts at reference points.
- The total bird count at RSA height at impact points was greatest during the 2021 late dry season and 2022 late wet season survey periods with counts of 191 and 135 respectively followed by relatively consistent counts during the 2021 mid wet season, 2020 late dry season and 2021 late dry season survey periods with counts of 97, 92 and 86 respectively. The lowest counts at RSA height at impacts points were recorded during the 2021 late wet, 2020 mid wet and 2020 early dry season survey periods with counts of 66, 46 and 16 respectively.
- The number of species recorded at RSA height at impact points was highest during the 2021 late dry season survey period at 18 followed by relatively consistent numbers of species during the 2021 mid wet, 2021 late wet, 2020 late dry and 2021 late dry season survey periods of 14, 13, 12 and 12. The lowest number of species at RSA height at impact points was recorded during the 2020 mid wet, 2022 late wet and 2020 early dry season survey periods with 10, seven and four respectively.
- The study area supports average numbers of raptors and lower numbers of waterbirds, bird groups considered more likely to collide with operating wind turbines.
- Two threatened species listed as Vulnerable under the EPBC Act and Vulnerable under the NC Act were recorded during the fixed-bird counts and as incidentals.
    - White-throated Needletail (also listed as Migratory under the EPBC Act) was observed during each wet season survey period with a total of 20 observations consisting of a total of 209 counts at impact points. The species was observed at impact points at heights between 10 metres and 350 metres with seventeen of the twenty observations (85 percent) first seen at RSA height (total count of 204). White-throated Needletail was not observed at reference points. The species was also observed incidentally to the formal BUS counts. The species was observed during 15 of the 36 days of BUS (42 percent) completed during the wet season.
    - Squatter Pigeon (Southern) was observed once during the early dry season survey period at an impact point. The species was also recorded incidentally to the BUS counts during each

survey period. Given that Squatter Pigeon (Southern) is a ground-dwelling bird and each observation was below RSA height, the species is not considered to be at risk of collision with wind turbines within the study area.

- The results from the BUS support a Before-After-Control-Impact (BACI) design as detailed in the MacIntyre Wind Farm Bird and Bat Adaptive Management Plan (Nature Advisory 2021). Eight seasonal pre-construction BUS have been completed to establish the baseline for the BACI assessment.
- Post-construction BUS aligning with the methodology applied during the pre-construction BUS and in accordance with the MacIntyre Wind Farm Bird and Bat Adaptive Management Plan (Nature Advisory 2021) will assist in determining the effect (if any) of the MacIntyre Wind Farm on bird assemblages and bird utilisation of the study area.

6. References

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Appendix 1. Bird species recorded

Bird Species List

Common Name	Scientific Name	EPBC Act	NC Act	Fixed-point Count		Incidental only
				Impact	Reference	
Apostlebird	*Struthidea cinerea*	-	-	Y	Y	
Australasian Darter	*Anhinga novaehollandiae*	-	-		Y	
Australasian Figbird	*Sphecotheres vieilloti*	-	-	Y	Y	
Australasian Grebe	*Tachybaptus novaehollandiae*	-	-	Y	Y	
Australasian Pipit	*Anthus novaeseelandiae*	-	-	Y	Y	
Australian Hobby	*Falco longipennis*	-	-		Y	
Australian King-parrot	*Alisterus scapularis*	-	-	Y		
Australian Magpie	*Cracticus tibicen*	-	-	Y	Y	
Australian Owlet-nightjar	*Aegotheles cristatus*	-	-	Y		
Australian Pelican	*Pelecanus conspicillatus*	-	-	Y	Y	
Australian Raven	*Corvus coronoides*	-	-	Y	Y	
Australian White Ibis	*Threskiornis molucca*	-	-	Y		
Australian Wood Duck	*Chenonetta jubata*	-	-		Y	
Banded Lapwing	*Vanellus tricolor*	-	-			Y
Bar-shouldered Dove	*Geopelia humeralis*	-	-	Y		
Black Kite	*Milvus migrans*	-	-	Y		
Black Swan	*Cygnus atratus*	-	-			Y
Black-chinned Honeyeater	*Melithreptus gularis*	-	-	Y	Y	
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	-	-	Y	Y	
Black-faced Woodswallow	*Artamus cinereus*	-	-	Y	Y	
Black-fronted Dotterel	*Elseyornis melanops*	-	-		Y	
Black-shouldered Kite	*Elanus axillaris*	-	-	Y		
Black-winged Stilt	*Himantopus himantopus*	-	-			Y
Blue-faced Honeyeater	*Entomyzon cyanotis*	-	-	Y	Y	
Brown Falcon	*Falco berigora*	-	-	Y	Y	
Brown Goshawk	*Accipiter fasciatus*	-	-	Y	Y	
Brown Honeyeater	*Lichmera indistincta*	-	-	Y	Y	
Brown Quail	*Coturnix ypsilophora*	-	-	Y	Y	
Brown Songlark	*Cincloramphus cruralis*	-	-			Y
Brown Thornbill	*Acanthiza pusilla*	-	-	Y		
Brown Treecreeper	*Climacteris picumnus*	-	-	Y	Y	
Brown-headed Honeyeater	*Melithreptus brevirostris*	-	-	Y	Y	
Brush Cuckoo	*Cacomantis variolosus*	-	-	Y	Y	
Buff-banded Rail	*Gallirallus philippensis*	-	-			Y
Cattle Egret	*Bubulcus ibis*	-	-			Y
Buff-rumped Thornbill	*Acanthiza reguloides*	-	-	Y		
Channel-billed Cuckoo	*Scythrops novaehollandiae*	-	-	Y	Y	
Chestnut-rumped Thornbill	*Acanthiza uropygialis*	-	-			Y
Cicadabird	*Coracina tenuirostris*	-	-	Y	Y	
Cockatiel	*Nymphicus hollandicus*	-	-	Y		
Collared Sparrowhawk	*Accipiter cirrocephalus*	-	-		Y	
Common Bronzewing	*Phaps chalcoptera*	-	-	Y	Y	
Common Myna	*Sturnus tristis*	-	-	Y	Y	
Crested Pigeon	*Ocyphaps lophotes*	-	-	Y	Y	
Crested Shrike-tit	*Falcunculus frontatus*	-	-			Y
Diamond Dove	*Geopelia cuneata*	-	-	Y		
Diamond Firetail	*Stagonopleura guttata*	-	-			Y
Dollarbird	*Eurystomus orientalis*	-	-	Y	Y	
Double-barred Finch	*Taeniopygia bichenovii*	-	-	Y		
Dusky Moorhen	*Gallinula tenebrosa*	-	-		Y	
Dusky Woodswallow	*Artamus cyanopterus*	-	-	Y		
Eastern Barn Owl	*Tyto alba*	-	-			Y
Eastern Great Egret	*Ardea modesta*	-	-			Y
Eastern Koel	*Eudynamys orientalis*	-	-	Y	Y	
Eastern Rosella	*Platycercus eximius*	-	-	Y	Y	
Eastern x Pale-headed Rosella (hybrid)	*Platycercus eximius x adscitus*	-	-		Y	
Eastern Yellow Robin	*Eopsaltria australis*	-	-	Y		
Emu	*Dromaius novaehollandiae*	-	-			Y
Fairy Martin	*Petrochelidon ariel*	-	-	Y	Y	
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	-	-	Y	Y	
Forest Kingfisher	*Todiramphus macleayii*	-	-		Y	
Fuscous Honeyeater	*Lichenostomus fuscus*	-	-	Y	Y	
Galah	*Eolophus roseicapillus*	-	-	Y	Y	

Common Name	Scientific Name	EPBC Act	NC Act	Fixed-point Count		Incidental only
				Impact	Reference	
Golden Whistler	*Pachycephala pectoralis*	-	-	Y	Y	
Golden-headed Cisticola	*Cisticola exilis*	-	-	Y	Y	
Grey Butcherbird	*Cracticus torquatus*	-	-	Y	Y	
Grey Fantail	*Rhipidura albiscapa*	-	-	Y	Y	
Grey Shrike-thrush	*Colluricincla harmonica*	-	-	Y	Y	
Grey Teal	*Anas gracilis*	-	-		Y	
Grey-crowned Babbler	*Pomatostomus temporalis*	-	-	Y	Y	
Ground Cuckoo-shrike	*Coracina maxima*	-	-	Y	Y	
Hardhead	*Aythya australis*	-	-			Y
Hooded Robin	*Melanodryas cucullata*	-	-	Y	Y	
Horsfield's Bronze-cuckoo	*Chalcites basalis*	-	-	Y	Y	
Horsfield's Bushlark	*Mirafra javanica*	-	-	Y		
Inland Thornbill	*Acanthiza apicalis*	-	-	Y		
Jacky Winter	*Microeca fascinans*	-	-	Y	Y	
King Quail	*Excalfactoria chinensis*	-	-			Y
Laughing Kookaburra	*Dacelo novaeguineae*	-	-	Y	Y	
Leaden Flycatcher	*Myiagra rubecula*	-	-	Y		
Little Corella	*Cacatua sanguinea*	-	-	Y	Y	
Little Eagle	*Hieraaetus morphnoides*	-	-	Y	Y	
Little Friarbird	*Philemon citreogularis*	-	-	Y	Y	
Little Lorikeet	*Glossopsitta pusilla*	-	-	Y	Y	
Little Pied Cormorant	*Microcarbo melanoleucos*	-	-		Y	
Magpie-lark	*Grallina cyanoleuca*	-	-	Y	Y	
Masked Lapwing	*Vanellus miles*	-	-	Y	Y	
Masked Woodswallow	*Artamus personatus*	-	-			Y
Mistletoebird	*Dicaeum hirundinaceum*	-	-	Y	Y	
Musk Lorikeet	*Glossopsitta concinna*	-	-	Y		
Nankeen Kestrel	*Falco cenchroides*	-	-	Y	Y	
Noisy Friarbird	*Philemon corniculatus*	-	-	Y	Y	
Noisy Miner	*Manorina melanocephala*	-	-	Y	Y	
Olive-backed Oriole	*Oriolus sagittatus*	-	-	Y	Y	
Pacific Baza	*Aviceda subcristata*	-	-		Y	
Pacific Black Duck	*Anas superciliosa*	-	-	Y	Y	
Painted Button-quail	*Turnix varius*	-	-	Y	Y	
Pale-headed Rosella	*Platycercus adscitus*	-	-	Y	Y	
Pallid Cuckoo	*Cacomantis pallidus*	-	-	Y		
Peaceful Dove	*Geopelia placida*	-	-	Y	Y	
Peregrine Falcon	*Falco peregrinus*	-	-		Y	
Pheasant Coucal	*Centropus phasianinus*	-	-			Y
Pied Butcherbird	*Cracticus nigrogularis*	-	-	Y	Y	
Pied Currawong	*Strepera graculina*	-	-	Y	Y	
Plum-headed Finch	*Neochmia modesta*	-	-	Y	Y	
Purple-backed Fairy-wren	*Malurus assimilis*	-	-	Y		
Rainbow Bee-eater	*Merops ornatus*	-	-	Y	Y	
Rainbow Lorikeet	*Trichoglossus haematodus*	-	-	Y	Y	
Red Wattlebird	*Anthochaera carunculata*	-	-	Y	Y	
Red-backed Fairy-wren	*Malurus melanocephalus*	-	-			Y
Red-browed Finch	*Neochmia temporalis*	-	-	Y		
Red-rumped Parrot	*Psephotus haematonotus*	-	-	Y	Y	
Red-winged Parrot	*Aprosmictus erythropterus*	-	-	Y	Y	
Restless Flycatcher	*Myiagra inquieta*	-	-	Y	Y	
Rufous Songlark	*Cincloramphus mathewsi*	-	-	Y	Y	
Rufous Whistler	*Pachycephala rufiventris*	-	-	Y	Y	
Sacred Kingfisher	*Todiramphus sanctus*	-	-	Y	Y	
Scaly-breasted Lorikeet	*Trichoglossus chlorolepidotus*	-	-	Y	Y	
Scarlet Honeyeater	*Myzomela sanguinolenta*	-	-	Y	Y	
Shining Bronze-cuckoo	*Chalcites lucidus*	-	-	Y		
Silvereye	*Zosterops lateralis*	-	-	Y		
Southern Whiteface	*Aphelocephala leucopsis*	-	-	Y		
Spangled Drongo	*Dicrurus bracteatus*	-	-	Y		
Speckled Warbler	*Chthonicola sagittata*	-	-	Y		
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	-	-	Y	Y	
Spotted Dove	*Streptopelia chinensis*	-	-	Y		

Common Name	Scientific Name	EPBC Act	NC Act	Fixed-point Count		Incidental only
				Impact	Reference	
Spotted Harrier	*Circus assimilis*	-	-			Y
Spotted Pardalote	*Pardalotus punctatus*	-	-	Y	Y	
Spotted Quail-thrush	*Cinclosoma punctatum*	-	-			Y
Square-tailed Kite	*Lophoictinia isura*	-	-	Y		
Squatter Pigeon (Southern)	*Geophaps scripta scripta*	V	V	Y		
Straw-necked Ibis	*Threskiornis spinicollis*	-	-		Y	
Striated Pardalote	*Pardalotus striatus*	-	-	Y	Y	
Striated Thornbill	*Acanthiza lineata*	-	-	Y		
Striped Honeyeater	*Plectorhyncha lanceolata*	-	-	Y	Y	
Sulphur-crested Cockatoo	*Cacatua galerita*	-	-	Y	Y	
Superb Fairy-wren	*Malurus cyaneus*	-	-	Y	Y	
Tawny Frogmouth	*Podargus strigoides*	-	-	Y		
Torresian Crow	*Corvus orru*	-	-	Y	Y	
Tree Martin	*Petrochelidon nigricans*	-	-	Y	Y	
Turquoise Parrot	*Neophema pulchella*	-	-	Y		
Varied Sittella	*Daphoenositta chrysoptera*	-	-	Y		
Wedge-tailed Eagle	*Aquila audax*	-	-	Y		
Weebill	*Smicrornis brevirostris*	-	-	Y	Y	
Welcome Swallow	*Hirundo neoxena*	-	-	Y	Y	
Whistling Kite	*Haliastur sphenurus*	-	-	Y	Y	
White-bellied Cuckoo-shrike	*Coracina papuensis*	-	-	Y		
White-browed Babbler	*Pomatostomus superciliosus*	-	-	Y		
White-browed Scrubwren	*Sericornis frontalis*	-	-	Y		
White-browed Woodswallow	*Artamus superciliosus*	-	-	Y	Y	
White-eared Honeyeater	*Lichenostomus leucotis*	-	-	Y	Y	
White-faced Heron	*Egretta novaehollandiae*	-	-	Y	Y	
White-headed Pigeon	*Columba leucomela*	-	-			Y
White-naped Honeyeater	*Melithreptus lunatus*	-	-	Y	Y	
White-necked Heron	*Ardea pacifica*	-	-	Y	Y	
White-plumed Honeyeater	*Lichenostomus penicillatus*	-	-	Y	Y	
White-throated Gerygone	*Gerygone albogularis*	-	-	Y	Y	
White-throated Honeyeater	*Melithreptus albogularis*	-	-		Y	
White-throated Needletail	*Hirundapus caudacutus*	V, M	V	Y		
White-throated Treecreeper	*Cormobates leucophaea*	-	-	Y	Y	
White-winged Chough	*Corcorax melanorhamphos*	-	-	Y	Y	
White-winged Triller	*Lalage sueurii*	-	-	Y	Y	
Willie Wagtail	*Rhipidura leucophrys*	-	-	Y	Y	
Wonga Pigeon	*Leucosarcia picata*	-	-	Y		
Yellow Thornbill	*Acanthiza nana*	-	-	Y	Y	
Yellow-faced Honeyeater	*Lichenostomus chrysops*	-	-	Y	Y	
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	-	-	Y	Y	
Yellow-tailed Black-cockatoo	*Calyptorhynchus funereus*	-	-	Y	Y	
Yellow-tufted Honeyeater	*Lichenostomus melanops*	-	-	Y		

Notes: V = Vulnerable, M = Migratory

Appendix 2. BUS data - fixed-point counts

| BUS Point | M1 | | | | | | | | M2 | | | | | | | | M3 | | | | | | | | M4 | | | | | | | | M5 | | | | | | | | M6 | | | | | | | | M7 | | | | | | | | M8 | | | | | | | | M9 | | | | | | | | M10 | | | | | | | | R1 | | | | | | | | R2 | | | | | | | | |
|---|---|---

| BUS Point | M1 | | | | | | | | | | M2 | | | | | | | | | | M3 | | | | | | | | | | M4 | | | | | | | | | | M5 | | | | | | | | | | M6 | | | | | | | | | | M7 | | | | | | | | | | M8 | | | | | | | | | | M9 | | | | | | | | | | M10 | | | | | | | | | | R1 | | | | | | | | | | R2 | | | | | | | | | | |
|---|---|---

BUS Point	M1								M2								M3								M4								M5							
Replicate	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Flight Height Class	A	D	A	A	A	D	A	B	A	A	A	B	A	D	A	A	B	A	D	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Apostlebird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Australasian Darter	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australasian Figbird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Australasian Grebe	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australasian Pipit	-	-	1	1	-	-	-	-	-	-	1	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australian Hobby	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australian King-parrot	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australian Magpie	1	-	3	1	1	-	-	-	1	-	1	1	-	-	-	-	1	-	-	-	-	-	1	-	1	1	1	1	-	1	1	1	1	-	2	-	-	-	-	-
Australian Owlet-nightjar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australian Pelican	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australian Raven	-	-	-	-	-	3	-	-	-	1	-	-	4	-	2	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Australian White Ibis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australian Wood Duck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bar-shouldered Dove	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Black Kite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Black-chinned Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Black-faced Cuckoo-shrike	1	-	1	1	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Black-faced Woodswallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Black-fronted Dotterel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Black-shouldered Kite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Blue-faced Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-
Brown Falcon	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brown Goshawk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brown Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	2	-	-	1	-	-	2	2	2	3	1	3	1	3
Brown Quail	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Brown Thornbill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Brown Treecreeper	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brown-headed Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brush Cuckoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Buff-rumped Thornbill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	-	-	3	-	-	-	-	-	-	-	-	-	-
Channel-billed Cuckoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cicadabird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cockatiel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Collared Sparrowhawk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Common Bronzewing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Common Myna	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Crested Pigeon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diamond Dove	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dollarbird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Double-barred Finch	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dusky Moorhen	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dusky Woodswallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eastern Koel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eastern Rosella	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eastern x Pale-headed Rosella (hybrid)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eastern Yellow Robin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fairy Martin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fan-tailed Cuckoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Forest Kingfisher	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fuscous Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Galah	-	-	-	-	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Golden Whistler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Golden-headed Cisticola	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grey Butcherbird	-	-	1	-	1	-	-	-	-	1	-	2	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	1	-	-	-	-	-	-	-
Grey Fantail	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Grey Shrike-thrush	-	-	-	-	-	-	-	1	-	1	-	-	-	-	1	-	-	-	-	-	-	-	1	1	1	-	1	-	-	1	1	1	1	-	-	-	-	-	-	-
Grey Teal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grey-crowned Babbler	-	-	-	-	-	-	-	-	-	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ground Cuckoo-shrike	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hooded Robin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Horsfield's Bronze-cuckoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Horsfield's Bushlark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Inland Thornbill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Jacky Winter	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	1	-	-	-	-	-	-	-
Laughing Kookaburra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Leaden Flycatcher	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	1	2	-	2	-	-	-	-	-	-	-
Little Corella	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Little Eagle	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Little Friarbird	-	-	1	1	1	1	-	2	-	2	-	1	1	-	1	-	3	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Little Lorikeet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Little Pied Cormorant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magpie-lark	1	-	2	2	2	1	-	-	-	1	-	1	-	1	-	1	-	2	2	-	1	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Masked Lapwing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mistletoebird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Musk Lorikeet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nankeen Kestrel	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Noisy Friarbird	-	-	1	1	1	2	-	1	2	2	1	1	5	1	-	1	-	2	2	-	1	-	1	1	1	1	1	1	-	-	-	-	1	-	-	-	-	-	-	-
Noisy Miner	2	-	2	1	-	-	-	-	1	1	1	2	3	-	4	-	2	3	-	3	-	2	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Olive-backed Oriole	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Pacific Baza	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pacific Black Duck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Painted Button-quail	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pale-headed Rosella	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pallid Cuckoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Peaceful Dove	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Peregrine Falcon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pied Butcherbird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pied Currawong	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plum-headed Finch	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Purple-backed Fairy-wren	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rainbow Bee-eater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rainbow Lorikeet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Red Wattlebird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Red-browed Finch	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Red-rumped Parrot	-	-	-	-	-	-	-	-	-	-	2	-	-	-	1	1	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Red-winged Parrot	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Restless Flycatcher	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rufous Songlark	-	-	1	1	1	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rufous Whistler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sacred Kingfisher	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scaly-breasted Lorikeet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scarlet Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Shining Bronze-cuckoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silvereye	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Southern Whiteface	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spangled Drongo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Speckled Warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spiny-cheeked Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spotted Dove	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spotted Pardalote	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Square-tailed Kite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Squatter Pigeon (Southern)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Straw-necked Ibis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Striated Pardalote	1	-	-	-	1	1	-	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Striated Thornbill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Striped Honeyeater	-	-	1	1	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphur-crested Cockatoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Superb Fairy-wren	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tawny Frogmouth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Torresian Crow	-	-	1	-	-	-	-	-	-	2	2	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tree Martin	-	-	3	-	-	-	-	1	-	-	-	1	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Turquoise Parrot	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Varied Sittella	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wedge-tailed Eagle	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Weebill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Welcome Swallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Whistling Kite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-bellied Cuckoo-shrike	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-browed Babbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-browed Scrubwren	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-browed Woodswallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-eared Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-faced Heron	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-naped Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-necked Heron	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-plumed Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-throated Gerygone	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-throated Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-throated Needletail	-	-	-	-	-	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-throated Treecreeper	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-winged Chough	-	-	-	1	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-winged Triller	1	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Willie Wagtail	1	-	-	1	-	1	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wonga Pigeon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yellow Thornbill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yellow-faced Honeyeater	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yellow-rumped Thornbill	-	-	-	-	1	1	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yellow-tailed Black-cockatoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yellow-tufted Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	9	1	15	16	10	15	17	8	4	13	8	8	15	18	1	13	1	19	13	2	13	3	8	1	14	9	3	13	9	14	10	5	24	11	23	9	10	12	15	9

BUS Point	M6								M7								M8								M9								M10								R1								R2								
Replicate	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	TOTAL
Flight Height Class	A	B	A	A	D	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	A	A	A	A	A	A	A	A	A	B	A	A	A	A	A	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	
Apostlebird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Australasian Darter	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australasian Figbird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Australasian Grebe	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
Australasian Pipit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
Australian Hobby	-	-	-	-	-	-	-	-	-	-	-

2d - 2021 Late Wet Season

| BUS Point | M1 | | | | | | | | M2 | | | | | | | | M3 | | | | | | | | M4 | | | | | | | | M5 | | | | | | | | M6 | | | | | | | | M7 | | | | | | | | M8 | | | | | | | | M9 | | | | | | | | M10 | | | | | | | | R1 | | | | | | | | R2 | | | | | | | | |
|---|---|---

| BUS Point | M1 | | | | | | | | M2 | | | | | | | | M3 | | | | | | | | M4 | | | | | | | | M5 | | | | | | | | M6 | | | | | | | | M7 | | | | | | | | M8 | | | | | | | | M9 | | | | | | | | M10 | | | | | | | | R1 | | | | | | | | R2 | | | | | | | | TOTAL |
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BUS Point	M1								M2								M3								M4								M6							
Replicate	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Flight Height Class	A	B	A	B	A	B	A	C	A	A	B	C	A	B	A	C	A	A	A	B	A	A	A	B	A	A	A	A	A	A	A	B	A	A	A	A	A	A	A	A
Apostlebird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australasian Darter	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australasian Figbird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australasian Grebe	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australasian Pipit	1	1	2	1	1	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australian Hobby	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australian King-parrot	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australian Magpie	-	1	-	-	-	1	1	-	-	1	1	-	2	-	-	-	-	1	2	2	-	-	-	-	-	-	-	1	-	1	-	-	-	1	-	1	-	1	1	1
Australian Owlet-nightjar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australian Pelican	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australian Raven	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	2	-	-	-	-	-	-	-	-	-	-	2
Australian White Ibis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australian Wood Duck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bar-shouldered Dove	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Black Kite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Black-chinned Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Black-faced Cuckoo-shrike	-	1	1	-	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Black-faced Woodswallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Black-fronted Dotterel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Black-shouldered Kite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Blue-faced Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-
Brown Falcon	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brown Goshawk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brown Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brown Quail	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brown Thornbill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brown Treecreeper	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brown-headed Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brush Cuckoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Buff-rumped Thornbill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	3	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Channel-billed Cuckoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cicadabird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cockatiel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Collared Sparrowhawk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Common Bronzewing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Common Myna	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Crested Pigeon	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diamond Dove	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dollarbird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Double-barred Finch	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-	-	-	-	-
Dusky Moorhen	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dusky Woodswallow	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eastern Koel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eastern Rosella	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eastern x Pale-headed Rosella (hybrid)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eastern Yellow Robin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fairy Martin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fan-tailed Cuckoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Forest Kingfisher	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fuscous Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Galah	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Golden Whistler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Golden-headed Cisticola	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grey Butcherbird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grey Fantail	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grey Shrike-thrush	-	-	1	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grey Teal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grey-crowned Babbler	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ground Cuckoo-shrike	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hooded Robin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Horsfield's Bronze-cuckoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Horsfield's Bushlark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Inland Thornbill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Jacky Winter	1	-	1	-	-	1	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Laughing Kookaburra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Leaden Flycatcher	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Little Corella	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Little Eagle	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Little Friarbird	1	-	-	-	-	-	1	2	-	1	-	1	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Little Lorikeet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Little Pied Cormorant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magpie-lark	3	2	2	1	1	2	1	1	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Masked Lapwing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Mistletoebird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Musk Lorikeet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nankeen Kestrel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Noisy Friarbird	-	1	1	-	1	-	2	1	-	1	-	2	1	-	1	1	-	-	1	1	-	1	-	-	1	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Noisy Miner	1	1	2	1	1	-	2	5	1	-	1	1	1	1	1	2	-	1	-	1	1	1	1	2	1	1	1	1	2	3	1	2	1	1	1	3	4	1	1	1
Olive-backed Oriole	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pacific Baza	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pacific Black Duck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Painted Button-quail	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pale-headed Rosella	-	-	-	-	-	1	-	-	-	-	-	2	-	-	2	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pallid Cuckoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Peaceful Dove	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Peregrine Falcon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pied Butcherbird	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pied Currawong	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	2	1	1	1	2	1	2	1	-	-	-	-	-	-	-	-
Plum-headed Finch	4	-	-	-	-	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Purple-backed Fairy-wren	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rainbow Bee-eater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rainbow Lorikeet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Red Wattlebird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Red-browed Finch	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Red-rumped Parrot	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Red-winged Parrot	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Restless Flycatcher	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rufous Songlark	1	3	1	2	2	2	1	1	-	1	1	-	2	1	-	2	2	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rufous Whistler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sacred Kingfisher	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scaly-breasted Lorikeet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scarlet Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Shining Bronze-cuckoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silvereye	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Southern Whiteface	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spangled Drongo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Speckled Warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spiny-cheeked Honeyeater	-	-	1	-	-	1	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spotted Dove	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spotted Pardalote	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Square-tailed Kite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Squatter Pigeon (Southern)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Straw-necked Ibis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Striated Pardalote	2	1	1	-	1	2	1	2	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Striated Thornbill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Striped Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphur-crested Cockatoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Superb Fairy-wren	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tawny Frogmouth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Torresian Crow	-	-	1	-	3	-	-	-	-	-	1	-	1	2	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-
Tree Martin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Turquoise Parrot	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Varied Sittella	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wedge-tailed Eagle	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Weebill	-	-	-	-	-	1	1	-	-	1	-	1	1	-	1	1	1	1	1	1	1	1	2	2	1	-	2	1	1	2	2	2	1	1	3	1	1	1	1	1
Welcome Swallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Whistling Kite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-bellied Cuckoo-shrike	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-browed Babbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-browed Scrubwren	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-browed Woodswallow	3	-	3	2	2	2	2	2	-	1	-	7	1	4	2	1	-	-	4	3	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-eared Honeyeater	2	-	-	1	1	-	1	1	-	-	1	-	1	1	1	-	1	1	1	1	-	1	-	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
White-faced Heron	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-naped Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-necked Heron	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-plumed Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-throated Gerygone	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-throated Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-throated Needletail	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-throated Treecreeper	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-winged Chough	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-winged Triller	-	1	1	2	2	2	1	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Willie Wagtail	-	1	1	-	2	1	1	1	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wonga Pigeon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yellow Thornbill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yellow-faced Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yellow-rumped Thornbill	2	5	-	-	2	1	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yellow-tailed Black-cockatoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yellow-tufted Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	29	3	21	1	19	2	10	2	21	2	2	80	20	2	17	1	11	8	8	1	18	4	13	2	1	9	13	13	4	15	3	9	9	11	4	13	10	17	5	11

BUS Point	M7								M8								M9								M10								R1								R2								
Replicate	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	TOTAL
Flight Height Class	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	C	A	A	A	C	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	
Apostlebird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australasian Darter	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australasian Figbird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australasian Grebe	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	9	-	1	-	12
Australasian Pipit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
Australian Hobby	-	-	-	-	-	-	-	-	-	-	-	-	-	-

BUS Point	M1								M2								M3								M4								M5							
Replicate	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Flight Height Class	A	A	A	A	A	A	B	A	A	A	B	A	A	A	B	A	A	A	C	A	A	A	B	A	B	A	B	A	A	B	A	B	A	A	C	A	A	B	A	B
Apostlebird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australasian Darter	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australasian Figbird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australasian Grebe	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australasian Pipit	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australian Hobby	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australian King-parrot	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australian Magpie	2	1	1	-	1	-	1	-	2	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	2	1	-	1	-	1	1	1	1	-	1	-
Australian Owlet-nightjar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australian Pelican	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australian Raven	1	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australian White Ibis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australian Wood Duck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bar-shouldered Dove	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Black Kite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Black-chinned Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Black-faced Cuckoo-shrike	-	1	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	2	-	-	2	1	-
Black-faced Woodswallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Black-fronted Dotterel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Black-shouldered Kite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Blue-faced Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	-
Brown Falcon	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brown Goshawk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brown Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	1	-	1	1	1	1	-	1	-	-
Brown Quail	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brown Thornbill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brown Treecreeper	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brown-headed Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brush Cuckoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Buff-rumped Thornbill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	1	-	-	1	-	2	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-
Channel-billed Cuckoo	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cicadabird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cockatiel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Collared Sparrowhawk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Common Bronzewing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Common Myna	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Crested Pigeon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-
Diamond Dove	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dollarbird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Double-barred Finch	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dusky Moorhen	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dusky Woodswallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eastern Koel	1	-	-	-	-	-	-	-	1	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eastern Rosella	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eastern x Pale-headed Rosella (hybrid)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eastern Yellow Robin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fairy Martin	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fan-tailed Cuckoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Forest Kingfisher	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fuscous Honeyeater	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	1	1	1	1
Galah	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Golden Whistler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Golden-headed Cisticola	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grey Butcherbird	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	1	2	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	1	-	-	-	1	-
Grey Fantail	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Grey Shrike-thrush	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grey Teal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grey-crowned Babbler	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ground Cuckoo-shrike	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hooded Robin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Horsfield's Bronze-cuckoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Horsfield's Bushlark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Inland Thornbill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Jacky Winter	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Laughing Kookaburra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Leaden Flycatcher	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Little Corella	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Little Eagle	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Little Friarbird	1	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Little Lorikeet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Little Pied Cormorant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magpie-lark	3	1	-	1	-	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Masked Lapwing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mistletoebird	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Musk Lorikeet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nankeen Kestrel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Noisy Friarbird	3	-	-	-	-	-	-	-	2	-	-	-	2	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Noisy Miner	4	2	3	2	-	2	-	-	1	3	4	-	2	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Olive-backed Oriole	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pacific Baza	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pacific Black Duck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Painted Button-quail	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pale-headed Rosella	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pallid Cuckoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Peaceful Dove	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Peregrine Falcon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pied Butcherbird	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pied Currawong	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plum-headed Finch	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Purple-backed Fairy-wren	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rainbow Bee-eater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rainbow Lorikeet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Red Wattlebird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Red-browed Finch	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Red-rumped Parrot	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Red-winged Parrot	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Restless Flycatcher	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rufous Songlark	2	2	1	1	2	1	-	1	2	2	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	1	1	-	1
Rufous Whistler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	1	1	2	1
Sacred Kingfisher	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scaly-breasted Lorikeet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scarlet Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Shining Bronze-cuckoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silvereye	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Southern Whiteface	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spangled Drongo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Speckled Warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spiny-cheeked Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spotted Dove	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spotted Pardalote	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Square-tailed Kite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Squatter Pigeon (Southern)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Straw-necked Ibis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Striated Pardalote	1	2	2	1	1	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	1	-	1	1	2	1	1	1	1
Striated Thornbill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Striped Honeyeater	-	1	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-
Sulphur-crested Cockatoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Superb Fairy-wren	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tawny Frogmouth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Torresian Crow	6	2	-	-	1	-	-	1	-	2	3	-	5	3	1	2	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tree Martin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Turquoise Parrot	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Varied Sittella	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wedge-tailed Eagle	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Weebill	-	-	1	-	-	-	-	-	2	-	-	1	1	1	1	-	1	-	2	2	-	-	1	-	2	-	-	1	1	-	1	2	-	1	2	1	1	1	1	-	1
Welcome Swallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Whistling Kite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-bellied Cuckoo-shrike	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-browed Babbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-browed Scrubwren	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-browed Woodswallow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-eared Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-faced Heron	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-naped Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-necked Heron	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-plumed Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-throated Gerygone	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-throated Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-throated Needletail	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-throated Treecreeper	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-winged Chough	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-winged Triller	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Willie Wagtail	1	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wonga Pigeon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yellow Thornbill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yellow-faced Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	1	-	2	1	2	-	1	-	1	1	-	1	2	-	2	2	-	3	-	1	2	1
Yellow-rumped Thornbill	1	-	2	-	-	2	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	1	-	-	1
Yellow-tailed Black-cockatoo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yellow-tufted Honeyeater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	30	14	13	7	6	8	4	4	5	13	12	3	8	15	7	2	2	3	10	9	5	2	9	7	7	1	6	1	8	8	13	12	15	1	1	11	11	2	9	2

BUS Point	M6								M7								M8								M9								M10								R1								R2								TOTAL
Replicate	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	
Flight Height Class	A	A	B	A	B	A	A	B	A	B	A	A	A	A	A	B	A	B	A	B	A	B	A	B	A	A	B	A	B	A	A	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	
Apostlebird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australasian Darter	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australasian Figbird	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Australasian Grebe	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	1	-	5	-	1	-	12
Australasian Pipit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

| BUS Point | M1 | | | | | | | | M2 | | | | | | | | M3 | | | | | | | | M4 | | | | | | | | M5 | | | | | | | | M6 | | | | | | | | M7 | | | | | | | | M8 | | | | | | | | M9 | | | | | | | | M10 | | | | | | | | R1 | | | | | | | | R2 | | | | | | | | |
|---|---|---

Appendix 3: MacIntyre Wind Farm White-throated Needletail Collision Risk Model

MacIntyre Wind Farm White-throated Needletail Collision Risk Model

Ver. 1.9

Submitted to Naure Advisory

symbolix

making your data work harder

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Author: Dr Julia Ryeland

Approved for release: Elizabeth Stark 2024-07-02

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Contents

1 Executive summary **1**
1.1 Summary of results . . . 2

2 Methodology **3**
2.1 Collision risk model overview . . . 3
2.2 Activity rate . . . 3
2.3 Distance corrections . . . 4
2.4 Accounting for clustering . . . 4
2.5 Spatial flight density . . . 5
2.6 Probability of collision given turbine interaction . . . 5

3 Dataset summary **7**
3.1 Survey summary . . . 7
3.2 Observation summary . . . 9

4 Distance detection models **9**
4.1 Corrected flight activity rates . . . 10

5 Annual collision rates **11**

References **13**

List of Tables

1 WTNT inputs for the NA-BAND model. . . . 6
2 Turbine inputs for the NA-BAND model (provided by Nature Advisory). . . . 6
3 Summary of survey effort. . . . 7
4 Summary of flights observered for White-throated Needletail included in analysis. 9
5 Expected annual number of collisions by avoidance rate. . . . 11

List of Figures

1 Survey (purple) and turbine (black) locations. . . . 8
2 Empirical (grey bars) and fitted (black line) observed-distance distributions for WTNT . . . 10
3 Plausible range of collisions for the White-throated Needletail at a 95% avoidance rate . . . 12

1 Executive summary

This document summarises the activity rate and collision risk forecasts for the White-throated Needletail (*Hirundapus caudacutus*; WTNT) at the proposed MacIntyre Wind Farm site, Queensland.

Nature Advisory collected flight data from September 2020 to February 2022 across 10 sites. Observations of WTNT were recorded during these surveys, including location, distance from the observer, flight height (starting, minimum and maximum) and flock size. Each surveys was 15 minutes in length, with 48 surveys were undertaken at each of 10 sites.

We report here an overview of the data used for analysis and an assessment of flight activity and collision risk with wind turbines at the proposed site. This analysis aims to provide quantitative data that can be considered as a part of an ecological risk analysis.

This includes:

- A summary of the survey effort and observations of WTNT across the site (Section 3.2).
- A flight activity rate (distance corrected) in flights per hectare per hour (Section 4). To distance correct the observation data, we use distance corrections models (Buckland et al. 2008) to obtain an overall estimate of flight density, accounting for the declining detectability with increasing distance from the observer (Section 2.3). This measure does not take into account spatial variation in activity, but provides a measure of average activity over the whole study area.
- An annual collision rate based on the flight activity rate, turbine parameters and bird parameters.

These analysis require the following assumptions to be met:

1. Surveys are conducted across seasons to ensure:

- A random sample of possible activity rates is captured (i.e. surveys do not predominately target times when the species is most active), and;
- When seasonal patterns in activity are present, the surveys capture all seasons.

2. Sites are randomly situated across the site, to sample the site variability in activity (i.e. they are not placed predominately where the species is most active).

1.1 Summary of results

A total of 120 survey hours were completed over 57 days of observations to capture WTNT activity across the proposed site. This captured the following.

- A total of 209 WTNT flights in 20 flocks.
- Flock sizes ranging from 1 to 51 birds.
- A maximum observation distance at first observeration of 300 meters.
- An effective detection radius of 210.3 metres[1].
- A distance-corrected activity rate of 0.13 flights per hectare per hour [0.05 to 0.32 95% confidence interval].
- An expected annual collision rate for WTNT of 54.28 or 135.71, at 98% and 95% avoidance rate, respectively[2].

[1]The effective detection radius is the radius of a circle, such that if 100% of flights were observed within this circle, then the expected number of flights detected is the same as for the actual survey (which has decaying detectability with distance).

[2]The avoidance rate is the probability that the individual will fly around the turbine infrastructure through alterations in flight path through the subject site or to fly through the risk zone of the turbine (i.e. the envelope of the tower and blade sweep) and avoid the turbine infrastructure.

2 Methodology

2.1 Collision risk model overview

Collision risk modelling (CRM) requires a step-wise risk model (Reason 1997), where the total risk is the probabilistic combination of the risk of each step in the process. The process can be summarised by the equation:

$$N_{\text{collision}} = F \times P(I|F) \times P(C|I) \times (1 - \text{AR})$$

where:

- $N_{\text{collision}}$ is the estimated number of flights ending in collision
- F is the estimated activity rate of flights in the region (flights / area / time)
- $P(I|F)$ is the probability of a flight interacting with a turbine or power line (given a flight in the region)
- $P(C|I)$ is the probability of collision, given an interaction occurs
- AR is the avoidance rate

The probability of collision given interaction (the final dot point above) is generated using the exact model published by Band Madders and Whitfield (2007), and Band (2012).

The probability of interaction component in Band Madders and Whitfield (2007) and Band (2012) (the third dot point above) includes an unreasonable assumption that every flight interacts with every turbine. The Nature-Advisory Band model (NA-BAND) uses spatial statistics to estimate the probability of interaction for each turbine, removing the reliance on the Band Madders and Whitfield (2007) and Band (2012) assumption. This use of Band (2012) with spatial input parameters has been peer reviewed in Australia as part of the approvals process for sites such as Dundonnell and Golden Plains Wind Farms.

2.2 Activity rate

The ability of an observer to sight and record flights is influenced by multiple factors including the object's size, colouring, volume, and weather conditions on the day. We also assume that an observer's ability to detect an object will decrease the further the object is from the observer.

Simply taking the number of objects observed and dividing it by the time spent surveying gives a naive "encounter rate", which is flights on the site per unit time. However, this doesn't account for unsurveyed area and the relationship between distance and detectability. Naive encounter rate is thus poor estimate of true flight activity.

Instead, distance corrections can be applied to the encounter rate to correctly scale it to an activity rate. The key concept of this is the "detection function", which provides a model describing the probability of detecting an object (flight) given that is a certain distance from the observer (Buckland et al. 2008). We calculated an activity rate for the White-throated Needletail

(*Hirundapus caudacutus*; WTNT) across the site.

2.3 Distance corrections

To correct for imperfect visibility as distance from the field observer increases, we apply distance correction (Buckland et al. 2008) methods to convert the raw encounter rate into an estimate of total flights per square km per year.

From the distance models, we obtain the effective detection radius (EDR), which provides a measure of the detectability in the study area. Larger EDRs suggest that detection is good at large distances, and the encounter rate requires a smaller correction for undetected flights.

Detection efficiency decreases as the distance between the observer and bird increases. Buckland et al. (2008) provides a method to estimate an "effective detection area" (EDA), which is a circular area with radius = EDR. The EDA is obtained by integrating the detection efficiency function. It represents a theoretical observed area with an expected number of flights observed within (based on the survey data) in which flights are observed with 100% probability. In essence, if in a survey, n flights were observed in t time, then the flight rate within that survey could be calculated as to be $\frac{n}{t \cdot \text{EDA}}$ flights per unit time per unit area.

It should be noted that although distance correction can be applied to smaller sample sizes, at least 50-70 positive observations of the target species is recommended by Buckland et al. (2008) for a robust detection function. Fewer observations may result in a larger EDR and an overestimation of activity.

We modelled the detection function using both a half-normal and hazard-rate distribution. Models were run with and without desktop truncation, which can improve the fit of the detection function as it is not forced to fit the long tail rather than the main body of the distribution (Buckland et al. 2008, pg. 151). There was evidence of the distance measurements being binned/rounded. As such, we included models with cut points for comparison. Models were compared and selected using the Akaike Information Criterion (AIC) (Burnham and Anderson 2002) and visual inspection.

To obtain a measure of uncertainty on the activity rate, we use the bootstrap (Buckland et al. 2008). The bootstrap is a stochastic technique involving resampling of the dataset in order to obtain "replicate" sets. The variation in replicate sets can be used to estimate the population variance.

2.4 Accounting for clustering

During the field surveys, birds were recorded in flocks, with the number of birds in a flock in a given observation recorded. Following Buckland et al. (2008), the detection function is produced from the number of observations (irrespective of flock size), but we account for flock size in our activity rate calculation.

2.5 Spatial flight density

Analysing spatial flight utilisation requires 1) relatively even observer visibility of the whole study area and 2) geolocated flight path data for each flight observed. Where flight path data are not available, survey locations must provide sufficient visibility across the study area to ensure the activity at the survey location is reflective of the surrounding area. We have no available flight path data from this site, and the effective detection radius from sites is small, with no clear spatial patterns in the number of birds observed at each site. We therefore must assume a flat utilisation pattern across the site.

2.6 Probability of collision given turbine interaction

Turbine collision risk was estimated using an avian collision risk model, based directly on Band Madders and Whitfield (2007) and Band (2012). The NA-BAND application updates the model to accept spatial data inputs where available. This modification extends Band (2012) to more correctly calculate the probably that a flight will interact with a turbine (if a flight occurs onsite) for general sites. The probability of collision after interaction is a geometric calculation using Band (2012). The NA-BAND model has previously been applied to assess collision risk for Moorabool Wind Farm, Dundonnell Wind Farm, and Golden Plains Wind Farm (Victoria).

There are a number of important assumptions of these models that must be met to ensure reliability of the model results. Firstly, the model assumes that the surveys are conducted at times throughout the year and locations across the site that are representative of the site as whole. For example, if the species activity rates substantially varies across the year (e.g. due to breeding or migratory behaviours), then the surveys must capture this variability and on average, represent of the species yearly utilisation of the site. Similarly, if there is spatial variability in species utilisation, the survey sites must capture the site average utilisation. This means that if utilisation is much higher in one region of the site, survey sites are not clustered in this region, but are evenly spread across areas of high to low utilisation.

Another important note is that the NA-BAND model has no assumption about the upper limit of the number of birds present in the area and available to collide with a given turbine. The model estimates the number of flights that are at risk of collision under the assumption that any individual bird is immediately replaced. This estimate of flight collisions is may be higher than the number of individuals present in the area at risk of collision.

2.6.1 CRM inputs

Additionally to an activity rate, the NA-BAND model requires a number of bird-related and turbine-related inputs, which are summarised in Tables 1 and 2 respectively. Species parameters were provided by NA based on published literature.

The activity rate is calculated as **flights / year / km^2**. However, WTNT are not active on site for the entirety of the year (being migratory) and therefore are unavailable to be struck during

the inactive periods. We therefore adjust for the proportion of the day and of the year in which the species is active on site. WTNT arrive in northern Australia from September, migrating southward to arrive in NSW from October (Higgins 2001). They will then leave Australia from February, with most leaving from mid-March to April (Higgins 2001). Although all individuals will not be present near the study area for the entirety of the October to April period, we used this as a conservative estimate when calculating the proportion of year on site.

Table 1: WTNT inputs for the NA-BAND model.

Parameter	Value
Bird length (m)	0.20
Bird wingspan (m)	0.49
Flight speed (m/s)	24.00
Percentage of year on site	0.58
Percentage of daytime active	100.00
Percentage of night time active	25.00

Table 2: Turbine inputs for the NA-BAND model (provided by Nature Advisory).

Parameter	Value
Rotor diameter (m)	163
Hub Height (m)	148
Rotation speed (rpm)	6
Maximum chord (m)	4.15
Pitch (degrees)	5
Model	N163-5700_IECS_R4
Proposed number of turbines*	162

Note:
Based on '20033_Turbine Layer.shp'

3 Dataset summary

Survey and observation data were provided to us from Nature Advisory.

3.1 Survey summary

- 480 surveys were performed between 2020-09-22 and 2022-02-06, across 6 seasons.
- Observations were made at 10 sites
- Each site received an equal number of survey hours (12 hours), totalling 120 hours or 20 hours per season.

The location of the 10 sites are show in Figure 1.

Ideally, CRM data collection surveys would have equal survey effort across the entire period a species is expected to be onsite. Our goal is to estimate the expected rate of flights on the site when the species is present which requires the surveys be representative of the site's spatial extent and the time period. This is particularly important when a species' activity varies throughout the survey period. In analysing this data we have assumed each survey period represents a random sample of activity.

The survey effort is summarised in Table 3.

Table 3: Summary of survey effort.

Year	Season	Start date	End date	Number of surveys	Total survey hours
2020	Late Dry	2020-09-22	2020-10-01	80	20
2020	Mid Wet	2020-12-03	2020-12-14	80	20
2021	Late Wet	2021-02-01	2021-02-12	80	20
2021	Late Dry	2021-09-21	2021-10-02	80	20
2021	Mid Wet	2021-12-14	2021-12-20	80	20
2022	Late Wet	2022-02-01	2022-02-06	80	20

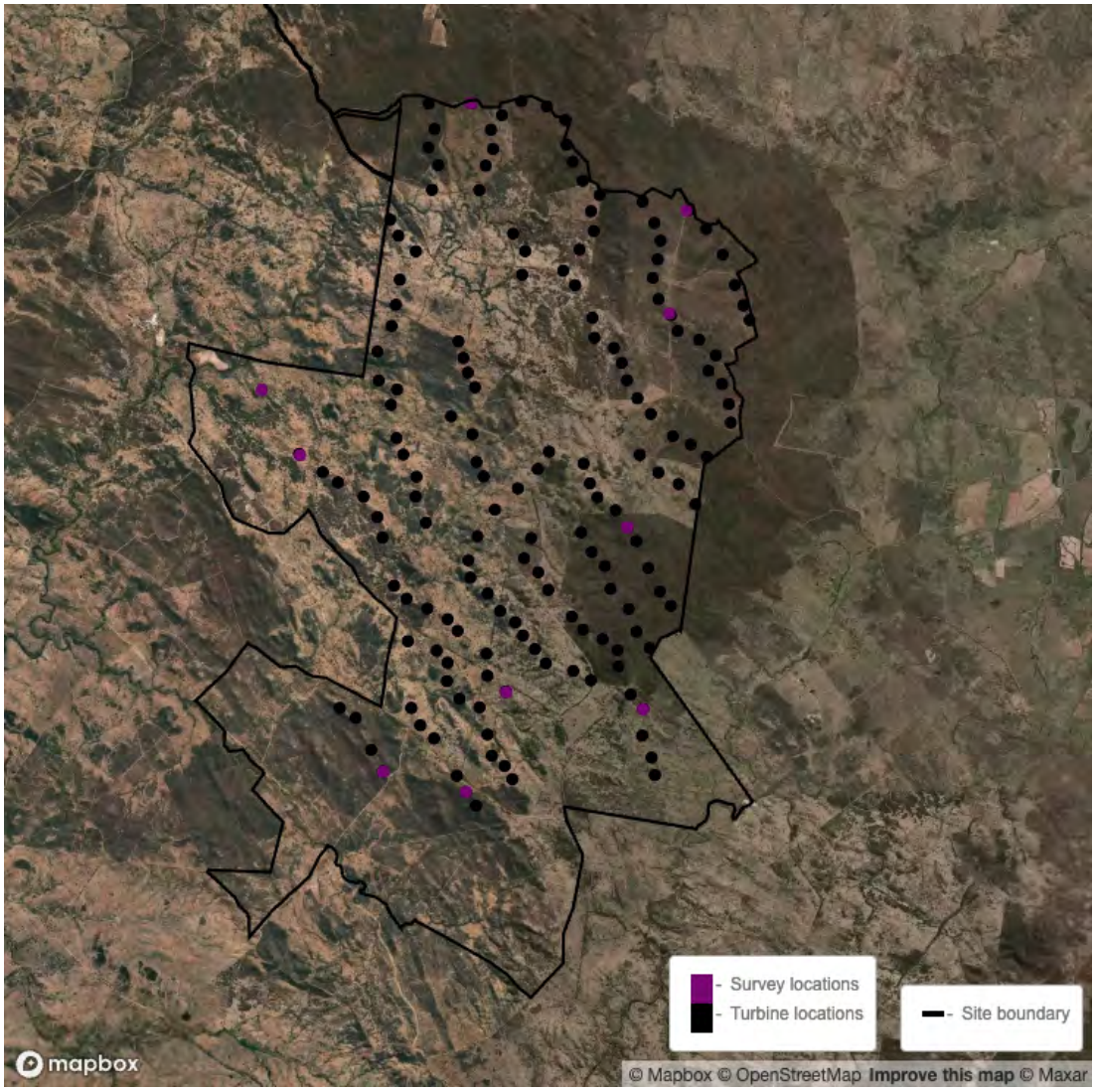

Figure 1: Survey (purple) and turbine (black) locations.

3.2 Observation summary

Analysis was based off:

- 20 observations of WTNT flocks, with a total of 209 flights sighted.
- Observations at heights of between 10 and 350 metres above ground and between 20 and 300 metres from the observer.
- All observations were recorded with height above ground and distance from the observer recorded, and therefore could be used for calculations of activity rates.

The WTNT observations are summarised in Table 4.

Table 4: Summary of flights observered for White-throated Needletail included in analysis.

Year	Season	Number of observations	Number of individuals	Average flock size	Encounter rate
2020	Late Dry	0	0	NA	0.0
2020	Mid Wet	4	19	4.8	0.9
2021	Late Wet	4	26	6.5	1.3
2021	Late Dry	0	0	NA	0.0
2021	Mid Wet	4	47	11.8	2.4
2022	Late Wet	8	117	14.6	5.8

4 Distance detection models

All observations contained a distance estimate and could be used in the model. This distribution of distances recorded is displayed in Figure 2. Based on visual analysis of model fit along with the AIC scores, we decided to neither truncate nor include cutpoints in the model. The half-normal model without truncation or cutpoints was the most appropriate model. Figure 2 plots the fitted models (curve) against the empirical distances (histogram).

The effective detection radius (EDR) provides a measure of detectability and is used to distance correct the raw activity rate. Here, the EDR was found to be 210.3 meters.

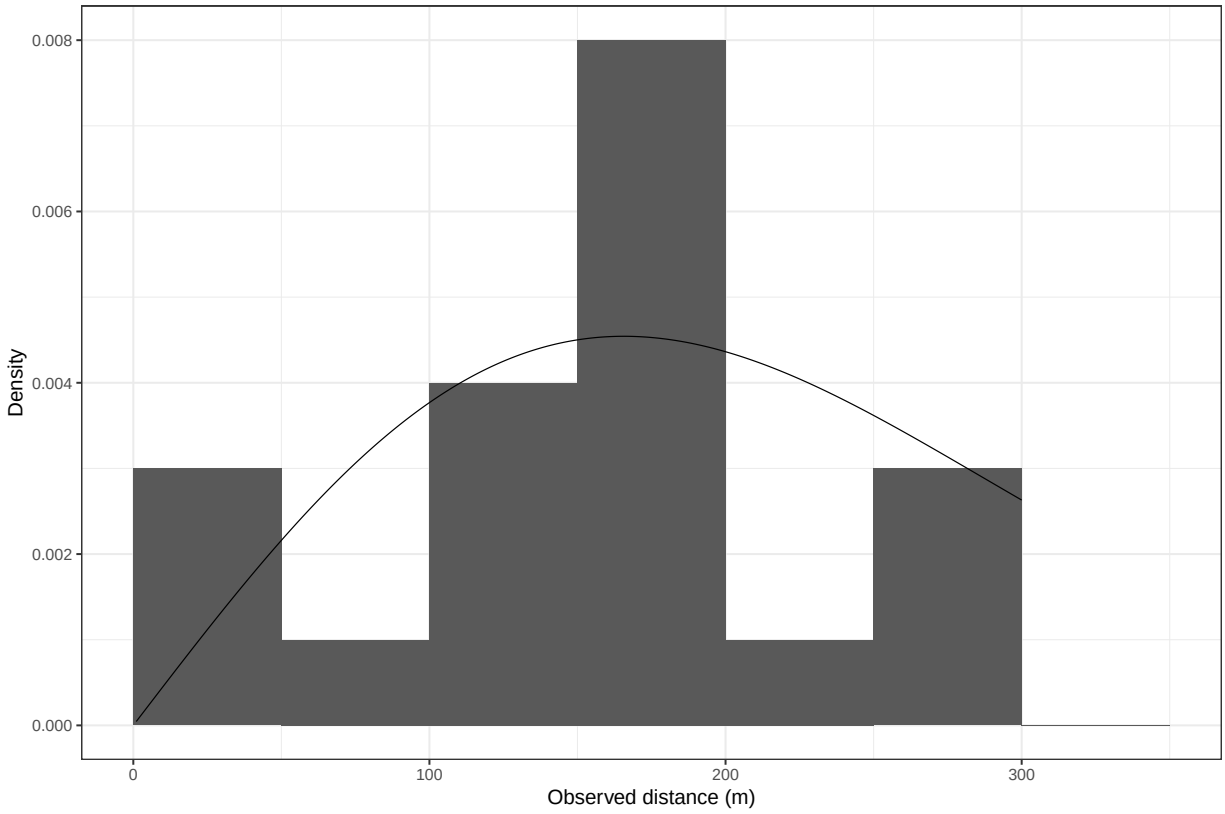

Figure 2: Empirical (grey bars) and fitted (black line) observed-distance distributions for WTNT

4.1 Corrected flight activity rates

Combining the observed activity rates and the distance modelling, we obtain the final estimate of distance-corrected activity rates.

The distance-corrected activity rate was 0.13 [0.05, 0.32 95% confidence interval] flights per hectare per hour.

5 Annual collision rates

To obtain the F term in the equation in Section 2.1 (that is, the estimated activity rate of flights in the region), we take the activity rate and expand it to flights over a year. We then account for the proportion of time the bird is on-site during the year, the proportion of time that the bird is active, and the proportion of flights at rotor swept height to obtain $P(I|F)$. The probability of collision $P(C|I)$ is obtained from the bird and turbine parameters and multiplied by the avoidance rate.

As an exact avoidance rate has not been published for WTNT, we use the generalised avoidance rate of 95% recommended in Cook et al. (2012), which is considered suitable in the absence of species-specific data.

With a modelled avoidance rate of 95%, a total (across the wind farm) of 135.7 collisions per annum are predicted. This equates to an estimated 0.84 collisions per year at each turbine

For completeness, we also modelled 98% avoidance, with results presented in Table 5.

Table 5: Expected annual number of collisions by avoidance rate.

Avoidance rate	Number of collisions	Number of collisions per turbine
0.95	135.71	0.84
0.98	54.28	0.34

The plausible range of cumulative collisions (over a 30 year period) are shown in Figure 3 (assuming 95% avoidance). These cumulative collisions are based on a Poisson distribution, which assumes collisions of individuals are independent of the time since the last event. The Poisson distribution is suitable for most collision risk estimates. This is because there's no evidence of the distribution of collisions for flocking species (for which collisions may not be independent) differing from other species. However, regardless of how the individual collisions manifest from the mean rate (i.e. what the particular distribution is), the mean collision rate is still correct.

Figure 3: Plausible range of collisions for the White-throated Needletail at a 95% avoidance rate

NOTE: This plot is in thousands, represented by the 'K':

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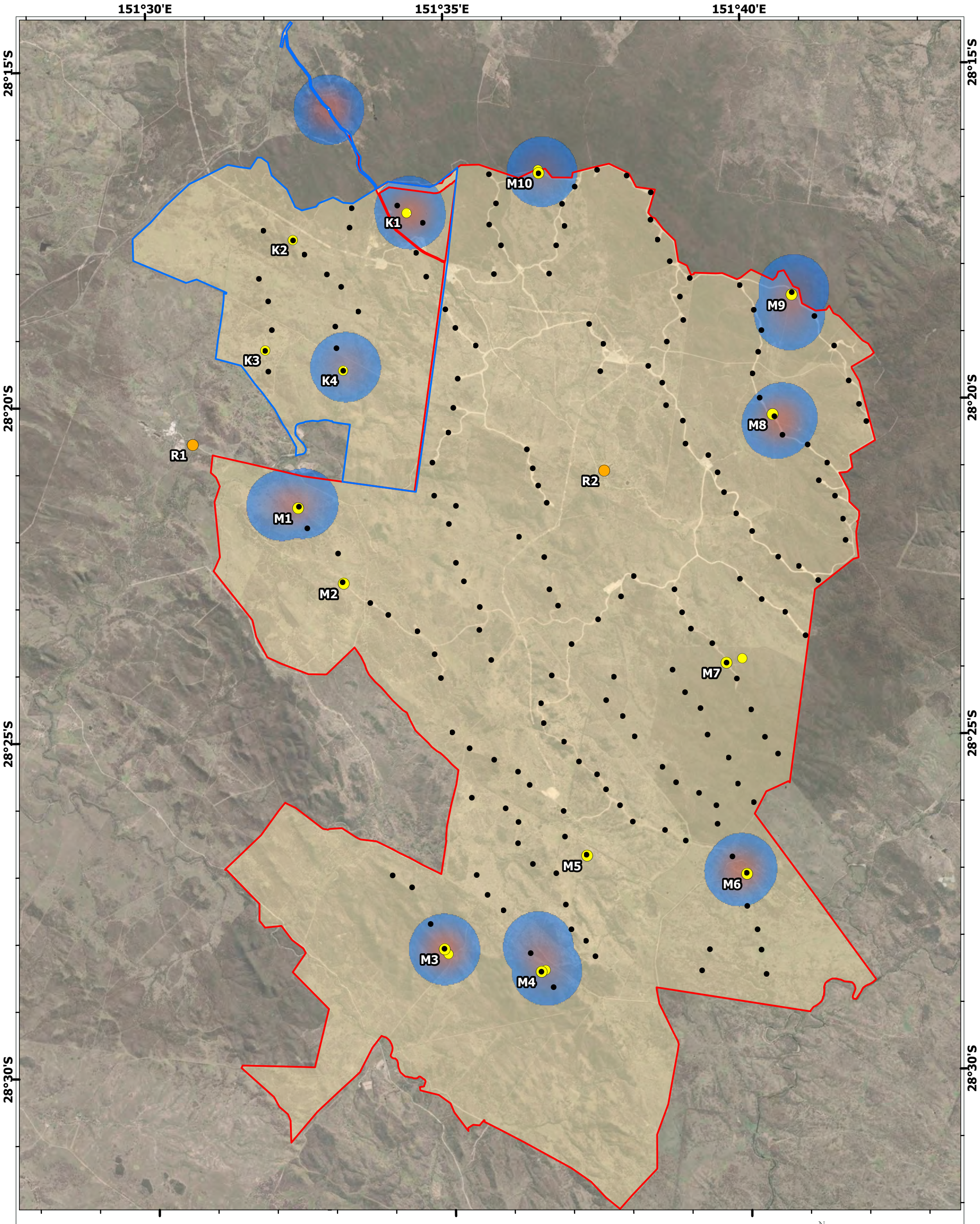
Appendix 4: White-throated Needletail habitat and records within MacIntyre WF



Appendix 4: White-throated Needletail habitat and records

Project: MacIntyre Wind Farm **Client**: ACCIONA Energy Australia Global Pty Ltd **Date**: 13/06/2024

- Study Area (MacIntyre)
- Study Area (Karara)
- Proposed Turbine (19/03/2021)

BUS

- Impact
- Reference

Threatened Species

White-throated Needletail records (heat mapping)

- Sparse
- Dense

Potential habitat for White-throated Needletail

N

Metres 0 2,000

Spatial Reference
Name: GDA 1994 MGA Zone 56
PCS: GDA 1994 MGA Zone 56

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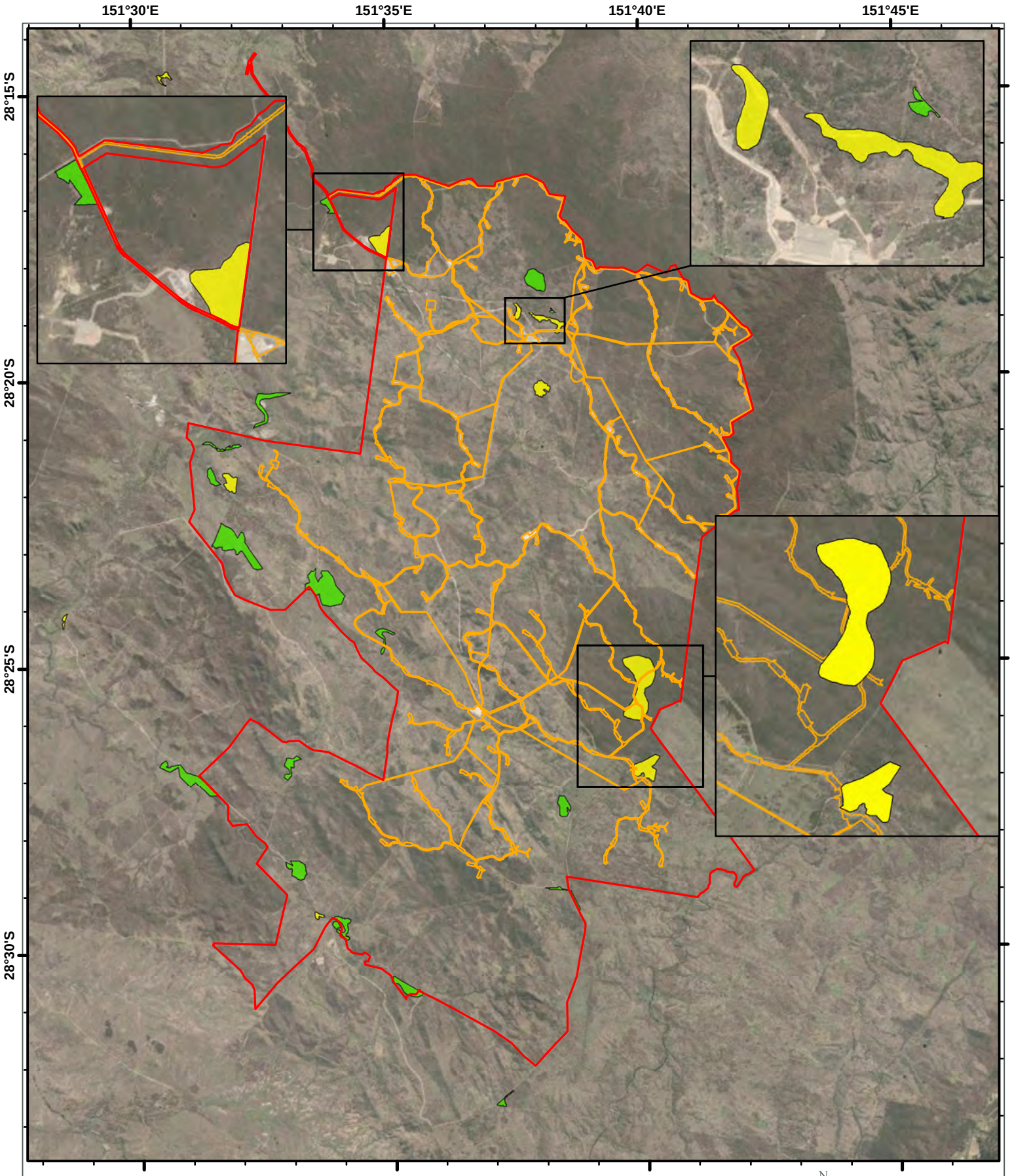
Appendix 5: Regent Honeyeater habitat within MacIntyre WF



Appendix 5: Regent Honeyeater Habitat

Project: Karara Wind Farm Client: ACCIONA Energy Australia Global Pty Ltd Date: 13/06/2024

- Study Area
- Development Footprint

Regent Honeyeater Habitat

- High Quality
- Potential

N

Metres 0 2,400

Coordinate System: GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994

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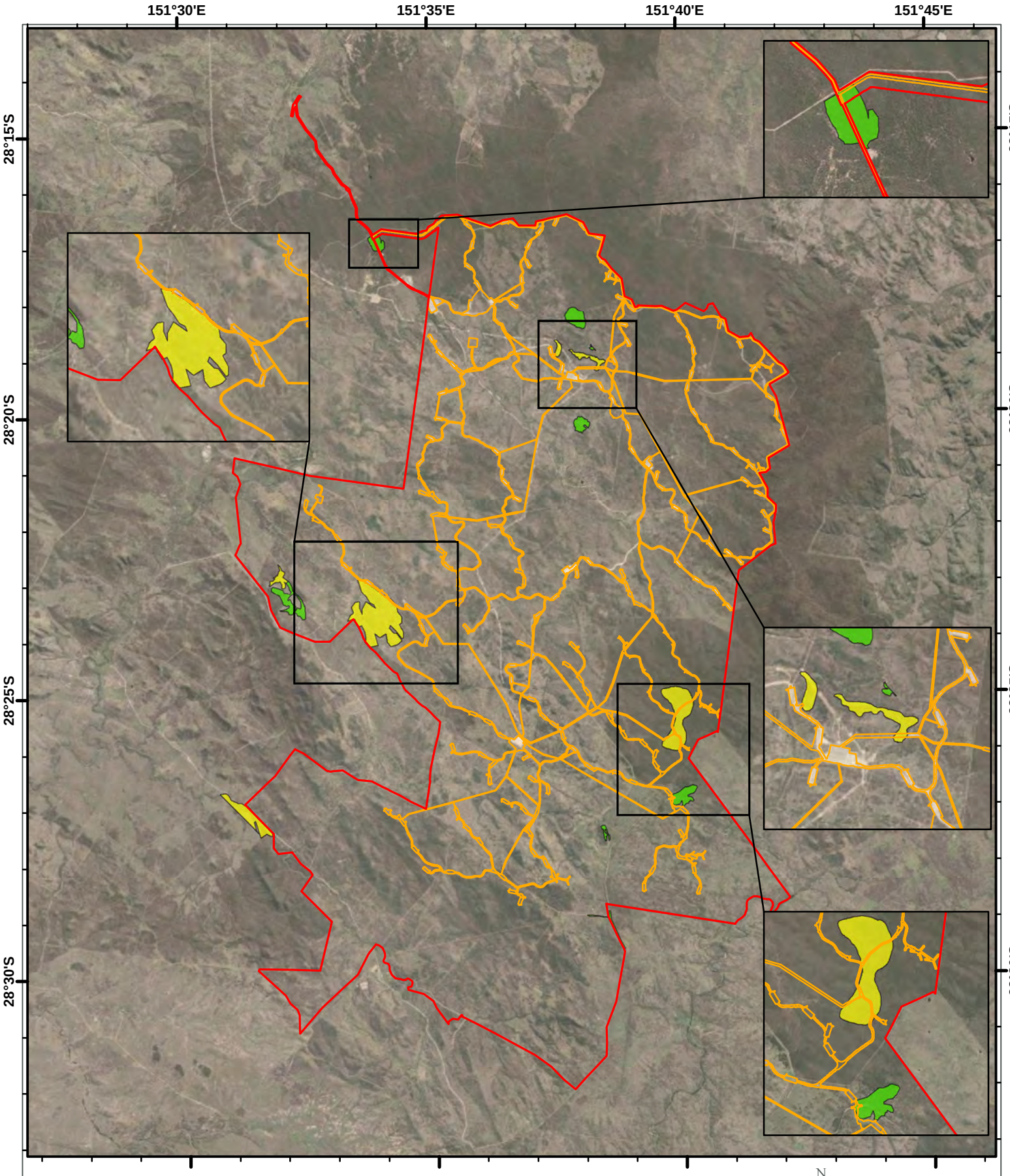
Appendix 6: Swift Parrot habitat within MacIntyre WF



Appendix 6: Swift Parrot Habitat

Project: MacIntyre Wind Farm Client: ACCIONA Energy Oceania Pty Ltd Date: 13/06/2024

- Study Area
- Development Footprint

Swift Parrot Habitat

- High Quality
- Potential

N

Metres 0 3,000

Coordinate System: GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994

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Appendix 7: Monitoring Data Sheet

MacIntyre Wind Farm

Observer:

Observation No.	Species	Date	Start time	Finish time	No. of birds	Age	Flight height (m)	Flight Direction	Flight behaviour	Notes (include Approx. distance of fly over wind farm)

Notes: **Flight Behavior**: Soaring (flying in a circular pattern within a thermal); flapping (flight powered by wing beat), gliding (straight flight path without wing beat), kitting (motionless flight of a bird within an updraft), hovering, or perching.

Appendix 8: Carcass Data Sheet

MACINTYRE WIND FARM - BIRD AND BAT MORTALITY MONITORING PROGRAM CARCASS SEARCH DATA-SHEET*				
Please fill out all details above the heavy line for each site searched All details below the line are required if a carcass is found Refer to Section 5.4.4 Carcass Detection Protocol **Do not move a carcass until the details below have been completed**				
MWF				
Date:				
Start Time:				
Finish Time:				
Turbine Number:				
Wind direction and strength in preceding 24 hours:				
Any unusual weather conditions in last 48 hours?				
Distance of Carcass from Tower (m):				
Bearing of Carcass from Tower (magnetic deg):				
Preliminary Species Identification:				
Photo Taken**	Yes / No			
Signs of injury:				
How old is carcass estimated to be (tick category):	<24 hrs	1-3 days	> 3 days	Other
Other Notes (i.e. sex/age of bird) and substrate:				
Post Find Actions: ▪ Place carcass in sealable plastic bag then wrap it in newspaper and into another plastic bag (with copy of this sheet within) and take to freezer at site office. ▪ Contact project ecologist to confirm identification of carcass				
* One form should be completed for each carcass found				
** Please attach photo to this form				