

Forest Wind Significant Impact Assessment Matters of National Environmental Significance

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List of Abbreviations

Abbreviation	Definition
ALA	Atlas of Living Australia
APS	Australian Painted Snipe
AVH	Australia's Virtual Herbarium
Biodiversity Status:	
E	Endangered
OC	Of Concern
NC	No Concern at Present
BBMP	Bird and Bat Management Plan
BFF	Black flying-fox
Conservation Class (VM Act):	
E	Endangered
OC	Of Concern
LC	Least Concern
DoEE	Commonwealth Department of the Environment and Energy
DES	Queensland Department of Environment and Science
DSEWPC	Commonwealth Department of Sustainability, Environment, Water, Population and Communities
DSITI	Queensland department of Science, Information Technology and Innovation
EH	Essential Habitat
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
ESCP	Erosion sediment control plan
EVNT	Endangered, Vulnerable or Near Threatened (conservation status listing of species under the EPBC Act)
FCRC	Fraser Coast Regional Council
FTS	Fork-tailed Swift
FWH	Forest Wind Holdings
GBF	Giant barred frog
GES	wetland of General Ecological Significance
GHFF	Grey-headed flying-fox
GPS	Global Positioning System
GRC	Gympie Regional Council
ha	Hectare
HES	wetland of High Ecological Significance
km	Kilometre
LGA	Local Government Areas
LM	Listed marine species

Abbreviation	Definition
LNP	Long-nosed potoroo
LRFF	Little red flying-fox
MNES	Matter of National Environmental Significance
MRC	Mary River cod
MRT	Mary River turtle
MSES	Matters of State Environmental Significance
MT	Migratory terrestrial species
MW	Migratory wetland species
NCWR	Nature Conservation (Wildlife) Regulation 2006
NFFMP	National flying-fox monitoring program
NSF	Native State Forest
NSW	New South Wales
OPP	Oxleyan pygmy perch
PLA	Plantation Licence Area
PMAV	Property map of assessable vegetation
PMST	Commonwealth EPBC Act protected matters search tool
RE	Regional Ecosystem
REDD	Regional ecosystem Description Database
RSA	Rotor Swept Area
SDAP	State Development assessment provision
SIA	Significant Impact Assessment
SFF	Spectacled flying-fox
SPP	State Planning Policy
SWTST	Southern white-throated snapping turtle
TEC	Threatened Ecological Community
VM Act	Queensland's Vegetation Management Act 1999
WBSE	White-bellied sea eagle
WTN	White-throated Needle-tail
WPA	Wetland Protection Area
WSF	Wallum sedge frog

1. INTRODUCTION

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

This report provides the Significant Impact Assessment (SIA) on Matters of National Environmental Significance (MNES) protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and has been prepared with reference to the following:

- Premise Environment (October 2017). Forest Wind, Ecological Assessment, Report No. 1701513b.
- Fox & Co Environmental (March 2020). Ecological Assessment Report, Forest Wind Project, Report FWH-03
- Fox & Co Environmental (March 2020). Forest Wind Bird and Bat Utilisation Survey, Report FWH-01.
- Fox & Co Environmental (March 2020). Forest Wind Bird and Bat Management Plan, FWH-02.
- Fox & Co Environmental (February 2020). Threatened Ecological Community and Ecological Assessment Report Raintree Bridge, Tinana Creek. Forest Wind Project. FWH-04
- University of the Sunshine Coast (September 2019). Forest Winds – Phase 1 Koala Survey Report

Specifically, the Project comprises a wind farm with up to 226 wind turbines and ancillary infrastructure (herein referred to as the Project Area, Plantation Licence Area (PLA)). The Project Area (PLA) is located almost entirely within existing operational and actively managed exotic pine plantations. A small portion of the Project Area (PLA) is Native State Forest (NSF) (on State Forest lot 1419 on FTY1697). The NSF area is located within the exotic pine plantation licence area and as such is included within the Project Area (PLA), however no works are proposed in the NSF area as part of this Project.

An ecological assessment has previously been undertaken to describe the existing environment and to assess the potential impacts that the Project may have on flora and fauna including MNES.

Preliminary ecological assessments were undertaken by O2Ecology (2016) and Premise Environment (Premise) (2017-2019). The initial assessments informed further survey design and assessments undertaken by Premise between 2017 and 2019. As the Project has undergone design changes, additional surveys and targeted assessments have been undertaken by Fox & Co Environmental Pty Ltd (Fox & Co). This report provides an assessment of the significance of impact of the Project on MNES in accordance with *Matters of National Environmental Significance, Significant Impact Guidelines (1.1), Department of Environment (DoE), 2013*.

1.1 Plantation Management

The Project will be located within an existing actively managed and operational exotic pine plantation in the Toolara, Tuan and Neerdie State Forests which is used for the primary purpose of growing and extracting exotic pine from a major forestry plantation, with two major timber processing facilities within the plantation. The exotic pine trees grown are a hybrid species of

slash pine (*Pinus elliottii*) and Caribbean pine (*Pinus caribaea*). The plantation is Australia's largest single plantation forestry operation consisting of a commercial crop, with maintained access for silviculture and harvesting purposes.

This exotic modified landscape will continue into the foreseeable future under various forestry stewardship and certification programs and Queensland *Biosecurity Act 2014*, on the terms of a licence until 2109. The plantation activities include:

- ploughing and planting;
- harvesting and haulage of timber from blocks to road verge;
- extensive haulage on forestry roads for;
 - transportation of logs timber processors;
 - transportation of timber waste and products to other timber processes;
- invasive weed management, including mechanical and chemical weed control;
- fire management (including comprehensive controlled prescribed burning regime);
- quarrying activities; and
- ongoing forestry road maintenance and with earthmoving machinery.

The Plantation Licensee undertakes the following management schedule of works on plantation compartments. Table 1 provides a summary of the Plantation Management Schedule.

Table 1 Plantation Management Schedule

Task	Typical Crop Age
Preplant overall weed control for grass and woody vegetation	Year 0
Tree row cultivation on selected blocks	Year 0
Tree row herbicide treatment by band tending method #1	Year 0
Tree row herbicide treatment by band tending method #2	Year 0
Machine inter-row mechanical weed control	Year 2-3
Prescribed burn#1	Year 8-10 (10m high)
Prescribed burn#2 (+3yrs)	Year 11-13
Prescribed burn#3 (+3yrs or as required)	Year 14+
Thinning mechanical on compartments with higher stocking	Year 17-20

Clearfell

Year 27

Over 27 years there are 9-10 intervention events to make the plantation safe and optimise productivity. On average non-plantation woody species are treated every 3-4 years.

Approximately 3,000 ha of crop is cleared per year under the current harvesting program by the licensee. The proposed area of pine plantation clearing for the Project is a one off event, consisting of only one sixth of the annual cleared crop area, or less than 1% of the pine plantation. There is only marginal increase in the pine plantation clearing rate as a consequence of the Project.

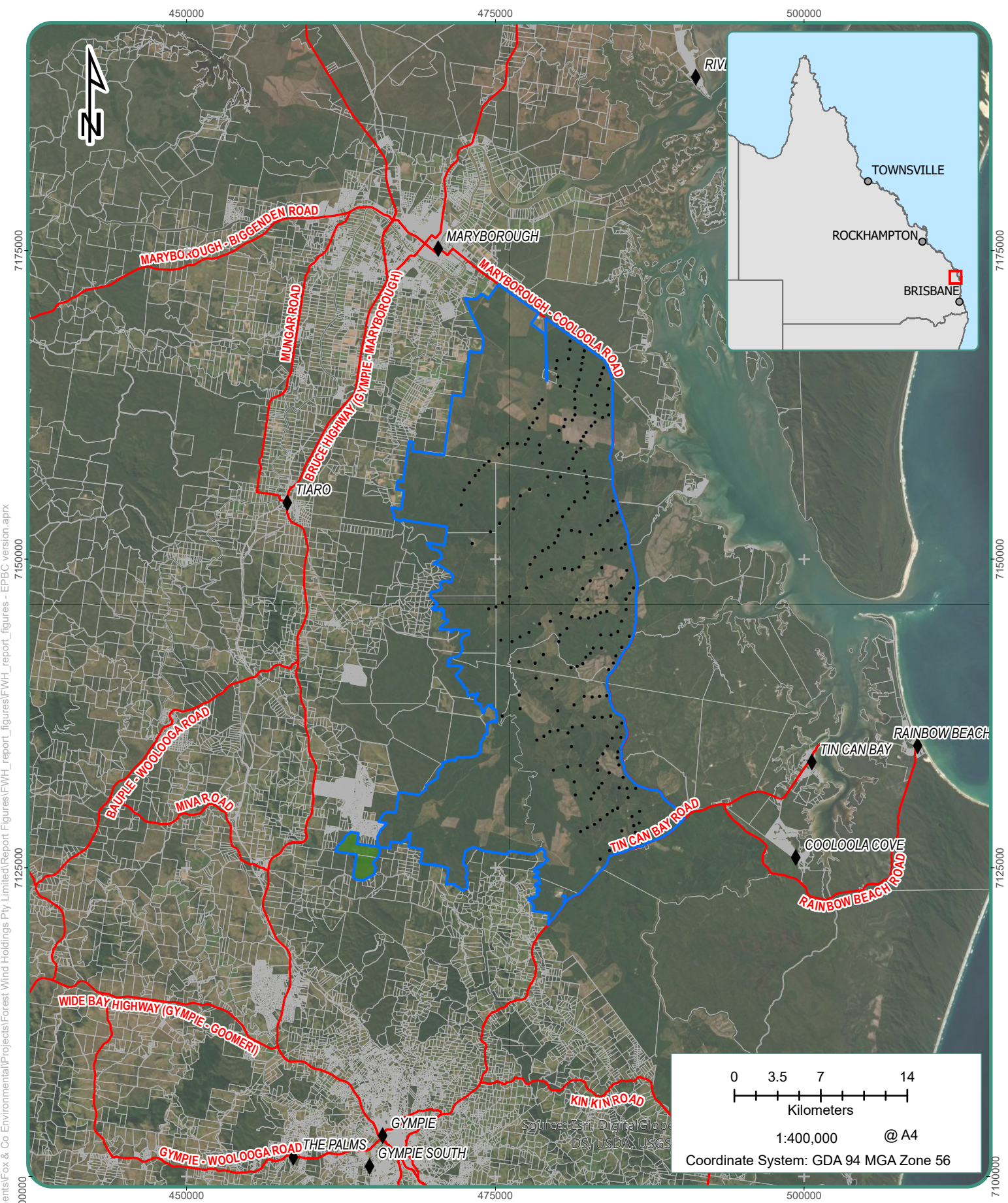
Tuan, Toolara and Neerdie State Forest roads and internal service tracks occupy approximately 4.5% of the aggregate plantation/road area. Roads and tracks provide access for forest management and fire protection. Primary haul roads within the PLA are predominately dirt/gravel dual lane surfaces that incur continuous daily traffic from heavy log-haul and light vehicle. Maintenance is ongoing with regular road pavement resurfacing, watering and compacting to accommodate the high vehicle frequency. Secondary haul roads in the PLA are generally single lane formed and gravelled surfaces used intermittently for silviculture and harvesting. Maintenance includes periodic surface inspections for pavement integrity and positive drainage with repairs effected as required to ensure the pavement is safe for general forest management traffic. Prior to a harvesting event (the year prior) upgrades to the pavement surface and drainage will be completed to ensure the secondary road is consolidated and serviceable for the planned harvest event. There are also internal compartment tracks and breaks which are generally single lane bare earth surfaces with table drains that discharge into adjoining compartments and native vegetation filter strips. Internal tracks are often parallel riparian native vegetation separating the plantation trees from creek lines and waterways.

Several invasive species which are a threat to Matters of National Environmental Significance (MNES) have been recorded on site during surveys including feral cats, wild dogs, pigs and wild horses. Wild horses are likely responsible for trampling riparian areas within the Project Area (PLA) as they were often observed in low-lying areas within the Project Area (PLA).

Table 2 provides the area of exotic pine plantation and existing remnant vegetation within the Project Area (PLA).

Table 2 Area of Exotic Pine and Remnant Vegetation within the Project Area (PLA)

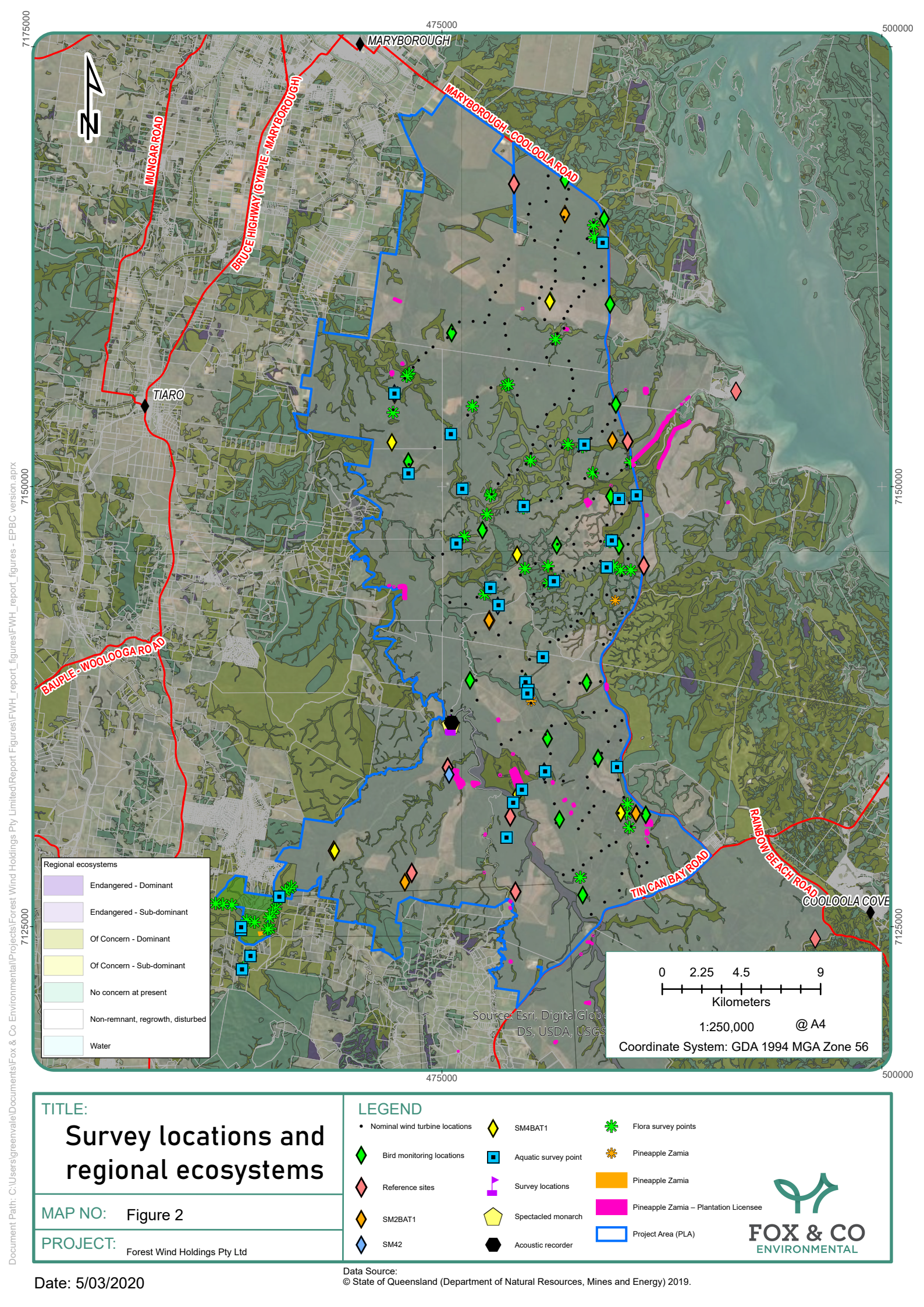
Aspect	Area	Area cleared for Project Infrastructure
Project Area (PLA)	67,131 ha	500 ha (total)
Project footprint (excludes existing access tracks)	Up to 500 ha or less of the Project Area (PLA)	-
Area of remnant vegetation in the Project Area (PLA)	17.4% of the Project Area (PLA) 11,691 ha	0 ha
Exotic pine plantation and cleared tracks in the Project Area (PLA)	82.6% of the Project Area (PLA) 55,440 ha	Up to 500 ha



TITLE: <h1>Project Area and Regional Context</h1>	
MAP NO: Figure 1	LEGEND
PROJECT: Forest Wind Holdings Pty Ltd	<ul style="list-style-type: none"> ◆ Populated places • Nominal turbine locations — State controlled roads ▭ Project Area (PLA) ▭ Property boundaries ▭ Native state forest

Date: 10/02/2020

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



Regional ecosystems

	Endangered - Dominant
	Endangered - Sub-dominant
	Of Concern - Dominant
	Of Concern - Sub-dominant
	No concern at present
	Non-remnant, regrowth, disturbed
	Water

0 2.25 4.5 9
Kilometers

1:250,000 @ A4

Coordinate System: GDA 1994 MGA Zone 56

TITLE:
Survey locations and regional ecosystems

MAP NO: Figure 2

PROJECT: Forest Wind Holdings Pty Ltd

LEGEND

	Nominal wind turbine locations		SM4BAT1		Flora survey points
	Bird monitoring locations		Aquatic survey point		Pineapple Zamia
	Reference sites		Survey locations		Pineapple Zamia
	SM2BAT1		Spectacled monarch		Pineapple Zamia – Plantation Licensee
	SM42		Acoustic recorder		Project Area (PLA)



2. SIGNIFICANT IMPACT ASSESSMENT

2.1 Threatened Ecological Communities

2.1.1 Lowland Rainforest of Subtropical Australia (EPBC Act – CE)

The Lowland Rainforest of Subtropical Australia threatened ecological community (TEC) primarily occurs from Maryborough in Queensland to the Clarence River (near Grafton) in New South Wales (NSW) on basalt and alluvial soils, including sand and old or elevated alluvial soils as well as floodplain alluvia. It also occurs occasionally on enriched rhyolitic soils and basaltically enriched metasediments. The ecological community is generally a moderately tall (≥ 20 m) to tall (≥ 30 m) closed forest (canopy cover $\geq 70\%$) and has 30-40 native woody species (from Appendix A of the EPBC Listing Advice).

Surveys undertaken in January 2020 confirmed that the area near Raintree Bridge on Tinana Creek equates to Regional Ecosystem (RE) 12.3.17 (described as *Simple notophyll fringing forest usually dominated by Waterhousea floribunda*). The RE is analogous to the EPBC Act listed Lowland Rainforest of Subtropical Australia TEC. However, the vegetation assessed at the existing Raintree Bridge crossing does not meet the species richness condition threshold for the listed community with only 11 native woody species from Appendix A of the listing advice recorded during the survey (Fox & Co, 2020) rather than the minimum 40 species required for remnant vegetation patches. Nonetheless, this area will be avoided by the Project due to the habitat values for potential EPBC Act listed species.

Table 3 provides a significant impact assessment (SIA) for the EPBC Act listed Lowland Rainforest of Subtropical Australia TEC undertaken in accordance with the *Matters of National Environmental Significance, Significant Impact Guidelines (1.1), Department of Environment (DoE), 2013*.

Table 3 Significant Impact Assessment for Lowland Rainforest of Subtropical Australia

Impact Criteria	Assessment
<p>An action is LIKELY to have a significant impact on a critically endangered or endangered ecological community if there is a real chance of possibility that it will:</p>	
<p>Reduce the extent of an ecological community</p>	<p>Not applicable. No Commonwealth listed TECs were identified within the Project Area (PLA) during the Fox & Co surveys (2020). The vegetation communities present along Tinana Creek in the area near Raintree Bridge do not meet the specific listing thresholds for the listed Lowland Rainforest of Subtropical Australia TEC. Therefore, no impacts to any listed TECs are predicted to occur as a result of the Project.</p> <p>Wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation by strategically placing turbines, compounds (operation and construction) within the pine plantations, therefore avoiding impacts to remnant vegetation. Access is via existing</p>

	<p>forestry tracks.</p> <p>Will not have a Significant Impact.</p>
<p>Fragment or increased fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines</p>	<p>Not applicable. No Commonwealth listed TECs were identified within the Project Area (PLA) during the Fox & Co surveys (2020). The vegetation communities present along Tinana Creek in the area near Raintree Bridge do not meet the specific listing thresholds for the listed TEC Lowland Rainforest of Subtropical Australia. Therefore, no impacts to any listed TECs are predicted to occur as a result of the Project.</p> <p>Wind Farm infrastructure within the Project Area (PLA) avoids remnant vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant native vegetation. Access is via existing forestry tracks.</p> <p>Will not have a Significant Impact.</p>
<p>Adversely affect habitat critical to the survival of an ecological community</p>	<p>Not applicable. No Commonwealth listed TECs were identified within the Project Area (PLA) during the Fox & Co surveys (2020). The vegetation communities present along Tinana Creek in the area near Raintree Bridge do not meet the specific listing thresholds for the listed TEC Lowland Rainforest of Subtropical Australia. Therefore, no impacts to any listed TECs are predicted to occur as a result of the Project.</p> <p>Wind Farm infrastructure within the Project Area (PLA) avoids remnant native vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation. Access is via existing forestry tracks.</p> <p>Will not have a Significant Impact.</p>
<p>Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns</p>	<p>Not applicable. No Commonwealth listed TECs were identified within the Project Area (PLA) during the Fox & Co surveys (2020). The vegetation communities present along Tinana Creek in the area near Raintree Bridge do not meet the specific listing thresholds for the listed TEC Lowland Rainforest of Subtropical Australia. Therefore, no impacts to any listed TECs are predicted to occur as a result of the Project.</p> <p>Wind Farm infrastructure within the Project Area (PLA) avoids remnant vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation. Access is via existing forestry tracks.</p> <p>Will not have a Significant Impact.</p>
<p>Cause a substantial change in the species composition of an occurrence of an ecological</p>	<p>Not applicable. No Commonwealth listed TECs were identified within the Project Area (PLA) during the Fox & Co surveys (2020). The vegetation communities present along Tinana Creek in the area</p>

<p>community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting</p>	<p>near Raintree Bridge do not meet the specific listing thresholds for the listed TEC Lowland Rainforest of Subtropical Australia. Therefore, no impacts to any listed TECs are predicted to occur as a result of the Project.</p> <p>Wind Farm infrastructure within the Project Area (PLA) avoids remnant vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation. Access is via existing forestry tracks.</p> <p>Will not have a Significant Impact.</p>
<p>Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:</p> <ul style="list-style-type: none"> • assisting invasive species, that are harmful to the listed ecological community, to become established, or • causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, 	<p>Not applicable. No Commonwealth listed TECs were identified within the Project Area (PLA) during the Fox & Co surveys (2020). The vegetation communities present along Tinana Creek in the area near Raintree Bridge do not meet the specific listing thresholds for the listed TEC Lowland Rainforest of Subtropical Australia. Therefore, no impacts to any listed TECs are predicted to occur as a result of the Project.</p> <p>Wind Farm infrastructure within the Project Area (PLA) avoids remnant vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation. Access is via existing forestry tracks.</p> <p>The existing weed management practices undertaken by the Plantation Licensee will also contain to manage weeds.</p> <p>Will not have a Significant Impact.</p>
<p>Interfere with the recovery of an ecological community</p>	<p>Not applicable. No Commonwealth listed TECs were identified within the Project Area (PLA) during the Fox & Co surveys (2020). The vegetation communities present along Tinana Creek in the area near Raintree Bridge do not meet the specific listing thresholds for the listed TEC Lowland Rainforest of Subtropical Australia. Therefore, no impacts to any listed TECs are predicted to occur as a result of the Project.</p> <p>Wind Farm infrastructure within the Project Area (PLA) avoids remnant vegetation by strategically placing turbines, compounds (operation and construction) within the pine plantations, therefore avoiding impacts to remnant vegetation. Access is via existing forestry tracks.</p> <p>Will not have a Significant Impact.</p>

No EPBC Act listed TEC were identified within the Project Area (PLA). Project infrastructure has specifically been sited to avoid remnant vegetation. The Project will not have a Significant Impact on an EPBC Act listed TEC.

2.2 Birds

2.2.1 Survey Effort

A total of 139 fixed-point Bird Utilisation Surveys (BUS) were undertaken between 2016 and 2019. The BUS assessments are fixed-time point counts undertaken over a 20 minute period using a method adapted from Reynolds *et al.* (1980) and Biosis (2016). Point count locations are selected to provide sufficient representation of turbine locations across the entire wind farm. Reference sites were also surveyed within and outside the Project Area (PLA) away from proposed turbine locations. The following is recorded:

- Species
- Number of birds
- Height of bird above the ground
- Horizontal distance from observer to bird
- Weather conditions (cloud cover, wind direction, wind speed)

Refer to *Fox & Co Environmental (February 2020), Ecological Assessment Report, Forest Wind Project, Report FWH-03 (Section 3.4.3)* for further details on the BUS assessments for the Project Area (PLA).

BUS assessments recorded 66 bird species across the Project Area (PLA). The following five (5) species as having conservation significance under the EPBC Act were recorded:

1. White-throated needletail (*Hirundapus caudacutus*) – Vulnerable (V), Migratory Terrestrial Species (MT), Listed Marine Species (LM)
2. Fork-tailed swift (*Apus pacificus*) – MT
3. Spectacled monarch (*Monarchar trivirgatus* Bonn as *Symposiachrus trivirgatus*) – LM, MT
4. Rainbow bee-eater (*Merops ornatus*) – LM
5. Cicadabird (*Coracina tenuirostris*) – LM

Migratory shorebirds are discussed in Section 2.3.

Table 4 identifies the bird species listed as threatened under the EPBC Act either known to occur or considered to have at least a moderate potential to occur within the PLA.

Table 4 Threatened Bird Species Known or having moderate potential to occur in Project Area (PLA). Source: Protected Matters Search Tool.

Scientific Name	Common Name	EPBC Act ¹	Likelihood of Occurrence
<i>Hirundapus caudacutus</i>	White-throated needletail	V, MT, LM	Known to occur
<i>Rostratula australis</i>	Australian painted snipe (Syn. <i>Rostratula benghalensis</i>)	E, LM, MW	Moderate potential to occur

¹ – EPBC Act: CE – Critically endangered, E – Endangered, V – Vulnerable, MM – Migratory Marine, MT – Migratory Terrestrial Species, ² - MW – Migratory Wetland Species, LM – Listed Marine Species

A description of each of the species is provided below.

2.2.2 White-throated needletail (EPBC Act – V, MT, LM)

2.2.2.1 Habitat and Populations

This species is a non-breeding summer migrant (October – April) to Australia. It occurs in high open spaces above a wide range of habitats, such as oceans, ranges and headlands (Morcombe, 2003). During the summer months, the white-throated needletail (WTN) is widespread in eastern and south-eastern Australia. In eastern Australia, it 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 (DoE, 2019).

Large tracts of native vegetation, particularly forest, may be a key habitat requirement for the species (DoE, 2015). In Australia, the WTN is almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground (DoE, 2019).

They often forage in areas of up draughts, such as ridges, cliffs or sand-dunes, or in the smoke of bushfires, or in whirlwinds. They often forage along the edges of low pressure systems, which both lift their food sources and assist with their flight, and it is thought that they follow these systems across Australia (DoE, 2019). In Australia, the WTN has been recorded foraging on a wide variety of insects, including beetles, cicadas, flying ants, bees, wasps, flies, termites, moths, locusts and grasshoppers (DoE, 2019). They have been observed foraging over the Project Area (PLA).

There are no published estimates of the extent of occurrence of the WTN in Australia, although the species occurs at numerous and widespread sites in eastern Australia (DoE, 2019)

Surveys demonstrated that the occurrence and abundance of this species across the Project Area (PLA) is highly variable. They were recorded during 22 of the 139 fixed-point BUS assessments. Two (2) of the 139 BUS assessments recorded numbers greater than 100 and five (5) of the 139 surveys recorded numbers greater than 10 (three of those five were less than 20 individuals). The two survey occasions when they were recorded in flocks greater than 100 were on days associated with local bushfires or stormfronts. The *draft referral guideline for 14 birds listed migratory under the EPBC Act* (DoE, 2015) lists ecologically significant proportions of each species population, which is 100 individuals (international proportion) or 10 individuals (national proportion) for the WTN. A significant impact involves the loss of this many birds from the population in a year.

In Australia there is evidence of collision of WTN with wind turbines however the scale of impact at a population level requires further investigation (Approved Conservation Advice, 2019). Hull *et al.* (2013) analysed bird utilisation survey data and carcass survey data obtained over a 10 year period at two Australian wind farms. Specific families/superfamilies and foraging strategies/zones were associated with collision risk (collided versus not-collided) and indicated that particular morphological, ecological and behavioural factors were associated with a species' vulnerability to colliding with wind turbines. WTN (aerial pursuit of prey) were not classified in the 'highest risk group'.

The species is listed as Vulnerable under the EPBC Act due to a population size reduction (reduction in total numbers) (DoE, 2019). The population size within Australia has not been quantified, however it is not believed to approach the thresholds for Vulnerable under the population size criterion (<10,000 mature individuals with a continuing decline estimated to be >10% in ten years or three generations, or with a specified population structure) (BirdLife International 2020). It also has an extremely large range and therefore does not meet the

thresholds for Vulnerable under the range size criteria (extent of occurrence <20,000 km² combined with a declining or fluctuating range size, habitat extent/quality, or population size and a small number of locations or severe fragmentation) (Birdlife International, 2020). An important population (as per the Significant Impact Criteria) is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range

Given the population size and extremely large range, the WTN observed within the Project Area (PLA) is not considered an important population.

The main existing threat to WTN is habitat loss and fragmentation. Logging of breeding habitat in the northern hemisphere is suspected to be impacting breeding success while loss of roosting sites (forest and woodland habitats) in Australia may also be contributing to the decline of WTN (Approved Conservation Advice, 2019). These species roosts in trees amongst dense foliage in the canopy or in hollows (DoE, 2019). Up to 82.6% of the Project Area (PLA) comprises exotic pine plantation and cleared tracks with the remaining 17.4% comprising a mosaic of native remnant vegetation. The crop is grown on a 27-30 year cycle, with approximately 3,000 ha / year of plantation harvesting within the Project Area (PLA). The sensitivity of the existing environment in these plantation areas is less than the remnant areas within and adjacent to the Project Area (PLA). The pine plantations are not considered suitable roosting habitat due to the lack of dense foliage and hollows. The fragmented remnant woodland areas within the Project Area (PLA) offer potential roosting habitat for WTN. The Project avoids clearing these patches of remnant vegetation areas as infrastructure has been sited within the pine plantation areas.

Potential collision with wind turbines is considered of low risk to the population. This is also consistent with the DoE Conservation advice regarding the assessment of threats to the WTN which states:

- Threat factor: Wind turbines and overhead wires
- Evidence Base: Impacts from wind farms can be categorized as direct (collisions with wind turbines) and indirect (barrier and alienation, with the potential to reduce access to habitat). Collision with wind turbines and overhead wires is of low severity and affects a small number of birds (Hull *et al.* 2013). (*Hirundapus caudacutus* (White-throated Needle-tail), Approved Conservation Advice, 4 July 2019 (Table 1).

2.2.2.2 Avoidance, Management and Mitigation

Avoidance is the guiding principle to avoiding impacts on all flora and fauna, particularly MNES within the Project Area (PLA). Avoidance measures utilised in the Project to minimize impacts on WTN include:

- The Project Area (PLA) is located within an existing exotic pine plantation and predominantly avoids remnant vegetation and therefore potential roosting sites.
- Electrical cabling will mostly be underground along existing access tracks which will further reduce the likelihood of collision of birds.
- Other infrastructure such as construction compounds avoid remnant vegetation and waterways and therefore avoid damage to remnant areas of natural habitat.
- Existing forestry tracks will be used to provide access within the Project Area (PLA) and therefore avoids disturbance to remnant vegetation and habitat within remnant areas.

Following all avoidance measures, additional management activities and controls and mitigation measures will be implemented in accordance with the Bird and Bat Management Plan (2020) and will include:

- Pre-construction and operational bird utilization surveys
- Mortality / carcass monitoring by an ecologist or trained detection dog or other approved method.
- Trial acoustic bird deterrents
- Slow rotor speeds or temporary shutdown of subject turbines if birds detected in the proximity of turbines.
- Pre-construction, post-construction and interim operational reporting, including annual reporting for bird data and assessment.

Table 5 provides a SIA for WTN undertaken in accordance with the *Matters of National Environmental Significance, Significant Impact Guidelines (1.1), Department of Environment (DoE), 2013*.

Table 5 Significant Impact Assessment for White-throated Needletail (EPBC – V, MT, LM)

Impact Criteria	Assessment
<p>An action is LIKELY to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:</p>	
<p>Lead to a long-term decrease in the size of an important population of a species</p>	<p>An ecologically significant proportion of the White-throated Needletail population is considered to be 100 individuals (international proportion) or 10 individuals (national proportion). An ecologically significant proportion of the population was identified during 7 of the 139 BUS assessments undertaken over three summer monitoring periods(2016, 2017, 2018/19). Seven of the 139 surveys recorded WTN in numbers greater than 10, with two of the surveys reporting numbers greater than 100. The two survey occasions when they were recorded in flocks greater than 100 were on days associated with local bushfires or stormfronts.</p> <p>Bird Utilisation Surveys have demonstrated the occurrence and abundance of this species across the Project Area (PLA) is highly variable (Fox & Co Environmental (February 2020). Forest Wind Bird and Bat Utilisation Survey, Report FWH-01). Previous studies (Hull <i>et al.</i>, 2013) have also indicated WTN is not a ‘high risk’ species for turbine collision. The Project Bird and Bat Management Plan also outlines procedures to be implemented should an impact event be recorded during operation of the wind farm.</p> <p>Considering the widespread distribution, highly variable occurrence across the Project area, avoidance behaviour, limited available roosting habitat and lack of clearing of remnant vegetation required for Project infrastructure, the Project is not expected to lead to a long-term decrease in the size of an important population.</p> <p>Will not have a Significant Impact.</p>
<p>Reduce the area of occupancy of</p>	<p>This species is a non-breeding summer migrant (October – April) to Australia. It occurs in high open spaces above a wide range of</p>

<p>an important population</p>	<p>habitats, such as oceans, ranges and headlands (Morcombe, 2003). During the Summer months, the WTN is widespread in eastern and south-eastern Australia. In eastern Australia, it 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 (DoE, 2019).</p> <p>Given the widespread nature of this species (while in Australia) and highly variable occurrence across the Project Area (PLA), the Project is not expected to reduce the area of occupancy of an important population.</p> <p>Will not have a Significant Impact.</p>
<p>Fragment an existing important population into two or more populations</p>	<p>As mentioned above, the species is highly mobile and widespread while in Australia during the summer months. The Project is not expected to fragment an existing important population into two or more populations.</p> <p>Will not have a Significant Impact.</p>
<p>Adversely affect habitat critical to the survival of a species</p>	<p>Large tracts of native forest / woodland which is considered potential important roosting habitat has previously been cleared from the PLA (now used as exotic pine plantation). The pine plantations of various growth stages (juveniles to mature trees up to 27-30 years old) are not considered suitable roosting habitat due to the lack of dense foliage and lack of hollows. The sensitivity of the existing environment in these plantation areas is less than the remnant areas within and adjacent to the Project Area (PLA). Clearing of remaining remnant vegetation for the Project is largely avoided therefore the Project is not expected to impact WTN roosting habitat.</p> <p>This species does not breed in Australia therefore consideration of breeding habitat is not required.</p> <p>Will not have a Significant Impact.</p>
<p>Disrupt the breeding cycle of an important population</p>	<p>Not applicable. This species does not breed in Australia.</p>
<p>Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</p>	<p>Breeding habitat for the WTN is not within Australia.</p> <p>As they have been observed foraging over the Project Area (PLA) the Project may marginally affect foraging availability, although given the widespread nature, highly variable occurrence and avoidance ability of the WTN (Hull <i>et al.</i>, 2013), the extent that the Project may modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline is not considered significant.</p> <p>Will not have a Significant Impact.</p>
<p>Result in invasive species that are harmful to vulnerable</p>	<p>No invasive species are currently listed as a threat to WTN (DoE,</p>

species becoming established in the vulnerable species' habitat	2019). Will not have a Significant Impact.
Introduce disease that may cause the species to decline	No diseases are listed as a current threat to WTN (DoE, 2019). Will not have a Significant Impact.
Interfere substantially with the recovery of the species	The approved conservation advice for WTN (July, 2019) categorises threats from wind turbines and overhead wires as a known threat. However based on available evidence, collision with wind turbines and overhead wires is of low severity and affects a small number of birds (Hull <i>et al.</i> 2013) (WTN Approved Conservation Advice, 2019). The Project is not expected to interfere substantially with the recovery of the species. Will not have a Significant Impact.
An action is LIKELY to have a significant impact on a migratory species if there is a real chance or possibility that it will:	
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	The Project is not substantially modifying, destroying or isolating important habitat for the WTN as it is located within an exotic pine plantation and clearing of native vegetation will be limited to upgrading existing access tracks. This native vegetation is also largely restricted to regrowth vegetation growing adjacent to the tracks in some areas, although this is also actively managed by the Plantation Licensee. Important Habitat for WTN (non-breeding habitat only) include: Found across a range of habitats, more often over wooded areas, where it is almost exclusively aerial. Large tracts of native vegetation, particularly forest, may be a key habitat requirement for species. Found to roost in tree hollows in tall trees on ridge-tops, on bark or rock faces. Appears to have traditional roost sites (Draft referral Guidelines 2015). No Important Habitat threshold area can be determined at this time for WTN or has been identified given lack of knowledge or rarity (Draft referral guidelines, 2015). Research on WTN may reveal site thresholds in tall forest used by roosting birds (Draft referral guidelines, 2015). WTN are highly mobile species and would not be affected by the Project in terms of fragmentation or isolation of habitats. Will not have a Significant Impact.
Result in an invasive species that is harmful to the migratory species becoming established in	No invasive species are currently listed as a threat to WTN (DoE, 2019).

an area of important habitat for the migratory species	Will not have a Significant Impact.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species	<p>An ecologically significant proportion of the population was identified during 7 of the 139 BUS assessments undertaken over 3 summer monitoring periods (2016, 2017, 2018/19). Some birds may be directly impacted however based on available evidence of avoidance behaviour of the WTN (Hull <i>et al.</i> 2013), widespread nature and highly variable occurrence on the Project Area (PLA), the impact is not considered likely to seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of this species.</p> <p>WTN do not breed in Australia and limited roosting habitat is available on site.</p> <p>Will not have a Significant Impact.</p>

WTN are present in Australia during the summer months (between October – April). During this period they are widespread in eastern and southern Australia. They were recorded within the Project Area (PLA) during summer surveys during 22 of the 139 BUS summer surveys. Surveys demonstrated the occurrence and abundance of this species across the Project Area (PLA) is highly variable.

An ecologically significant proportion of the WTN population is 100 individuals (international proportion) or 10 individuals (national proportion). Two (2) of the 139 BUS assessments recorded numbers greater than 100 and five (5) of the 139 surveys recorded numbers greater than 10 (3 of those 5 were less than 20 individuals). Collision of IWTN with wind turbines and overhead wires is of low severity and affects a small number of birds (Hull *et al.* 2013). Although are aerial insectivores (aerial pursuit of prey) and are known to fly within the rotor swept area (RSA), they are not classified as having a high risk of collision due to their avoidance behaviour (Hull *et al.*, 2013).

Given their widespread distribution (when in Australia during the Summer months), lack of resting habitat within the Project Area (PLA), turbine collision avoidance behaviour and highly variable occurrence and abundance across the Project Area (PLA), the Project will not have a Significant Impact on the WTN

2.2.3 Australian Painted Snipe (EPBC Act – E, LM, MW)

2.2.3.1 Habitat and Population

There is one previous record (2007) for the Australian Painted Snipe (APS) from database searches undertaken within the Project Area (PLA).

The APS inhabits a variety of habitats but generally requires presence of water. They inhabit 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 (DoE, 2019). There is patchy occurrence of small wetland habitats in some remnant areas across the Project Area (PLA) and also adjacent to the Project Area (PLA). The APS was therefore considered to have a moderate potential to occur.

None were recorded on site during BUS undertaken during 2016-2019, nor whilst onsite during other field investigations during this period. Although suitable habitat exists, numbers of APS are considered likely to be low given one record in 2007, lack of recent records or regular

records. It is acknowledged that this species is very secretive, mainly crepuscular (active at dawn and dusk) and generally remain in dense cover while feeding, making detection difficult.

This species is considered low risk of collision due to specific habitat preferences and low numbers moving through the Project Area (PLA).

2.2.3.2 Avoidance, Management and Mitigation

Avoidance is the guiding principle to avoiding impacts on all flora and fauna, particularly MNES within the Project Area (PLA). Avoidance measures utilised in the Project to minimize impacts on APS include:

- The Project Area (PLA) is located within an existing exotic pine plantation and avoids low-lying remnant vegetation and therefore possible nesting and feeding sites.
- Electrical cabling will mostly be underground along existing access tracks which will further reduce the likelihood of collision of birds.
- Other infrastructure such as construction compounds avoid remnant vegetation and low-lying areas therefore avoid damage to wetland habitat.
- Existing forestry tracks will be used to provide access within the Project Area (PLA) and therefore avoids disturbance to low-lying remnant vegetation and wetland habitat within remnant areas.

Following all avoidance measures, additional management activities and controls and mitigation measures will be implemented in accordance with the Bird and Bat Management Plan (2020) and will include:

- Potential indirect impacts to remnant wetland areas are mitigated through management measures such as the implementation of Erosion and Sediment Control Plans (ESCP) to manage stormwater and sediment runoff during construction.
- Pre-construction and operational bird utilization surveys.
- Mortality / carcass monitoring by an ecologist or trained detection dog or other approved method.
- Trial acoustic bird deterrents.
- Slow rotor speeds or temporary shutdown of subject turbines if birds detected in the proximity of turbines.
- Pre-construction, post-construction and interim operational reporting, including annual reporting for bird data and assessment

Table 6 provides a SIA for APS undertaken in accordance with the *Matters of National Environmental Significance, Significant Impact Guidelines (1.1), Department of Environment (DoE), 2013*.

Table 6 Significant Impact Assessment for Australian Painted Snipe (EPBC – E, LM, MW)

Impact Criteria	Assessment
An action is LIKELY to have a significant impact on an animal that is ‘Critically Endangered’ or ‘Endangered’ species if there is a real chance or possibility that it will:	
Lead to a long-term decrease in the size of a population	The proposed wind farm construction and operation will not lead to a long-term decrease in the size of the APS population given the low number of sightings (one record in 2007) and overall moderate

	<p>potential of a population within the Project Area.</p> <p>Project avoids any low-lying wetland areas in remnant vegetation.</p> <p>Will not have a Significant Impact.</p>
Reduce the area of occupancy of the species	<p>Although no APS were observed during field surveys and only one previous record in 2007, should this species occur within the Project Area (PLA) it would be restricted mainly within the remnant low-lying wetland areas. None of these areas are proposed to be cleared or disturbed by this project.</p> <p>Given the above, it is not expected that the Project will significantly reduce the area of the occupancy of this species.</p> <p>Will not have a Significant Impact.</p>
Fragment an existing population into two or more populations	<p>No known populations are within the Project Area (PLA). No clearing within low-lying remnant areas and therefore the Project is not fragmenting any potential habitat within the low-lying wetland areas within the Project Area (PLA).</p> <p>Will not have a Significant Impact.</p>
Adversely affect habitat critical to the survival of a species	<p>Wind farm infrastructure is sited away from low-lying areas and remnant vegetation. Existing forestry tracks will be used to provide access within the Project Area (PLA) and therefore avoids disturbance to remnant vegetation and habitat. Only marginal clearing of native vegetation may occur for upgrades to existing waterway crossings on the forestry access tracks.</p> <p>Given the above, it is not expected that the Project will significantly affect habitat critical to the survival of this species.</p> <p>Will not have a Significant Impact.</p>
Disrupt the breeding cycle of a population	<p>Wind farm infrastructure is sited away from low-lying areas and remnant vegetation. It is not expected that the Project will disrupt the breeding cycle of a population, should APS be present in the low-lying wetland habitats.</p> <p>Will not have a Significant Impact.</p>
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	<p>The Project Area (PLA) is already highly fragmented and modified due to the actively managed pine plantation. As discussed above, it is not expected the Project will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p> <p>The Project will not have indirect impacts to wetland areas (on and adjacent to the Project Area (PLA)) due to management measures such as the implementation of ESCPs to manage stormwater and sediment runoff during construction.</p>

	Will not have a Significant Impact.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	<p>Several invasive species which are a threat to APS have been recorded on the Project Area (PLA) during surveys including feral cats and wild dogs. Wild horses may also damage habitat as they were often observed in low-lying areas within the Project Area (PLA). The Project will not increase the extent of these known invasive species. The Project is not expected to result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.</p> <p>Will not have a Significant Impact.</p>
Introduce disease that may cause the species to decline	<p>No diseases are listed as a current threat to the APS. The Project is not expected to introduce a disease that may cause the species to decline.</p> <p>Will not have a Significant Impact.</p>
Interfere with the recovery of the species	<p>The main threats to APS are loss and degradation of habitat and predation by feral animals. The Project avoids low-lying native vegetation and it is not expected to increase the current extent of feral animal occurrence.</p> <p>Given the small number of records and avoidance of low-lying remnant habitat, the Project is unlikely to interfere with the recovery of the species.</p> <p>Will not have a Significant Impact.</p>
An action is LIKELY to have a significant impact on a migratory species if there is a real chance or possibility that it will:	
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	<p>As discussed above, it is not expected the Project will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p> <p>Will not have a Significant Impact.</p>
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	<p>As mentioned above, feral cats, wild dogs and wild horses are present within the Project Area (PLA). The Project is not expected to result in an increase in these invasive species nor is it expected to result in the introduction of new invasive species that is harmful to APS.</p> <p>Will not have a Significant Impact.</p>

Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species	Wind farm infrastructure is sited away from low-lying areas and remnant vegetation. It is not expected the Project will disrupt the breeding cycle of a population. Will not have a Significant Impact.
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Given one (1) previous record 13 years ago and avoidance of potential low-lying habitat, the Project will not have a Significant Impact on APS.

2.3 Migratory Bird Species

2.3.1 Migratory Shorebird Species

Shorebirds (waders) inhabit intertidal areas and/or freshwater wetlands. Thirty-four (34) migratory shorebirds are recorded from Australia and breed in northern China, Mongolia, Siberia and Alaska birds and Russia. These species migrate to non-breeding grounds in Australia along the East Asian – Australasian (EAA) flyway. Migratory shorebirds were assessed for their susceptibility to collision based impacts considering their arrival and departure from the Great Sandy Strait over the summer months. The risk of impact is low or unlikely and is provided in Table 7 below.

Internationally important sites and current flyway population estimates have been identified by Bamford *et al.* (2008) in Migratory shorebirds of the East Asian–Australasian Flyway: Population estimates and internationally important sites. The identification of important sites is based on Criterion 6 of the Ramsar Convention, which states that “a wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbirds” (Bamford *et al.*, 2008). Australia has 118 internationally important sites (Bamford *et al.*, 2008).

The Great Sandy Strait is considered an internationally important site for seven (7) migratory species: terek sandpiper (*Xenus cinereus*), grey-tailed tattler (*Tringa brevipes*), common greenshank (*Tringa nebularia*), bar-tailed godwit (*Limosa lapponica baueri* and *Limosa lapponica menzbieri*), lesser sand plover (*Charadrius mongolus*), whimbrel (*Numenius phaeopus*), far eastern curlew (*Numenius madagascariensis*) (Bamford *et al.*, 2008). The below table provides an assessment of those seven (7) species mentioned above, although all migratory species either known or predicted to occur were also assessed and are provided in the likelihood of occurrence table in the *Ecological Assessment Report (Fox & Co, 2019)*.

Table 7 Migratory Shorebird Risk Assessment

Species	Likelihood of Occurrence	Distribution and Flight Behaviours	Susceptibility of Collision
Terek sandpiper (<i>Xenus cinereus</i>)	Unlikely in the Project Area (PLA). Known to occur in the Great Sandy Strait as a	Forages mostly in the open, on soft wet intertidal mudflats or in sheltered estuaries, embayments, harbours or lagoons. The species has also been recorded on islets, mudbanks, sandbanks and spits, and near mangroves and occasionally in samphire (<i>Halosarcia</i> spp.). Birds are	Low

Species	Likelihood of Occurrence	Distribution and Flight Behaviours	Susceptibility of Collision
	summer migrant.	<p>seldom near the edge of water, however, birds may wade into the water (Department of the Environment, 2016e).</p> <p>There appear to be two waves of migration down the eastern coast: one in August or September and one in November (DoE, 2019).</p> <p>Widespread in coastal Queensland, from south-east of the Gulf of Carpentaria, north to Torres Strait and along the eastern coast to south-east Australia.</p> <p>Migratory shorebird of the East Asian – Australasian Flyway (EAA). The Great Sandy Strait is an important non-breeding site in Australia (Bamford <i>et al.</i>, 2008).</p> <p>Low risk of collision due to specific habitat preferences that restrict species distribution to intertidal areas. No habitat immediately adjacent west of Project Area (PLA) so short flights unlikely to occur.</p>	
Grey-tailed tattler (<i>Tringa brevipes</i>)	<p>Unlikely in the Project Area (PLA).</p> <p>Known to occur in the Great Sandy Strait as a summer migrant.</p>	<p>Within Australia, the Grey-tailed Tattler has a primarily northern coastal distribution and is found in most coastal regions. In Queensland it is found along the entire coast, with small numbers located in the Gulf of Carpentaria.</p> <p>The Grey-tailed Tattler is often found on sheltered coasts with reefs and rock platforms or with intertidal mudflats. It can also be found at intertidal rocky, coral or stony reefs as well as platforms and islets that are exposed at low tide. It has been found around shores of rock, shingle, gravel or shells and also on intertidal mudflats in embayments, estuaries and coastal lagoons, especially fringed with mangroves (DoE, 2019).</p> <p>Migratory shorebird of the EAA. The Great Sandy Strait is an important non-breeding site in Australia (Bamford <i>et al.</i>, 2008).</p>	Low

Species	Likelihood of Occurrence	Distribution and Flight Behaviours	Susceptibility of Collision
		<p>Low risk of collision due to specific habitat preferences that restrict species distribution to intertidal areas. No habitat immediately adjacent west of Project Area (PLA) so short flights unlikely to occur.</p>	
<p>Common greenshank (<i>Tringa nebularia</i>)</p>	<p>Unlikely in the Project Area (PLA).</p> <p>Known to occur in the Great Sandy Strait as a summer migrant.</p>	<p>It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass. Habitats include embayments, harbours, river estuaries, deltas and lagoons and are recorded less often in round tidal pools, rock-flats and rock platforms (Department of the Environment, 2019).</p> <p>Migratory shorebird of the EAA. The Great Sandy Strait is an important non-breeding site in Australia (Bamford <i>et al.</i>, 2008).</p> <p>Low risk of collision due to specific habitat preferences that restrict species distribution to intertidal areas. No habitat immediately adjacent west of Project Area (PLA) so short flights unlikely to occur.</p>	<p>Low</p>
<p>Bar-tailed godwit (<i>Limosa lapponica baueri</i> and <i>Limosa lapponica menzbieri</i>)</p>	<p>Unlikely in the Project Area (PLA).</p> <p>Known to occur in the Great Sandy Strait as a summer migrant.</p>	<p>Inhabits mainly in coastal areas such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays, around beds of seagrass, saltmarsh, coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats. Rarely found on inland wetlands or in areas of short grass, such as farmland, paddocks and airstrips (DoE, 2019; Morcombe, 2003).</p> <p>Breeds in eastern Russia and Alaska Migratory shorebird of the EAA. Seven important non-breeding sites in Australia; one being the Great Sandy Strait.</p> <p>Low risk of collision due to specific habitat preferences that restrict species distribution to intertidal areas. No habitat immediately adjacent west of Project Area (PLA) so short flights</p>	<p>Low</p>

Species	Likelihood of Occurrence	Distribution and Flight Behaviours	Susceptibility of Collision
		unlikely to occur.	
Lesser sand plover (<i>Charadrius mongolus</i>)	<p>Unlikely in the Project Area (PLA).</p> <p>Known to occur in the Great Sandy Strait as a summer migrant.</p>	<p>Within Australia, the lesser sand plover is widespread in coastal regions and has been recorded in all states. It mainly occurs in northern and eastern Australia, in south-eastern parts of the Gulf of Carpentaria, western Cape York Peninsula, islands in Torres Strait, and along the entire east coast (DoE Conservation Advice, 2016). It is most numerous in Queensland and New South Wales. Inhabits mud and sandflats in sheltered bays, estuaries, harbours, and occasionally rocky outcrops, sandy beaches and coral reefs. Roosting occurs near foraging areas (DoE, 2019).</p> <p>Migratory shorebird of the EAA. Seven important non-breeding sites in Australia; one being the Great Sandy Strait.</p> <p>Numbers begin to increase at various sites in northern Australia between February and April (mostly March to April), suggesting that birds move along the eastern and northern coasts before they leave on their northern migration in April (DoE, 2019)</p> <p>Low risk of collision due to specific habitat preferences that restrict species distribution to intertidal areas. No habitat immediately west of Project Area (PLA) so short flights unlikely to occur.</p>	Low
Whimbrel (<i>Numenius phaeopus</i>)	<p>Unlikely in the Project Area (PLA).</p> <p>Known to occur in the Great Sandy Strait as a summer migrant.</p>	<p>Often found in mudflats of estuaries, particularly those with mangroves. Occasionally found on sandy or rocky beaches, on coral or rocky islets, or on intertidal reefs and platforms (DoE, 2019).</p> <p>When they arrive, they move south along the east coast. Influxes (which are mostly temporary) occur at sites along the east coast during migration in August (north of 20°S), and in September-October (south of 20°S)</p>	Low

Species	Likelihood of Occurrence	Distribution and Flight Behaviours	Susceptibility of Collision
		<p>(DoE, 2019).</p> <p>When they depart Australia, Whimbrels begin migrating from February onwards (Higgins & Davies 1996). Influxes occur at most sites in Queensland from early March to early April. The birds leave the north and north-east coasts by late April (DoE, 2019).</p> <p>Migratory shorebird of the EAA. Non-breeding period in Australia (Bamford <i>et al.</i>, 2008).</p> <p>Low risk of collision due to specific habitat preferences that restrict species distribution to intertidal areas. No habitat immediately west of the Project Area (PLA) so short flights unlikely to occur.</p>	
Far eastern curlew (<i>Numenius madagascariensis</i>)	<p>Unlikely in the Project Area (PLA).</p> <p>Known to occur in the Great Sandy Strait as a summer migrant.</p>	<p>Associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sand flats (Morcombe, 2003).</p> <p>Migratory shorebird of the EAA. Non-breeding period in Australia (Bamford <i>et al.</i>, 2008).</p> <p>Low risk of collision due to specific habitat preferences that restrict species distribution to intertidal areas. No habitat immediately west of Project Area (PLA) so short flights unlikely to occur.</p>	Low

Table 8 provides a SIA for the seven (7) migratory shorebirds listed in Table 5. However, due to the common habitat preferences and flight behaviour of all the migratory shorebirds known to visit the Great Sandy Strait, it is also considered to represent those shorebirds. Refer to *Fox & Co Environmental (March 2020), Ecological Assessment Report, Forest Wind Project, Report FWH-03 (Appendix D)* for further details on all migratory shorebirds known or likely to visit the Great Sandy Strait during the Australian Summer months. The SIA has been undertaken in accordance with the *Matters of National Environmental Significance, Significant Impact Guidelines (1.1), Department of Environment (DoE), 2013*.

Table 8 Significant Impact Assessment for Migratory Shorebirds

Impact Criteria	Assessment
<p>An action is LIKELY to have a significant impact on a migratory species if there is a real chance or possibility that it will:</p>	
<p>Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species</p>	<p>The Project is set-back a minimum 4km from the Great Sandy Strait. The possibility of migratory birds passing through the site on their arrival and/or departure informed the BUS assessment design and timing (migratory periods). The 139 fixed-point BUS assessments were undertaken between 2016 and 2019. Refer to <i>Fox & Co Environmental (February 2020), Ecological Assessment Report, Forest Wind Project, Report FWH-03 (Section 3.4.3)</i> for further details on the BUS for the Project Area (PLA). No migratory shorebirds have been observed during the summer migratory periods. Shorebirds are very vocal when they depart, calling continuously to each other. In addition to not being sighted, no migratory shorebirds were heard calling over the site during summer migratory periods. The Project Area (PLA) is not considered an area of important habitat for migratory shorebirds as it is within a highly fragmented actively managed exotic pine plantation.</p> <p>There have been several studies on the climbing and flight speeds of coastal shorebirds when departing on long-distance migratory flights (Piersma <i>et al.</i> 1990 and 1997). Based on these studies, it is understood shorebirds depart in an elongated, shallow “V” formation, termed an “echelon” in flocks of between 5 and 250 birds, with occasional observations of larger flocks. They ascend rapidly and steeply, often resulting in being lost from sight while still ascending. Estimates of climb rate vary, however larger / heavier species of shorebirds are slower to ascend (Piersma <i>et al.</i> 1990, 1997). Observations of flight altitude using weather radar show that during migration, shorebirds fly at between 0.5 and 6 km (Piersma <i>et al.</i> 1990) however it is likely higher, as studies using radar from oceanic islands when the birds are in a long-flight, level pattern have reporting heights ranging from 2.6 km to 6 km above sea-level.</p> <p>Given the absence of migratory shorebird records within and/or flying over the Project Area (PLA) during known summer migratory periods over three summer seasons, the known steep and rapid ascent on departure and distance of a minimum of 4 km from the Great Sandy Strait, it is considered:</p> <ul style="list-style-type: none"> • migratory shorebirds present in the Great Sandy Strait during the summer months possibly arrive or depart in a north-south direction along the coast, avoiding the Project Area (PLA); • should migratory shorebirds pass through the Project Area (PLA), due to the rapid and steep rate of departure and distance of at least 4 km from the Great Sandy Strait, it is unlikely shorebirds would be flying at heights low enough to be impacted by the rotor swept area of the turbines. • Shorebirds have specific habitat preferences and are unlikely to

	<p>fly into the site.</p> <p>As such, the Project is considered unlikely to substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.</p> <p>Will not have a Significant Impact.</p>
<p>Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species</p>	<p>The Project Area (PLA) is not considered an area of important habitat for migratory shorebirds as it is within a highly fragmented and actively managed exotic pine plantation.</p> <p>Several invasive species which are a threat to all birds have been recorded in the Project Area (PLA) during surveys including feral cats and wild dogs.</p> <p>The Project is not expected to create conditions which would favour the increase in these species that are already present.</p> <p>The Project is not expected to result in an invasive species that is harmful to the migratory species becoming introduced and established in an area of important habitat for the migratory species.</p> <p>Will not have a Significant Impact.</p>
<p>Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species</p>	<p>There are no ecologically significant proportions of a migratory species populations within the Project Area (PLA). As above, given the absence of migratory shorebird records within and/or flying over the Project Area (PLA) during known migratory periods over three summer seasons, the known steep and rapid rate of departure and distance of a minimum of 4 km from the Great Sandy Strait, it is considered:</p> <ul style="list-style-type: none"> • migratory shorebirds present in the Great Sandy Strait during the Summer months possibly arrive or depart in a north-south direction along the coast, avoiding the Project Area (PLA); • should migratory shorebirds pass through the Project Area (PLA), due to the rapid and steep rate of departure and distance of at least 4 km from the Great Sandy Strait, it is unlikely shorebirds would be flying at heights low enough to be impacted by the rotor swept area of the turbines. • Shorebirds have specific habitat preferences and are unlikely to fly into the site. <p>As such, the Project is considered unlikely to seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.</p> <p>Will not have a Significant Impact.</p>

As a result of the SIA process, it is concluded that the Project will not have a Significant Impact on migratory shorebird species.

Other migratory (excluding shorebirds) or listed marine bird species either known to occur or with a moderate likelihood of occurrence are included in Table 9. Refer to *Fox & Co Environmental (February 2020), Ecological Assessment Report, Forest Wind Project, Report FWH-03 (Appendix D – Likelihood of Occurrence)* and *Fox & Co Environmental (2020). Forest Wind Bird and Bat Utilisation Survey, FWH-01 (Collision Risk Assessment (Section 4.2.2.1.1 Table 11))*.

Table 9 Migratory (non-shorebird) or Listed Marine Species Potentially Occurring and Known to Occur in Project Area (PLA)

Scientific Name	Common Name	EPBC Act ¹	Likelihood of Occurrence
Listed Migratory Species			
Migratory Marine Birds			
<i>Apus pacificus</i>	Fork-tailed Swift	MM, LM	Known to Occur
Migratory Terrestrial Species			
<i>Cuculus optatus</i>	Oriental cuckoo	MT	Moderate Potential
<i>Monarcha melanopsis</i>	Black-faced monarch	MT, LM	High Potential
<i>Monarcha trivirgatus</i> (syn. <i>Symposiarchus trivirgatus</i>)	Spectacled Monarch	MT, LM	Known to occur
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	MT, LM	High Potential
<i>Rhipidura rufifrons</i>	Rufous Fantail	MT, LM	High Potential
Listed Marine Species			
<i>Anseranas semipalmata</i>	Magpie Goose	LM	Moderate Potential
<i>Ardea alba</i> (syn. <i>A. modesta</i>)	Great Egret, White Egret	LM	Moderate Potential
<i>Ardea ibis</i> (syn. <i>Bubulcus ibis</i>)	Cattle egret	LM	Moderate Potential

Scientific Name	Common Name	EPBC Act ¹	Likelihood of Occurrence
Listed Migratory Species			
<i>Haliaeetus leucogaster</i>	White-bellied sea-eagle	LM	Moderate Potential
<i>Merops ornatus</i>	Rainbow bee-eater	LM	Known to Occur
<i>Coracina tenuirostris</i>	Cicadabird	LM	Known to Occur

¹ – EPBC Act: CE – Critically endangered, E – Endangered, V – Vulnerable, MM – Migratory Marine, MT – Migratory Terrestrial Species, ² - MW – Migratory Wetland Species, LM – Listed Marine Species

The SIA is undertaken for migratory (non-shorebird) and listed marine species below. Table 10 provides a SIA for fork-tailed swifts (FTS) undertaken in accordance with the *Matters of National Environmental Significance, Significant Impact Guidelines (1.1), Department of Environment (DoE), 2013*.

2.3.2 Fork-tailed Swifts (EPBC Act – MT, LM)

The fork-tailed swift (FTS) is a non-breeding migratory visitor to all states and territories of Australia and are found across a range of habitats, from inland open plains to wooded areas (Draft referral guidelines, 2015). The FTC is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher (DoE, 2020). FTS usually arrives in Australia around October with most birds having departed to return to their Northern Hemisphere breeding grounds by May (DoE, 2020).

FTS forage along the edge of low pressure systems and for that reason are considered a precursor to unsettled weather. Low pressure systems help to lift prey, such as insects, from the ground and assists in flight. Feeding flight is characterized by circular flight patterns throughout areas of high prey concentration. They feed in flocks ranging from 10 to 1000 birds (DoE, 2020).

The draft referral guidelines (2015) for 14 birds listed as migratory species lists important habitat (non-breeding habitat only) for FTS as “found across a range of habitats, from inland open plains to wooded areas, where it is exclusively aerial”.

There are no significant threats to the FTS in Australia. Potential threats include habitat destruction and predation by feral animals. The potential impacts are thought to be negligible due to the wide range of the species and habitat (DoE, 2020). There are no known harmful species (draft referral guidelines, 2015).

An ecologically significant proportion of the population is considered to be 1,000 individuals (for an internationally important proportion) or 100 individuals (for a nationally important proportion) (draft referral guidelines, 2015).

FTS were recorded during four of the 16 survey days (15 of the 139 fixed-point BUS assessments). One (1) survey (29 November 2018) recorded up to 51 individuals at one site (they were recorded at most sites assessed during that survey). Bushfires in the Wide Bay area on the 29 November 2018 (the small township of Tinnanbar was cut off by bushfires) correlated with the highest number of FTS recorded. This is consistent with their known flight behaviour

associated with up draughts or unsettled weather and associated insect disturbance. WTN were also recorded during the same survey.

Table 10 Significant Impact Assessment for Fork-tailed Swift

Impact Criteria	Assessment
<p>An action is LIKELY to have a significant impact on a migratory species if there is a real chance or possibility that it will:</p>	
<p>Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species</p>	<p>Tall buildings, wind turbines and overhead power lines are known to cause mortalities of migrating birds (draft referral guidelines, 2015). As they are large wind turbines and / or tall structures are considered to represent a potential substantial loss or modification of important habitat (draft referral guidelines, 2015).</p> <p>FTS are known to occur across Australia during summer months in a wide variety of landscapes. No important habitat threshold area has been determined for FTS or has been identified given lack of knowledge or rarity (draft referral guidelines, 2015).</p> <p>As FTS are widespread across Australia during summer months, the habitat above the Project Area (PLA) is not considered important habitat for this species.</p> <p>Surveys were undertaken to calculate numbers and heights to determine collision risk. Given the numbers are less than the ecologically significant proportion of the population (internationally and nationally), and the habitat is not considered important habitat for the species, the project is not expected to substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.</p> <p>Will not have a Significant Impact.</p>
<p>Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species</p>	<p>Invasive species harmful to FTS are unknown (draft referral guidelines, 2015).</p> <p>Most of the Project Area (PLA) is a highly modified environment consisting of exotic pine plantations and is not considered important habitat for the FTS and other migratory species known to occur or with a moderate potential to occur.</p> <p>Several invasive species which are a threat to all birds have been recorded on site during surveys including feral cats and wild dogs.</p> <p>The Project is not expected to create conditions which would favour the increase in these species which are already present.</p> <p>The Project is not expected to result in an invasive species that is harmful to the migratory species becoming introduced and established in an area of important habitat for the migratory species.</p>

	Will not have a Significant Impact.
<p>Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species</p>	<p>An ecologically significant proportion of the FTS population is considered to be 1,000 individuals (for an internationally important proportion) or 100 individuals (for a nationally important proportion) (draft referral guidelines, 2015).</p> <p>Surveys were undertaken to calculate numbers and heights to determine collision risk and whether flocks observed represented a significant proportion of the population. FTS were recorded during four of the 16 survey days (15 of the 139 fixed-point BUS assessments). One (1) survey (29 November 2018) recorded up to 51 individuals at one site (they were recorded at most sites surveyed during that particular survey). This is less than the ecologically significant proportion of the population.</p> <p>FTS are exclusively aerial. Although observed during BUS, given the widespread nature, highly variable occurrence and numbers observed less than the ecologically significant proportion of the population, the project is considered unlikely to seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of FTS.</p> <p>Ongoing utilisation surveys will be undertaken in accordance with the BBMP and Before and After Control Impact (BACI) survey design, which continues during and post-construction to assess impacts to monitor if the Project is causing disruption to birds across the PLA.</p> <p>Will not have a Significant Impact.</p>

Most of the Project Area (PLA) is a highly modified environment consisting of exotic pine plantations and is not considered important habitat for the migratory species known to occur or with a moderate potential to occur. The Project will not substantially modify, destroy or isolate an area of important habitat for a migratory species. The Project will not result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species. The Project will not seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species.

As a result of the SIA process, it is concluded that the Project will not have a Significant Impact on FTS.

2.3.3 Cuckoo, Monarch and Flycatcher Species (EPBC Act – MT, LM)

These bird species have the potential to occur or do occur (spectacled monarch) within the Project Area (PLA). They have been grouped together due to their important habitat preferences which may co-occur within remnant areas within the Project Area (PLA). The Project avoids clearing of remnant vegetation and therefore potential habitat for these species.

Further information on the preferred habitat and likelihood of occurrence of cuckoo, monarch and flycatcher species is provided in *Fox & Co Environmental (March 2020). Ecological Assessment Report, Forest Wind Project, Report FWH-03*.

Table 11 provides a SIA for cuckoo, monarch and fly-catcher species undertaken in accordance with the *Matters of National Environmental Significance, Significant Impact Guidelines (1.1), Department of Environment (DoE), 2013*.

Table 11 Significant Impact Assessment for Cuckoo, Monarch and Flycatcher Species

Impact Criteria	Assessment
<p>An action is LIKELY to have a significant impact on a migratory species if there is a real chance or possibility that it will:</p>	
<p>Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species</p>	<p>Most of the Project Area (PLA) is a highly modified environment consisting of exotic pine plantations and is not considered important habitat for the migratory species known to occur or with a moderate potential to occur</p> <p>Important habitat (non-breeding habitat only) for the following species is:</p> <ul style="list-style-type: none"> • Oriental cuckoo - monsoonal rainforest, vine thickets, wet sclerophyll forest or open <i>Casuarina</i>, <i>Acacia</i> or <i>Eucalyptus</i> woodlands. Frequently at edges or ecotones between habitat types (draft referral guidelines, 2015) • Black-faced monarch - Wet forest specialist, found mainly in rainforest and wet sclerophyll forest, especially in sheltered gullies and slopes with a dense understorey of ferns and/or shrubs (draft referral guidelines, 2015). • Spectacled monarch – Dense vegetation, mainly in rainforest but also in moist forest or wet sclerophyll and occasionally in other dense vegetation such as mangroves, drier forest and woodlands (draft referral guidelines, 2015). • Satin flycatcher - Eucalypt forest and woodlands, at high elevations when breeding. They are particularly common in tall wet sclerophyll forest, often in gullies or along water courses. In woodlands they prefer open, grassy woodland types. During migration, habitat preferences expand, with the species recorded in most wooded habitats except rainforests. Wintering birds in northern Qld will use rainforest - gallery forests interfaces, and birds have been recorded wintering in mangroves and paperbark swamps (draft referral guidelines, 2015). <p>As previously mentioned, wind farm infrastructure within the Project Area (PLA) avoids native vegetation by strategically placing wind turbines, compounds (operation and construction) within the pine plantations, therefore avoiding impacts to remnant vegetation and terrestrial and freshwater wetland habitat. Existing forestry tracks will be used to provide access within the Project Area (PLA) and therefore avoids disturbance to remnant vegetation and habitat.</p> <p>The Project is not expected to substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat</p>

	<p>for a migratory species.</p> <p>Will not have a Significant Impact.</p>
<p>Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species</p>	<p>Black Rat (<i>Rattus rattus</i>), invasive vines of riparian habitat (e.g. rubber vine (<i>Cryptostegia grandiflora</i>)) are invasive species harmful to black-faced monarch, spectacled monarch and satin flycatcher (draft referral guidelines, 2015).</p> <p>Harmful invasive species for oriental cuckoo are unknown.</p> <p>Several invasive species which are a threat to all birds have been recorded on site during surveys including feral cats and wild dogs.</p> <p>The Project is not expected to create conditions which would favour the increase in these species which are already present.</p> <p>The Project is not expected to result in an invasive species that is harmful to the migratory species being introduced and becoming established in an area of important habitat for the migratory species.</p> <p>Will not have a Significant Impact.</p>
<p>Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species</p>	<p>Oriental cuckoos, black-faced monarch and satin flycatchers were not recorded within the Project Area (PLA) during BUS assessments. Other than oriental cuckoo, they have previously been recorded within the Project Area (PLA), although records are at least 15 years old for black-faced monarch and satin flycatcher. A pair of spectacled monarchs were observed in the understory of the riparian vine forest along Tinana Creek near Raintree Bridge. Records of these species within the Project Area (PLA) are as follows:</p> <ul style="list-style-type: none"> • Black-faced monarch – 1 record (2005) (Wildnet 2020) • Satin flycatcher – 1 record (1974) (Wildnet 2020) • Spectacled monarch – 7 records (2007) and 2 individuals observed associated with the riparian area of Tinana Creek (2020). <p>A significant proportion of the population for each species is:</p> <ul style="list-style-type: none"> • Oriental cuckoo – 10,000 (international) and 1,000 (national) • Black-faced monarch - 4,600 (international) and 460 (national) • Satin flycatcher – 17,000 (international) and 1,700 (national) • Spectacled monarch – 6,500 (international) and 650 (national) <p>None of these species were observed in numbers considered to be an ecological significant population, or an ecologically significant proportion of the population</p>

	<p>Most of the Project Area (PLA) is a highly modified environment consisting of exotic pine plantations. There are large tracts of remnant vegetation outside of the Project Area in contrast to the mosaic of remnant and regrowth vegetation remaining within the Project Area. Remaining vegetation which might be utilised for resting, breeding or feeding habitat is avoided by siting most project infrastructure within the pine plantations.</p> <p>Ongoing utilisation surveys will be undertaken in accordance with the BBMP and BACI survey design, which continues during and post-construction to assess impacts to monitor if the Project is causing disruption to birds across the Project Area (PLA).</p> <p>Will not have a Significant Impact.</p>
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As a result of the SIA process, the Project will not impact populations of oriental cuckoo, black-faced monarch, spectacled monarch or satin flycatcher species.

2.4 Listed Marine Species

Listed marine bird species have been split into the following categories for the SIA:

- Wetland birds (magpie goose, great egret and cattle egret) (Table 12)
- Raptors (white-bellied sea eagle) (Table 13)
- Insectivores (rainbow bee-eater and cicadabird) (Table 14)

2.4.1 Wetland Species (EPBC Act – LM)

Magpie goose, great egret and cattle egret are EPBC Act listed marine species that share wetland habitats. They are not listed threatened species or listed migratory species.

Magpie geese are more common north of Rockhampton, however are known to occur in the region. Great egret and cattle egret are common and widespread and occur in a range of wetland habitats.

Table 12 Significant Impact Assessment for Listed Marine Wetland Species

Impact Criteria	Assessment
An action is LIKELY to have a significant impact on a migratory species if there is a real chance or possibility that it will:	
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	<p>Most of the Project Area (PLA) is a highly modified environment consisting of pine plantations and is not considered important habitat for the listed marine species with a moderate potential to occur</p> <p>As previously mentioned, wind farm infrastructure within the Project Area (PLA) avoids native vegetation by strategically placing wind turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and terrestrial and freshwater wetland habitat. Existing forestry tracks will be used to provide access within the Project Area (PLA) and therefore avoids disturbance to remnant and regrowth vegetation</p>

	<p>and habitat.</p> <p>The Project is not expected to substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a listed marine wetland species.</p> <p>Will not have a Significant Impact.</p>
<p>Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species</p>	<p>Most of the Project Area (PLA) is a highly modified environment consisting of exotic pine plantations and is not considered important habitat for the listed marine species known to occur or with a moderate potential to occur.</p> <p>Several invasive species which are a threat to all birds have been recorded on site during surveys including feral cats and wild dogs.</p> <p>The Project is not expected to create conditions which would favour the increase in these species which are already present.</p> <p>The Project is not expected to result in an invasive species that is harmful to the listed marine species becoming introduced and established in an area of important habitat for the listed marine species.</p> <p>Will not have a Significant Impact.</p>
<p>Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species</p>	<p>No previous records from the Project Area (PLA). However, considering the wide range of wetland habitats and wide range of occurrence, these species have potential to occur.</p> <p>No information is available on the significant proportion of their populations as they are not listed migratory species. Due to lack of previous and current records, it is considered unlikely the Project Area (PLA) contains important populations or ecologically significant proportions of the population.</p> <p>Most of the Project Area (PLA) is a highly modified environment consisting of exotic pine plantations. There are large tracts of remnant vegetation outside of the Project Area (PLA) in contrast to the mosaic of remnant vegetation remaining within the Project Area (PLA). Remaining vegetation which might be utilised for resting, breeding or feeding habitat is avoided by siting most project infrastructure within the exotic pine plantations.</p> <p>Ongoing utilisation surveys will be undertaken in accordance with the BBMP and use BACI survey design, which continues during and post-construction to assess impacts to monitor if the Project is causing disruption to birds across the Project Area (PLA).</p> <p>Will not have a Significant Impact.</p>

Magpie goose, great egret and cattle egret have a moderate potential to occur in the Project Area (PLA). These species were subject to the Collision Risk Assessment and were considered at low susceptibility of collision, given the lack of previous and current records and low numbers

moving through the site. Therefore the Project will not have a significant impact on listed marine wetland species such as magpie goose, great egret and cattle egret.

2.4.2 White-bellied Sea-eagle (EPBC Act – LM)

Occurs in predominantly coastal areas although also occurs far inland on large pools of rivers. Mostly over islands, reefs, headlands, beaches and estuaries. Known to occur on seasonally inundated swamps, lagoons and floodplains (Morcombe, 2003).

No White-bellied sea-eagles (WBSE) were observed within the Project Area (PLA) although they are known to occur in the Great Sandy Strait region.

Bird utilisation data collected by Biosis Research (2005) at a variety of wind farms and observations made during numerous assessments for other purposes, indicates that WBSE residing in coastal locations are almost entirely confined to a narrow zone and are rarely sighted more than 500 m inland (Section 2.3, Cumulative Impacts to White-bellied Sea-eagles, Biosis, 2005).

Avoidance rates of WBSE have been observed and also modelled on other wind farms in Australia. WBSE display 99% avoidance rates (Smales, 2005). Cumulative impact assessments of the impact of wind farms within Australia on WBSE (within the Australian WBSE range) have modelled a mortality rate of 0.9 individuals/year across approximately 50 wind farms (built and proposed). (Cumulative Impacts to White-bellied Sea-eagles, Biosis, 2005).

Table 13 Significant Impact Assessment for White-bellied sea-eagle

Impact Criteria	Assessment
<p>An action is LIKELY to have a significant impact on a migratory species if there is a real chance or possibility that it will:</p>	
<p>Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species</p>	<p>Most of the Project Area (PLA) is a highly modified environment consisting of exotic pine plantations and is not considered important habitat for tWBSE.</p> <p>As previously mentioned, wind farm infrastructure within the Project Area (PLA) avoids native vegetation by strategically placing wind turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and terrestrial and freshwaterwetland habitat. Existing forestry tracks will be used to provide access within the Project Area (PLA) and therefore avoids disturbance to remnant vegetation and habitat.</p> <p>The Project is not expected to substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for WBSE.</p> <p>Will not have a Significant Impact.</p>
<p>Result in an invasive species that is harmful to the migratory species becoming established in</p>	<p>Most of the Project Area (PLA) is a highly modified environment consisting of exotic pine plantations and is not considered important</p>

<p>an area of important habitat for the migratory species</p>	<p>habitat for the WBSE.</p> <p>Several invasive species which are a threat to all birds have been recorded on site during surveys including feral cats and wild dogs.</p> <p>The Project is not expected to create conditions which would favour an increase in these species which are already present.</p> <p>Will not have a Significant Impact.</p>
<p>Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species</p>	<p>WBSE have not been recorded within the Project Area (PLA). Preferred feeding habitat is along the coastline of the Great Sandy Strait.</p> <p>Ongoing utilisation surveys will be undertaken in accordance with the BBMP and use BACI survey design, which continues during and post-construction to assess impacts to monitor if the Project is causing disruption to birds across the Project Area (PLA).</p> <p>Will not have a Significant Impact.</p>

WBSE occur along the Great Sandy Strait. No WBSE have been recorded previously or recently within the Project Area (PLA). The WBSE were subject to the Collision Risk Assessment and were considered at low risk of impact due to low numbers moving through the Project Area (PLA) and preferred foraging habitat along the coastline outside of the Project Area (PLA).

As a result of the SIA process, the Project will not have a significant impact on WBSE populations.

2.4.3 Rainbow Bee-eater and Cicadabird

2.4.3.1 Rainbow Bee-eater

Rainbow bee-eaters are EPBC Act listed marine species. They are not listed threatened species or listed migratory species.

Rainbow bee-eaters were recorded on seven of the 16 survey days (10 of the 139 fixed-point BUS assessments). Birds were observed in small numbers with two birds or less recorded during fixed-point BUS assessments. There are no published estimates of the global or Australian population sizes. Consequently, it is not possible to determine what proportion of the global population occurs in Australia. The Australian population is not distinct; an unknown proportion of the Australian population migrates to Papua New Guinea and eastern Indonesia for the non-breeding period. The total population size of the rainbow bee-eater in Australia has not been estimated. However, the population size is assumed to be reasonably large based on reporting rates for the species (DoE, 2020). Rainbow bee-eater occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation (DoE, 2020).

The only actual, identified threat to the rainbow bee-eater is the introduced cane toad (*Rhinella marina*). Cane toads reduce the breeding success and productivity of the rainbow bee-eater by feeding on eggs and especially nestlings, and usurping and occupying nesting burrows (DoE, 2020). Introduced predators such as wild dogs and shooting by apiarists are also considered a potential threat.

The rainbow bee-eater is currently considered to be a low priority for management. The population size and population trends have not been quantified, but the population size is assumed to be reasonably large, and there is little documented evidence of population declines (DoE, 2020).

2.4.3.2 Cicadabird

Cicadabirds are EPBC Act listed marine species. They are not listed threatened species or listed migratory species.

Two (2) cicadabirds were observed at one location within the Project Area (PLA) in 2016.

Table 14 Significant Impact Assessment for Rainbow Bee-eater and Cicadabird

Impact Criteria	Assessment
<p>An action is LIKELY to have a significant impact on a migratory species if there is a real chance or possibility that it will:</p>	
<p>Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species</p>	<p>Most of the Project Area (PLA) is a highly modified environment consisting of exotic pine plantations and is not considered important habitat for either rainbow bee-eaters or cicadabirds</p> <p>Rainbow bee-eaters were recorded on seven of the 16 survey days (10 of the 139 fixed-point BUS assessments). Birds were observed in small numbers with two birds or less recorded during fixed-point BUS assessment.</p> <p>Two (2) cicadabirds were observed at one location within the Project Area (PLA) in 2016.</p> <p>As previously mentioned, wind farm infrastructure within the Project Area (PLA) avoids native vegetation by strategically placing wind turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and terrestrial and freshwaterwetland habitat. Existing forestry tracks will be used to provide access within the Project Area (PLA) and therefore avoids disturbance to remnant vegetation and habitat.</p> <p>The Project is not expected to substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for these species.</p> <p>Will not have a Significant Impact.</p>
<p>Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species</p>	<p>Most of the Project Area (PLA) is a highly modified environment consisting of pine plantations and is not considered important habitat for the migratory species known to occur or with a moderate potential to occur.</p> <p>Cane toads which are considered a threat to Rain bee-eaters were recorded within the Project Area (PLA).</p>

	<p>Several other invasive species which are a threat to all birds have been recorded on site during surveys including feral cats and wild dogs.</p> <p>The Project is not expected to create conditions which would favour the increase in these species which are already present.</p> <p>The Project is not expected to result in an invasive species that is harmful to the rainbow bee-eaters or cicadabirds becoming introduced and established within the Project Area (PLA).</p> <p>Will not have a Significant Impact.</p>
<p>Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species</p>	<p>There is no information on what constitutes an ecologically significant proportion of a population of rainbow bee-eaters or cicadabirds. However, given the low numbers observed and wide distribution, it is considered unlikely that the individuals observed represent an important population or significant proportion of a population.</p> <p>Most of the Project Area (PLA) is a highly modified environment consisting of exotic pine plantations. There are large tracts of remnant vegetation outside of the Project Area (PLA) in contrast to the mosaic of remnant vegetation remaining within the Project Area (PLA). Remaining vegetation which might be utilised for resting, breeding or feeding habitat is avoided by siting most project infrastructure within the exotic pine plantations.</p> <p>Rainbow bee-eaters were observed feeding in non-remnant areas over cleared-felled pine plantation areas. A collision risk assessment identified rainbow bee-eaters at moderate risk of collision, however given the low numbers and wide distribution, a significant impact to the population is considered unlikely.</p> <p>Ongoing utilisation surveys will be undertaken in accordance with the BBMP and use BACI survey design, which continues during and post-construction to assess impacts to monitor if the Project is causing disruption to birds across the Project Area (PLA).</p> <p>Will not have a Significant Impact.</p>

The rainbow bee-eater and cicadabird were subject to the Collision Risk Assessment and were considered at low risk of impact due to low numbers moving through the Project Area (PLA).

As a result of the SIA process, it is concluded that the Project will not have a significant impact on rainbow bee-eater and cicadabird populations.

2.5 Bats

2.5.1 Survey Effort

The echolocation calls of insectivorous bats were recorded using two (2) ultrasonic detectors (Songmeters) (SM2BAT® and SM4BAT) and stored on compact flash memory cards for later computer analysis and identification. The detector locations were selected based on:

- attempts to maximise diversity of bat species detected; and

- the degree to which the locations represent fauna habitat types within the Project Area (PLA).

Detectors were placed on the ground or on trees in suitably open areas (to maximise acoustic clarity) or flyways. Detectors were deployed across the Project Area (PLA) between 14 February 2019 and 26 March 2019. Songmeters were moved on a weekly basis over the 6-week period, which equates to 80 nights of recording. Batteries were changed each week and data was downloaded before re-deployment. All bat calls recorded were sent to a qualified and experienced bat-call analyst (Greg Ford; Balance Consulting) for identification.

A grey-headed flying-fox (GHFF) assessment was undertaken in accordance with the recommended DoEE survey approach (DoEE, 2019). Given GHFF occupies most areas in their distribution in highly irregular patterns, surveys based on animal sightings are unlikely to be reliable (DoEE, 2019). A more effective survey method is to search appropriate databases and other sources for the locations of camps, and to conduct vegetation surveys to identify feeding habitat (DoEE, 2019).

An inventory of the current status of 14 historical flying-fox camps within and near the scoping area was carried out on 7 December 2016 by Premise Australia (Premise, 2017). The locations of the flying-fox camps were informed by the DoE National Flying-fox Monitoring Viewer (DoE, 2015) and DES flying-fox roost monitoring locations (Department of Environment and Heritage Protection, 2016a). Species present and estimated camp size were recorded. Flying-foxes were observed leaving one camp (the closest camp to the Project Area (PLA)) for the evening to understand the general direction of travel relative to possible placement of turbines, although the dispersal direction may also be influenced by climatic conditions and food availability.

The DoE National Flying-fox Monitoring Viewer (informed by the DoE, National Flying-fox Monitoring Program (NFFMP) – flying-fox census) was again reviewed in 2019 to assess the status of the flying-fox camps in the region, given that camps fluctuate over time (utilisation, abundance and species present). The NFFMP determines camp activity, camp size and which of the four (4) flying-fox species are utilising the camp (grey-headed flying-fox (GHFF), little red flying-fox (LRFF), Spectacled flying-fox (SFF) and black flying-fox (BFF)).

Table 15 lists the threatened bat species potentially occurring within and adjacent to the Project Area (PLA).

Table 15 Threatened Bat Species Potentially Occurring in Project Area (PLA)

Scientific Name	Common Name	EPBC Act ¹
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V

¹ – EPBC Act: CE – Critically endangered, E – Endangered, V – Vulnerable, MM – Migratory Marine, MT – Migratory Terrestrial Species, ² - MW – Migratory Wetland Species, LM – Listed Marine Species

2.5.2 Grey-headed Flying-fox (EPBC Act – V)

2.5.2.1 Habitat and Population

GHFF is a canopy-feeding frugivore and nectarivore, which utilises vegetation communities including rainforests, open forests, closed and open woodlands, *Melaleuca* swamps and *Banksia*

woodlands (DoE, 2019). Camp sites are typically located near water, such as lakes, rivers or the coast.

The GHFF is highly mobile and the national population is fluid, moving up and down the east coast in response to food availability (DoE, 2019) from Rockhampton in central Queensland to Melbourne, Victoria. GHFF presence will be dependent on food resources. The time and location of flowering and fruiting of diet plants varies among seasons and years. In particular, drought years can have a strong influence on eucalypt flowering times. Sites noted as important in one year or period may not be visited again in the following year (DoE, 2019).

There are seven (7) known GHFF camps within 50 km of the Project Area (PLA) (refer Table 16). The definition of a Nationally Important GHFF Camp is defined for the management of GHFF and Spectacled Flying-fox camps, specifically relating to *in-situ* camp management. Camps that have contained $\geq 10,000$ GHFF in more than one year in the last 10 years, or have been occupied by more than 2,500 GHFF permanently or seasonally every year for the last 10 years (*EPBC Policy Statement, September 2015*) are considered Nationally Important Camps.

Four (4) of the seven (7) camps in proximity to the Project Area (PLA) are Nationally Important Flying-fox Colonies (Maaroom, Glenwood Varley Road, Gympie and Woocoo), which are a minimum 4 km, 14 km, 30 km and 40 km from the nearest turbine, respectively. The Gympie colony is 66 km from the furthest turbine, while Woocoo is 65 km from the furthest turbine. Vast areas of foraging habitat are present between the camps and the Project Area (PLA), with significantly less foraging habitat within the Project Area (PLA) compared to outside (with a 15 km and 50 km foraging zone) (refer Figure 2)

The two closest camps are Anderleigh Road (9 km and 49 km (closest and furthest turbine)) and Maaroom (4 km and 42 km) (Maaroom is Nationally Important Camp). These camps are known to fluctuate over time, however surveys undertaken since 2012 for the National Flying-fox Monitoring Program indicate they generally average between 2,500 – 9,999 (category 3) individuals.

An important population (as per the Significant Impact Criteria) is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

1. key source populations either for breeding or dispersal
2. populations that are necessary for maintaining genetic diversity, and/or
3. populations that are near the limit of the species range.

The national population of the GHFF is spatially structured into colonies, however, there are no separate or distinct populations due to the constant genetic exchange and movement between camps throughout the species' entire geographic range. This indicates that there is one single interbreeding population (DoE, 2020). As such, each individual camp is not considered a key source population (criteria 1 above), nor is each individual camp necessary for maintaining genetic diversity (criteria 2 above). As such, all of the camps collectively represent an important population due to the constant dispersal and genetic exchange. As the distribution extends from Rockhampton to Melbourne, the camps within the region are not near the limit of the species range (criteria 3 above).

Table 16 Grey-headed flying-fox Camps within 50km of the Project Area (PLA)

Camp Name/ ID	Distance from turbines (km)		Counts/Category during most recent known activity	Date of survey activity	Notes
	Minimum	Maximum			
Glenwood Varley Road (53)	16km	39km	16,000 – 49,000 (category 5)	August 2018	≥10,000 GHFF three times in the last 10 years (2012, 2015, 2018)
Maaroom, Esplanade (209)	4km	42km	500 – 2,499 (category 2)	May 2018	≥ 10,000 GHFF twice in the last 10 years (2015, 2017)
Goomboorian, Anderleigh Road Ginger Creek (55)	9km	49km	2,500 – 9,999 (category 3)	August 2018	
Maryborough, Kent Street (88)	12km	51km	1-499 (category 1)	May 2018	No GHFF in November 2018
Maryborough, Albion Road Wetlands (Island Plantation) (87)	14km	55km	10,000 – 15,999 (category 4)	May 2017	
Gympie (59)	30km	66km	500-2,499 (category 2)	February 2018	Nationally Important GHFF Colony
Woocoo (171)	40km	65km	>50,000 (category 6)	November 2018	Nationally Important GHFF Colony. Located in Woocoo National Park

GHFF require foraging resources and roosting sites (DoEE, 2019). No roosts are known within the Project Area (PLA) however the mosaic of remnant vegetation amongst the exotic pine plantations may occasionally provide foraging resources such as when the vegetation is in flower. GHFF usually forage up to 15 km of the day roost site, although they are capable of nightly foraging flights of up to 50 km from their camp as resource availability changes (DoEE, 2019). Irregular GHFF migration may also occur between camps subject to food availability.

Within these 15 km and 50 km foraging zones from each camp, most of the available GHFF foraging habitat (96 – 100%) is outside of the Project Area (PLA) (ie. 0-4% within the Project

Area (PLA)). Refer to Figure 2 for the foraging areas of each GHFF camp and Table 17 for the areas and proportions of available foraging habitat. This demonstrates the low likelihood of foraging behaviour within the Project Area (PLA) as opposed to the available foraging habitat and associated behaviour outside the Project Area (PLA).

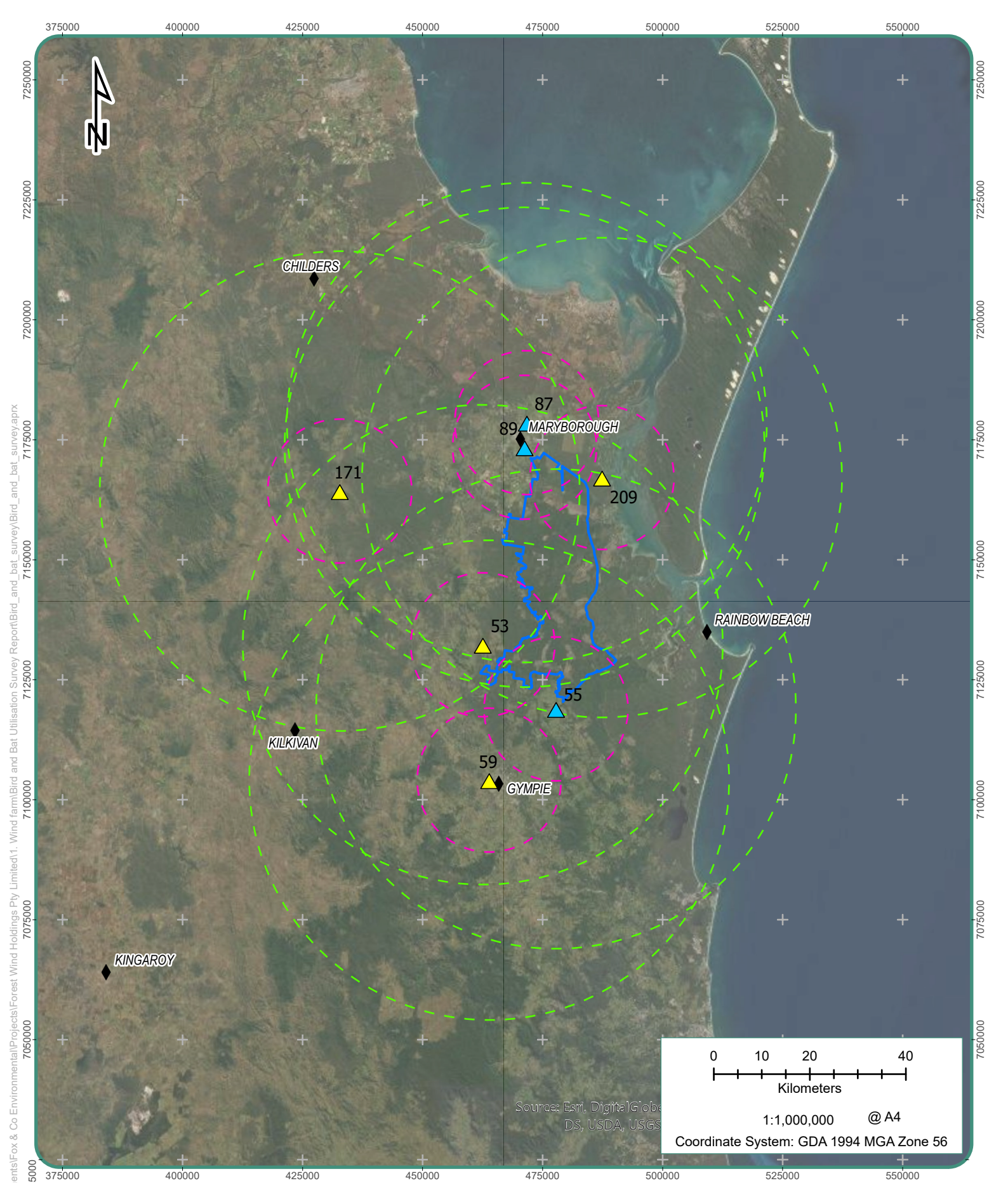
Calculations are considered conservative as they exclude non-remnant vegetation outside the Project Area (PLA) which could also include orchards, street trees and regrowth vegetation (which is largely absent from the Project Area (PLA) in comparison) which would provide additional foraging habitat outside of the Project Area (PLA).

Table 17 GHFF Foraging Habitat Outside / Inside of Project Area (PLA)

GHFF Camp	Foraging radius from camp	Mapped remnant vegetation outside Project Area (PLA) within foraging radius (ha)	Mapped remnant vegetation inside Project Area (PLA) within foraging radius (ha)	Total remnant within foraging radius	% of Foraging Habitat	
					Outside Project Area (PLA)	Inside Project Area (PLA)
Glenwood	15km	35,514	142	35,657	99.60%	0.4%
	50km	394,078	8,887	402,965	97.79%	2.21%
Maaroom	15km	29,454	737	30,191	97.56%	2.44%
	50km	334,648	8,887	343,535	97.41%	2.59%
Goomborium	15km	29,488	1,281	30,769	95.84%	4.16%
	50km	349,507	8,853	358,360	97.53%	2.47%
Maryborough Albion Road	15km	33,531	53	33,585	99.84%	0.16%
	50km	398,666	7,850	406,516	98.07%	1.93%
Gympie	15km	29,917	0	29,917	100.00%	0.0%
	50km	408,925	6,643	415,568	98.40%	1.6%
Woocoo	15km	46,740	0	46,740	100.00%	0.0%
	50km	420,312	3,404	423,717	99.20%	0.8%

Maryborough	15km	29,563	197	29,760	99.34%	0.66%
Tinana Crescent	50km	400,221	8,822	409,043	97.84%	2.16%

The above table excludes non-remnant areas (which could also be foraging areas such as orchards outside of the Project Area (PLA)) and waterways (including oceans, estuaries and canals).



TITLE:
Grey headed flying-fox potential foraging distances

- LEGEND**
- ▲ Grey headed flying-fox camp
 - ▲ Nationally important flying-fox camp
 - ◆ Populated places
 - Project Area (PLA)
 - Flying-fox camp 15km buffer
 - Flying fox camp 50km buffer

MAP NO: Figure 7

PROJECT: Forest Wind Holdings Pty Ltd - Bird & Bat Utilisation Survey



Date: 10/02/2020

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

Document Path: C:\Users\greenvalle\Documents\Fox & Co Environmental\Projects\Forest Wind Holdings Pty Limited\1. Wind farm\Bird and Bat Utilisation Survey Report\Bird_and_Bat_Utilisation_Survey\Bird_and_Bat_Utilisation_Survey.aprx

The relatively small amount of native vegetation within the Project Area (PLA) (0% - 4.16% of available remnant foraging habitat with a 15km and 50km radius from the camp) is not considered core foraging habitat compared to the surrounding native state forests and National Parks, outside of the Project Area (PLA). The exotic pine plantations within the Project Area (PLA) are not considered important habitat for GHFF. However, the NSF portion of the Project Area (PLA) does provide foraging habitat as GHFF were observed in the eucalypts in this part of the Project Area. This is located in the south-west portion of the Project Area (PLA) away from turbines and no infrastructure is currently proposed for this portion of the Project Area. Local populations dispersing at night are also likely to be below the RSA height.

Infrequent collision due to local dispersal flight height, absence of roosts within the Project Area (PLA), camp size (category 3) and the widespread distribution of preferred foraging habitat outside of the Project Area (PLA) is therefore considered to pose a low risk to the National population.

2.5.2.2 Avoidance, Management and Mitigation

Avoidance is the guiding principle to minimise impacts on all flora and fauna, particularly MNES within the Project Area (PLA). Avoidance measures utilised in the Project to minimise impacts on GHFF include:

- The Project Area (PLA) is located within an existing exotic pine plantation and predominantly avoids remnant vegetation and therefore possible foraging habitat.
- Electrical cabling will mostly be underground along existing access tracks which will further reduce the likelihood of collision of bats.
- Other infrastructure such as construction compounds avoid remnant vegetation and waterways and therefore avoid damage to remnant areas of natural habitat.
- Existing forestry tracks will be used to provide access within the Project Area (PLA) and therefore avoids disturbance to remnant vegetation and foraging habitat within remnant areas.

Following all avoidance measures, additional management activities, controls and mitigation measures will be implemented in accordance with the Bird and Bat Management Plan (Fox & Co, 2020) and will include:

- The bird and bat management plan outlines measures to monitor regional GHFF camps and activity during known periods of camp utilization and activity (flowering periods when a camp is active) (*Fox & Co Environmental (February 2020). Forest Wind Bird and Bat Management Plan, FWH-02*).
- Mortality / carcass monitoring by an ecologist or trained detection dog or other approved method.
- Trial acoustic and/or sonar bat deterrents.
- Slow rotor speeds or temporary shutdown of subject turbines at times of peak activity.
- Pre-construction, post-construction and interim operational reporting, including annual reporting for bat data and assessment

A SIA on the population of GHFF (*Pteropus poliocephalus*) is provided in Table 18.

Table 18 Significant Impact Assessment for Grey-headed Flying-fox (EPBC – V)

Impact Criteria	Assessment
An action is LIKELY to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
<p>Lead to a long-term decrease in the size of an important local population of a species.</p>	<p>The national population of GHFF is spatially structured into colonies, however due to the movement of GHFF between camps, there are no separate or distinct populations (DoE, 2019), indicating there is a single national interbreeding population. The national population of the GHFF is spatially structured into colonies (DoE, 2019). However, there are no separate or distinct populations due to the constant genetic exchange and movement between camps throughout the species' entire geographic range. This indicates that there is one single interbreeding population (DoE, 2019). The last National Flying-fox count (undertaken in 2005) estimated the National population at approximately 674,000, however these estimates are based on incomplete knowledge of camp location and use (DoE, 2019). Due to its wide distribution and extensive mobility, annual national counts of the GHFF have not taken place since 2005 (DoE, 2019).</p> <p>The local population is part of the one single interbreeding national population. This national population is highly mobile moving up and down the east coast searching for food, responding to changes in the amount of available food results in irregular movement pattern between camps.</p> <p>No camps will directly be impacted by the Project.</p> <p>The operation of the Project has the potential to cause some GHFF mortality due to collision with rotor blades, whilst flying through the site or foraging in the small remnant patches during flowering periods. Collision is likely to be infrequent considering the minimal amount of available foraging habitat within the Project Area (PLA) compared to outside the Project Area (PLA) (predominantly exotic pine plantation within the Project Area (PLA)) and no known roosts are within the Project Area (PLA). GHFF were observed feeding on eucalypt blossoms within the NSF portion of the Project Area, however nocturnal surveys undertaken during the same week within the remnant areas amongst the pine plantations did not report any GHFF presence although the same eucalypt species were in flower at the same time.</p> <p>Given the small amount of foraging habitat and no known roosts within the Project Area (PLA), the Project is considered unlikely to lead to a long-term decrease in the size of an important local population of a species.</p> <p>Will not have a Significant Impact.</p>
<p>Reduce the area of occupancy of an important population</p>	<p>GHFF camps are highly mobile. No known camps are within the Project Area (PLA) and there is limited foraging habitat within the Project Area (PLA). The Project is unlikely to reduce the area of</p>

	<p>occupancy of an important population.</p> <p>Will not have a Significant Impact.</p>
Fragment an existing important population into two or more populations	<p>As mentioned above, the GHFF population is considered to be one (1) Nation-wide population given the high migration between camps. The Project is not expected to fragment an existing important population into two or more populations.</p> <p>Will not have a Significant Impact.</p>
Adversely affect habitat critical to the survival of a species	<p>No roosting habitat will be disturbed by the Project. Very little foraging habitat is present within the Project Area (PLA) compared to outside of the Project Area (PLA). Minimal clearing of remaining remnant vegetation within the Project Area (PLA) is proposed.</p> <p>The project is not expected to affect habitat critical to the survival of GHFF.</p> <p>Will not have a Significant Impact.</p>
Disrupt the breeding cycle of an important population	<p>No camps are proposed to be disturbed by the Project. The Project is not expected to disrupt the breeding cycle of an important population of GHFF.</p> <p>Will not have a Significant Impact.</p>
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	<p>As previously mentioned, most of the available foraging habitat of the camps in the region is outside of the Project Area (PLA). Given the large amount of available foraging habitat outside of the Project Area (PLA), the Project is not expected to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p> <p>Will not have a Significant Impact.</p>
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	<p>No invasive species are currently listed as a threat to GHFF (DoE, 2019).</p> <p>Will not have a Significant Impact.</p>
Introduce disease that may cause the species to decline	<p>The effects of the pathogens, Australian Bat Lyssavirus (ABL), Bat Paramyxovirus and Menangle Pig virus (Hoar <i>et al.</i> 1998), on the GHFF are unknown. However, the incidence of ABL in the species is very low while approximately 25% of wild flying-foxes carry antibodies to Menangle Pig virus (University of Sydney, 2000) (DoE, 2019). The Project is not expected to introduce disease that may cause the species to decline.</p> <p>Will not have a Significant Impact.</p>

Interfere substantially with the recovery of the species	<p>No camps are directly impacted by the Project. Minimal foraging habitat is present within the Project Area (PLA) compared to outside the Project Area (PLA). The Bird and Bat Management Plan (Fox & Co 2020) outlines measures to monitor GHFF during known periods of activity (flowering periods when a camp is active). The Project is not expected to interfere substantially with the recovery of the species.</p> <p>Will not have a Significant Impact.</p>
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The GHFF is highly mobile and the national population is fluid, moving up and down the east coast in search of food. GHFF are considered to be one single, highly mobile interbreeding population. There are no known camps within the Project Area (PLA). Regional camps within 50 km of the Project Area (PLA) are often mixed with black flying-fox and /or little red flying-fox. Camp occupancy and numbers fluctuate over time, generally depending on seasons and availability of food resources.

There is limited foraging habitat within the Project Area (PLA) compared to foraging habitat available outside of the Project Area (PLA). There are no known GHFF camps within the Project Area (PLA).

As a result of the SIA process, it is concluded that the Project will not have a Significant Impact on GHFF.

2.6 Mammals (excluding bats)

Suitable habitat exists within the remnant vegetation patches within the exotic pine plantation for four (4) non-flying mammal species (koala (*Phascolarctos cinereus*), southern greater glider (*Petauroides volans volans*), water mouse (*Xeromys myoides*) and long-nosed potoroo (*Potorous tridactylus tridactylus*)) (Table 19).

Remnant vegetation will not be cleared for construction of the wind farm infrastructure within the Project Area (PLA). However, minimal clearing is expected for potential upgrades of existing waterway crossings on forestry access tracks. Provided remnant vegetation is avoided, impacts on these species are not expected.

Table 19 Threatened Mammals (excluding bats) Species Potentially Occurring and Known to Occur in the Project Area (PLA)

Scientific Name	Common Name	EPBC Act ¹	Likelihood of Occurrence
<i>Petauroides volans volans</i>	Southern greater glider	V	Low-moderate potential to occur in NSF area
<i>Phascolarctos cinereus</i>	Koala	V	Known to occur in NSF area

Scientific Name	Common Name	EPBC Act ¹	Likelihood of Occurrence
<i>Xeromys myoides</i>	Water mouse	V	Moderate potential to occur
<i>Potorous tridactylus tridactylus</i>	Long-nosed potoroo	V	Low – moderate potential to occur

¹ – EPBC Act: CE – Critically endangered, E – Endangered, V – Vulnerable

2.6.1 Koala (EPBC Act – V)

2.6.1.1 Survey Effort

Koala surveys were undertaken in the NSF portion of the Project Area (PLA) using a trained koala scat detector dog from the University of the Sunshine Coast (USC, 2019). A total of 20 surveys were undertaken over two (2) days. Koala scats were recorded within the NSF portion of the Project Area (PLA). Habitat utilization determined from systematic surveys is considered low at approximately between 0-6%. From the age of scats found (ranged from days to months old), this suggests variability in the time frames that koalas were present. Numerous scats approximately one (1) month old were found near Mt Eaton Creek.

2.6.1.2 Habitat and Populations

Koalas may occur in remnant patches along waterway corridors within the Project Area (PLA). It is possible that koalas may utilise creek lines for movement corridors within remnant vegetation in the Project Area (PLA). Clearing remnant vegetation within the Project Area (PLA) is not required. No infrastructure is proposed for the NSF portion on the Project Area (PLA) at this stage. The Project Area (PLA) consists largely of exotic pine plantation of various ages as the crop is grown on a 27-30 year harvesting cycle, with approximately 3,000 ha / year of pine plantation harvesting undertaken within the Project Area (PLA). The sensitivity of the existing environment in these plantation areas is less than the remnant areas within and adjacent to the Project Area (PLA). Project infrastructure has specifically been sited in the exotic pine plantation areas to avoid potential impacts on MNES such as koalas. Whilst not considered preferred habitat, koalas may potentially take refuge in an exotic pine tree if disturbed whilst moving across the ground between food trees.

2.6.1.3 Avoidance, Management and Mitigation

Avoidance is the guiding principle to minimise impacts on all flora and fauna, particularly MNES within the Project Area (PLA). Avoidance measures utilised in the Project to minimise impacts on koalas include:

- The Project Area (PLA) is located within an existing exotic pine plantation and predominantly avoids clearing of remnant vegetation and therefore possible koala habitat.

- Electrical cabling will mostly be underground along existing access tracks which will further reduce the amount of clearing required for infrastructure.
- Other infrastructure such as construction compounds avoid remnant vegetation and waterways and therefore avoid damage to remnant areas of natural habitat and potential corridors for koala movement.
- Existing forestry tracks will be used to provide access within the Project Area (PLA) and therefore avoids disturbance to remnant vegetation and habitat within remnant areas.
- Pre-clearance surveys to be undertaken to ensure koalas are not taking refuge in a pine tree adjacent to remnant vegetation.

Table 20 provides the Koala Habitat Assessment Tool results for the Project Area (PLA). Koalas have been identified within the NSF portion of the Project Area (PLA), yet not within the broader Project Area (PLA) within the pine plantations. For transparency these distinct areas have been split for the habitat assessment.

Table 20 Koala Habitat Assessment Tool

Attribute	Score	Coastal	NSF Portion of Project Area (PLA)	Pine Plantation Portion of Project Area (PLA)
Koala occurrence	+2 (high)	Evidence of one or more koalas within the last 2 years.	2	
	+1 (medium)	Evidence of one or more koalas within 2 km of the edge of the impact area within the last 5 years.		
	0 (low)	None of the above.		0
Vegetation composition	+2 (high)	Has forest or woodland with two or more known koala food tree species, OR one food tree species that alone accounts for >50% of the vegetation in the relevant strata.	2	2
	+1 (medium)	Has forest or woodland with only one species of known koala food tree present.		
	0 (low)	None of the above.		
Habitat	+2	Area is part of a contiguous	2	

Attribute	Score	Coastal	NSF Portion of Project Area (PLA)	Pine Plantation Portion of Project Area (PLA)
connectivity	(high)	landscape ≥500 ha.		
	+1 (medium)	Area is part of a contiguous landscape <500 ha, but ≥300 ha.		
	0 (low)	None of the above.		0
Key existing threats	+2 (high)	Areas which score 0 for koala occurrence and have no dog or vehicle threat present		
	+1 (medium)	Areas which score 0 for koala occurrence and are likely to have some degree dog or vehicle threat present.	1	1
	0 (low)	Areas which score 0 for koala occurrence and have a significant dog or vehicle threat present.		
Recovery value	+2 (high)	Habitat is likely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1 (of the koala referral guidelines).		
	+1 (medium)	Uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	1	
	0 (low)	Habitat is unlikely to be important for achieving the interim recovery objectives for the relevant context, as outlined		0

Attribute	Score	Coastal	NSF Portion of Project Area (PLA)	Pine Plantation Portion of Project Area (PLA)
		in Table 1.		
	TOTAL		8	3

Although the NSF portion of the Project Area (PLA) has a habitat score of 8, no clearing is proposed within this area. Two of the three points scored within the pine plantation areas is conservatively attributed to the remnant vegetation within the plantation, which are also avoided by the Project. The Project is not considered to have an adverse effect on habitat critical to the survival of the koala. Further details are provided in Table 21, which provides a SIA for koala undertaken in accordance with the *Matters of National Environmental Significance, Significant Impact Guidelines (1.1), Department of Environment (DoE), 2013* and the *EPBC Act referral guidelines for the vulnerable koala, DoE, 2014* (koala referral guidelines).

Table 21 Significant Impact Assessment for Koala (EPBC – V)

Impact Criteria	Assessment
<p>An action is LIKELY to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:</p>	
<p>Lead to a long-term decrease in the size of an important population of a species.</p>	<p>Wind Farm infrastructure within the Project Area (PLA) avoids remnant vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and terrestrial and aquatic habitat. Access is via existing forestry tracks. Remnant vegetation within the Project Area (PLA) for internal distribution lines will be spanned where possible.</p> <p>Given the lack of previous records or lack of recent previous records and minimal remnant vegetation disturbance by siting infrastructure away from remnant vegetation on site, the Project is not expected to lead to a long-term decrease in the size of an important population of a species.</p> <p>Will not have a Significant Impact.</p>
<p>Reduce the area of occupancy of an important population.</p>	<p>As above, given the lack of previous records or lack of recent previous records and minimal remnant vegetation disturbance by siting infrastructure away from remnant vegetation on site, the Project is not expected to reduce the area of occupancy of an important population.</p> <p>Will not have a Significant Impact.</p>

<p>Fragment an existing important population into two or more populations</p>	<p>The Project Area (PLA) is already extremely fragmented with a network of linear remnant corridors often associated with waterways, existing as a mosaic with the broader pine plantation.</p> <p>Remnant vegetation in these areas is retained as project infrastructure has been strategically sited to avoid impacts on the remaining remnant vegetation on site.</p> <p>The Project is not expected to fragment an existing important population into two or more populations.</p> <p>Will not have a Significant Impact.</p>
<p>Adversely affect habitat critical to the survival of a species</p>	<p>Wind Farm infrastructure within the Project Area (PLA) avoids remnant vegetation by strategically placing turbines, compounds (operation and construction) within the pine plantations, therefore avoiding impacts to remnant vegetation and terrestrial habitat.</p> <p>While koalas may potentially take refuge up an exotic pine tree, the areas of pine plantation proposed to be cleared are not habitat critical to the survival of the species.</p> <p>The Project is therefore not expected to adversely affect habitat critical to the survival of a species.</p> <p>Will not have a Significant Impact.</p>
<p>Disrupt the breeding cycle of an important population</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation by strategically placing turbines, compounds (operation and construction) within the pine plantations, therefore avoiding impacts to native vegetation and terrestrial habitat.</p> <p>The Project is not expected to disrupt the breeding cycle of an important population.</p> <p>Will not have a Significant Impact.</p>
<p>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to native vegetation and terrestrial habitat.</p> <p>The Project is not expected to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p> <p>Will not have a Significant Impact.</p>
<p>Result in invasive species that are harmful to a vulnerable species becoming established in</p>	<p>Several invasive species which are a threat to koalas have been recorded within the Project Area (PLA) during surveys including feral cats and wild dogs. Dense weed populations may also hinder on-ground movement by koalas between trees. The pine plantation</p>

<p>the vulnerable species' habitat</p>	<p>licensee undertakes regular weed management as part of their silviculture processes.</p> <p>The Project is not expected to result in invasive species that are harmful to a vulnerable species becoming introduced and established in the vulnerable species' habitat. The project is not expected to lead to an increase in existing invasive species.</p> <p>Will not have a Significant Impact.</p>
<p>Introduce disease that may cause the species to decline</p>	<p>The most well-known disease present in the koala population is associated with particular strains of <i>Chlamydia</i>. Koala Retrovirus (KoRV) was recently identified and is thought to be responsible for a range of conditions, including leukaemia and an immunodeficiency syndrome (DoE, 2019).</p> <p>There is circumstantial evidence that chlamydiosis might increase in response to environmental stresses such as overcrowding and poor nutrition.</p> <p>As impacts to native vegetation within the Project Area (PLA) is avoided, additional stress (and therefore possible increase in <i>Chlamydia</i>) as a result of clearing is unlikely to occur.</p> <p>The Project is not expected to introduce disease that may cause the species to decline.</p> <p>Will not have a Significant Impact.</p>
<p>Interfere substantially with the recovery of the species</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation by strategically placing turbines, compounds (operation and construction) within the pine plantations, therefore avoiding impacts to remnant vegetation and terrestrial habitat.</p> <p>For koalas this could include the following (as per the koala referral guidelines):</p> <ul style="list-style-type: none"> • Increasing koala fatalities in habitat critical to the survival of the koala due to wild dog attack and vehicle strikes to a level that is likely to result in multiple, ongoing fatalities; or • Facilitating the introduction or spread of disease or pathogens for example <i>Chlamydia</i> or <i>Phytophthora cinnamomi</i>, to habitat critical to the survival of the koala, that are likely to significantly reduce the reproductive output of koalas or reduce the carrying capacity of the habitat • Creating a barrier to movement between or within habitat critical to the survival of the koala that is likely to result in a long-term reduction in genetic fitness or access to habitat critical to the survival of the koala • Changing hydrology which degrades habitat critical to the survival of the koala to the extent that the carrying capacity of the habitat is reduced in the long-term

	<p>As mentioned above, the Project is not expected to introduce diseases, modify or destroy koala habitat, create barriers to movement or increase the level of predatory species.</p> <p>As the Project Area (PLA) is a working exotic pine plantation, any increases in traffic volumes for construction will be managed in accordance with the construction Environmental Management Plan (EMP), this will include speed limit restrictions on haul roads.</p> <p>The Project is not expected to interfere substantially with the recovery of the species.</p> <p>Will not have a Significant Impact.</p>
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Koala habitat within the NSF portion of the Project Area (PLA) contains high quality core habitat critical to the species survival (habitat score of 8 (refer Table 20)). The broader exotic pine plantation area of the Project Area (PLA) scored three (3) on the koala habitat assessment tool (2 of the 3 points attributed to the remnant vegetation which is avoided).

Koala habitat within the NSF portion of the Project Area (PLA) is not proposed to be impacted by the Project. Should koalas occur within the mosaic of remnant vegetation amongst the exotic pine plantation within the Project Area (PLA), these will not be impacted by the Project as the project infrastructure has specifically been sited within the exotic pine plantations to avoid areas of remnant vegetation. Pre-clearance surveys will be undertaken and fauna spotter catchers with koala experience will also be utilised during clearing of pine trees to ensure koalas are not taking refuge amongst the pine.

As a result of the SIA process, it is concluded that the Project will not have a Significant Impact on koalas. Given the avoidance measures proposed, the Project is not considered to have a significant impact on koalas.

2.6.2 Water Mouse (EPBC Act – V)

2.6.2.1 Survey Effort

Targeted surveys were not undertaken for water mouse, nor were they considered required due to their habitat preferences and avoidance of low-lying remnant areas.

2.6.2.2 Habitat and Populations

Water mouse have previously been recorded in the region with previous records within Tuan State Forest and one (1) record (from 1999) (Wildnet 2020) in the Project Area (PLA). Marginal suitable habitat exists within the Project Area (PLA) within the small patches of remnant freshwater wetlands areas.

Water mouse has been recorded in coastal saltmarsh, mangrove and adjacent freshwater wetland habitats in Queensland (National Recovery Plan, 2010). Important populations in the Wide Bay area are within the Great Sandy National Park, Great Sandy Conservation Park and Poona National Park. Within the Great Sandy Strait, south-east Queensland, some populations of water mouse are located within the Fraser Island World Heritage Area and others occur within the Wide Bay Military Reserve. A large proportion of the water mouse populations in the Great Sandy Strait and Moreton Bay areas of south-east Queensland occur in inter-tidal habitats within the Great Sandy Strait and Moreton Bay Ramsar Sites which are not within the Project Area (PLA).

The principal threat in Queensland to water mouse populations is habitat loss, through clearing and fragmentation and habitat degradation due to altered hydrology. Additional threats that may contribute to local population extinctions include site-specific impacts from introduced animals, recreational vehicles, habitat modification including by changes in soil chemistry due to disturbance of acid sulphate soils, and pesticide applications (National Recovery Plan, 2010).

2.6.2.3 Avoidance, Management and Mitigation

Avoidance is the guiding principle to minimise impacts on all flora and fauna, particularly MNES within the Project Area (PLA). Avoidance measures utilised in the Project to minimize impacts on water mouse (should they occur) include:

- The Project Area (PLA) is located within an existing exotic pine plantation and avoids low-lying wetland areas and therefore possible water mouse habitat.
- Electrical cabling will mostly be underground along existing access tracks which will further reduces the amount of clearing required for infrastructure.
- Other infrastructure such as construction compounds avoid remnant vegetation and waterways and therefore avoid damage to low-lying remnant areas.
- Existing forestry tracks will be used to provide access within the Project Area (PLA) and therefore avoids disturbance to remnant vegetation and waterways within remnant areas.

Table 22 provides a SIA for water mouse undertaken in accordance with the *Matters of National Environmental Significance, Significant Impact Guidelines (1.1), Department of Environment (DoE), 2013*.

Table 22 Significant Impact Assessment for Water Mouse (EPBC – V)

Impact Criteria	Assessment
An action is LIKELY to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
Lead to a long-term decrease in the size of an important population of a species.	<p>Wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and terrestrial and aquatic habitat. Access will be via existing forestry tracks. Remnant vegetation within the Project Area (PLA) for internal distribution lines will be spanned where possible.</p> <p>Given the lack of previous records or lack of recent records and minimal remnant vegetation disturbance by siting infrastructure away from remnant vegetation on site, the Project is not expected to lead to a long-term decrease in the size of an important population of this species.</p> <p>Will not have a Significant Impact.</p>
Reduce the area of occupancy of an important population.	No known important populations of water mouse are within the Project Area (PLA). Important populations in the Wide Bay region are within the Great Sandy National Park, Great Sandy Conservation

	<p>Park and Poona National Park.</p> <p>As above, given the lack of previous records or lack of recent previous records and minimal remnant vegetation disturbance by siting infrastructure away from remnant vegetation on site, the Project is not expected to reduce the area of occupancy of an important population.</p> <p>Will not have a Significant Impact.</p>
<p>Fragment an existing important population into two or more populations</p>	<p>The Project Area (PLA) is already extremely fragmented with a network of linear remnant corridors often associated with waterways, existing as a mosaic with the broader exotic pine plantation.</p> <p>Remnant vegetation in these areas is retained as Project infrastructure has been strategically sited to avoid impacts on the remaining remnant vegetation on site.</p> <p>Given there are no known important populations of water mouse within the Project Area (PLA) and remnant vegetation is retained, the Project is not expected to fragment an existing important population into two or more populations.</p> <p>Will not have a Significant Impact.</p>
<p>Adversely affect habitat critical to the survival of a species</p>	<p>Wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation by strategically placing wind turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and terrestrial and aquatic habitat.</p> <p>The areas of pine plantation proposed to be cleared are not water mouse habitat and therefore the Project will not affect habitat critical to the survival of the species.</p> <p>The Project is therefore not expected to adversely affect habitat critical to the survival of a species.</p> <p>Will not have a Significant Impact.</p>
<p>Disrupt the breeding cycle of an important population</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and terrestrial and aquatic habitat.</p> <p>The Project is not expected to disrupt the breeding cycle of an important population.</p> <p>Will not have a Significant Impact.</p>
<p>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and</p>

<p>decline</p>	<p>terrestrial and aquatic habitat.</p> <p>The Project is not expected to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p> <p>Will not have a Significant Impact.</p>
<p>Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat</p>	<p>Several invasive species which are a threat to water mouse have been recorded within the Project Area (PLA) during surveys including feral cats and wild dogs. Wild horses may also damage potential water mouse habitat as they were often observed in low-lying areas within the Project Area (PLA).</p> <p>The Project is not expected to result in invasive species that are harmful to a vulnerable species becoming introduced and established in the vulnerable species' habitat. The Project is not expected to lead to an increase in existing invasive species.</p> <p>Will not have a Significant Impact.</p>
<p>Introduce disease that may cause the species to decline</p>	<p>No diseases are listed as threats to water mouse.</p> <p>The Project is not expected to introduce disease that may cause the species to decline.</p> <p>Will not have a Significant Impact.</p>
<p>Interfere substantially with the recovery of the species</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and terrestrial and aquatic habitat.</p> <p>The Project is not expected to interfere substantially with the recovery of the species.</p> <p>Will not have a Significant Impact.</p>

Marginal habitat exists within the Project Area (PLA) for water mouse and these areas (low-lying wetland areas in remnant freshwater melaleuca forests) are avoided by the Project. No important populations are known to occur within the Project Area (PLA). Important populations are associated with the inter-tidal areas of the Great Sandy Strait rather than within the Project Area (PLA).

Nonetheless, should water mouse occur in small pockets of remnant low-lying habitat, these areas are avoided by the Project, management measures are also proposed to mitigate indirect impacts to low-lying areas and waterways; and therefore the Project will not have a significant impact.

2.6.3 Southern Greater Glider (EPBC Act – V)

2.6.3.1 Survey Effort

Nocturnal surveys were undertaken over a 2-night period in June 2019 within the NSF portion of the Project Area (PLA). Additional nocturnal surveys were undertaken 1 week later within the remnant areas, including along creek lines within the Project Area (PLA).

2.6.3.2 Habitat and Populations

Southern greater gliders have not previously been recorded in the Project Area (PLA) although potential marginal habitat exists in the remnant woodland patches within the Project Area (PLA). Although suitable woodland with a diversity of eucalypt species and hollows exist within the mosaic of remnant vegetation within the Project Area (PLA), they are considered unlikely to occur due to their sensitivity to forest clearance (DoEE, 2019). Although not detected during surveys and no previous records, they may potentially occur in the NSF portion of the Project Area (PLA) although no clearing or infrastructure is currently proposed for this area.

The southern greater glider is considered to be particularly sensitive to forest clearance and to intensive logging (DoEE, 2019). They have low persistence in small forest fragments, and disperse poorly across vegetation that is not native forest (Conservation Advice, 2016). The vegetation within the Project Area (PLA) is highly fragmented and is considered unlikely to support a population of southern greater gliders, however as remnant eucalypt woodland vegetation exists within the Project Area (PLA), a SIA has been prepared as a precautionary measure to demonstrate avoidance measures are considered.

The principal threat to the southern greater glider is the cumulative effects of clearing and logging activities, current burning regimes and the impacts of climate change which are a major threat to large hollow-bearing trees on which the species relies (Conservation Advice, 2016).

2.6.3.3 Avoidance, Management and Mitigation

Avoidance is the guiding principle to minimising impacts on all flora and fauna, particularly MNES within the Project Area (PLA). Avoidance measures utilised in the Project to minimize impacts on greater gliders include:

- The Project Area (PLA) is located within an existing exotic pine plantation and predominantly avoids remnant vegetation and therefore potential marginal southern greater glider habitat.
- Electrical cabling will mostly be underground along existing access tracks which will further reduce the amount of clearing required for infrastructure.
- Other infrastructure such as construction compounds avoid remnant vegetation and waterways and therefore avoid damage to remnant areas of natural habitat and potential corridors for greater glider movement.
- Existing forestry tracks will be used to provide access within the Project Area (PLA) and therefore avoids disturbance to remnant vegetation and habitat within remnant areas.

Table 23 provides a SIA for southern greater glider undertaken in accordance with the *Matters of National Environmental Significance, Significant Impact Guidelines (1.1), Department of Environment (DoE), 2013*.

Table 23 Significant Impact Assessment for Southern Greater Glider (EPBC – V)

Impact Criteria	Assessment
<p>An action is LIKELY to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:</p>	
<p>Lead to a long-term decrease in the size of an important population of a species.</p>	<p>Wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and terrestrial habitat. Access will be via existing forestry tracks. Remnant vegetation within the Project Area (PLA) for internal distribution lines will be spanned where possible.</p> <p>Given the lack of previous records and minimal remnant vegetation disturbance by siting infrastructure away from remnant vegetation on site, the Project is not expected to lead to a long-term decrease in the size of an important population of a species.</p> <p>Will not have a Significant Impact.</p>
<p>Reduce the area of occupancy of an important population.</p>	<p>As above, given the lack of previous records or lack of recent previous records and minimal remnant vegetation disturbance by siting infrastructure away from remnant vegetation on site, the Project is not expected to reduce the area of occupancy of an important population.</p> <p>Will not have a Significant Impact.</p>
<p>Fragment an existing important population into two or more populations</p>	<p>The Project Area (PLA) is already extremely fragmented with a network of linear remnant corridors often associated with waterways, existing as a mosaic with the broader exotic pine plantation.</p> <p>Remnant vegetation in these areas is retained as project infrastructure has been strategically sited to avoid impacts on the remaining remnant vegetation on site.</p> <p>The Project is not expected to fragment an existing important population into two or more populations.</p> <p>Will not have a Significant Impact.</p>
<p>Adversely affect habitat critical to the survival of a species</p>	<p>Wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and terrestrial habitat.</p> <p>The areas of pine plantation proposed to be cleared are not greater glider habitat and therefore the Project will not affect habitat critical to the survival of the species.</p>

	<p>The Project is therefore not expected to adversely affect habitat critical to the survival of a species.</p> <p>Will not have a Significant Impact.</p>
<p>Disrupt the breeding cycle of an important population</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to native vegetation and terrestrial habitat.</p> <p>The Project is not expected to disrupt the breeding cycle of an important population.</p> <p>Will not have a Significant Impact.</p>
<p>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to native vegetation and terrestrial and aquatic habitat.</p> <p>The Project is not expected to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p> <p>Will not have a Significant Impact.</p>
<p>Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat</p>	<p>Several invasive species which are a threat to southern greater glider have been recorded within the Project Area (PLA) during surveys including feral cats and wild dogs.</p> <p>The project is not expected to result in invasive species that are harmful to a vulnerable species becoming introduced and established in the vulnerable species' habitat. The project is not expected to lead to an increase in existing invasive species.</p> <p>Will not have a Significant Impact.</p>
<p>Introduce disease that may cause the species to decline</p>	<p>No diseases are listed as threats to southern greater glider.</p> <p>The Project is not expected to introduce disease that may cause the species to decline.</p> <p>Will not have a Significant Impact.</p>
<p>Interfere substantially with the recovery of the species</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation by strategically placing turbines, compounds (operation and construction) within the pine plantations, therefore avoiding impacts to remnant vegetation and terrestrial and aquatic habitat.</p> <p>The Project is not expected to interfere substantially with the</p>

	recovery of the species. Will not have a Significant Impact.
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Southern greater gliders are considered to have a low potential to occur however have been included in the SIA as a precautionary measure. Given the lack of previous records and sensitivity to forest clearance and intensive logging (the Project Area (PLA) is within an actively managed plantation forest) and avoidance of remnant vegetation, the Project will not impact southern greater gliders.

2.6.4 Long-nosed Potoroo (EPBC Act – V)

2.6.4.1 Survey Effort

Targeted surveys were not undertaken for long-nosed potoroo (LNP), nor were they considered required due to their habitat preferences and avoidance of low-lying remnant areas.

2.6.4.2 Habitat and Populations

There are no previous or current records of LNP within the Project Area (PLA). Marginal suitable habitat exists within the Project Area (PLA) within the small patches of remnant heath areas or woodland areas, provided the ground vegetation is dense.

They are widely but patchily distributed along the southeastern coast of mainland Australia, from south-eastern South Australia through Victoria and NSW to south-eastern Queensland. The stronghold of its northern distribution is along the foothills and eastern ranges of the Great Dividing Range in northern NSW and southern Queensland (LNP Conservation Advice, 2019).

The principal threat to LNP is habitat loss and fragmentation and predation by foxes and feral and domestic cats. Further threats include inappropriate fire regimes, forestry activities, and habitat degradation due to livestock and feral herbivores (LNP Conservation Advice, 2019).

2.6.4.3 Avoidance, Management and Mitigation

Avoidance is the guiding principle to minimising impacts on all flora and fauna, particularly MNES within the Project Area (PLA). Avoidance measures utilised in the Project to minimize impacts on LNP (should they occur) include:

- The Project Area (PLA) is located within an existing exotic pine plantation and avoids remnant vegetation and therefore possible LNP habitat.
- Electrical cabling will mostly be underground along existing access tracks which will further reduces the amount of clearing required for infrastructure.
- Other infrastructure such as construction compounds avoid remnant vegetation and waterways and therefore avoid damage to low-lying remnant areas.
- Existing forestry tracks will be used to provide access within the Project Area (PLA) and therefore avoids disturbance to vegetation within remnant areas.

Table 22 provides a SIA for LNP undertaken in accordance with the *Matters of National Environmental Significance, Significant Impact Guidelines (1.1), Department of Environment (DoE), 2013*.

Table 24 Significant Impact Assessment for long-nosed potoroo

Impact Criteria	Assessment
<p>An action is LIKELY to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:</p>	
<p>Lead to a long-term decrease in the size of an important population of a species.</p>	<p>Wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and terrestrial and aquatic habitat. Access will be via existing forestry tracks. Remnant vegetation within the Project Area (PLA) for internal distribution lines will be spanned where possible.</p> <p>Given the lack of previous records or lack of recent records and minimal remnant vegetation disturbance by siting infrastructure away from remnant vegetation on site, the Project is not expected to lead to a long-term decrease in the size of an important population of this species.</p> <p>Will not have a Significant Impact.</p>
<p>Reduce the area of occupancy of an important population.</p>	<p>No known important populations are within the Project Area (PLA).</p> <p>As above, given the lack of previous records or lack of recent records and minimal remnant vegetation disturbance by siting infrastructure away from remnant vegetation on site, the Project is not expected to reduce the area of occupancy of an important population.</p> <p>Will not have a Significant Impact.</p>
<p>Fragment an existing important population into two or more populations</p>	<p>The Project Area (PLA) is already extremely fragmented with a network of linear remnant corridors often associated with waterways, existing as a mosaic with the broader exotic pine plantation.</p> <p>Remnant vegetation in these areas is retained as Project infrastructure has been strategically sited to avoid impacts on the remaining remnant vegetation on site.</p> <p>Given there are no known important populations within the Project Area (PLA) and remnant vegetation is retained, the Project is not expected to fragment an existing important population into two or more populations.</p> <p>Will not have a Significant Impact.</p>
<p>Adversely affect habitat critical to the survival of a species</p>	<p>Wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation by strategically placing wind turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and terrestrial and aquatic habitat.</p>

	<p>The areas of pine plantation proposed to be cleared are not LNP habitat and therefore the Project will not affect habitat critical to the survival of the species.</p> <p>The Project is therefore not expected to adversely affect habitat critical to the survival of this species.</p> <p>Will not have a Significant Impact.</p>
<p>Disrupt the breeding cycle of an important population</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and terrestrial habitat.</p> <p>The Project is not expected to disrupt the breeding cycle of an important population.</p> <p>Will not have a Significant Impact.</p>
<p>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and terrestrial habitat.</p> <p>The Project is not expected to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p> <p>Will not have a Significant Impact.</p>
<p>Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat</p>	<p>Several invasive species which are a threat to LNP have been recorded within the Project Area (PLA) during surveys including feral cats and wild dogs. Wild horses may also degrade potential habitat within the Project Area (PLA). The pine plantation licensee undertakes weed management as part of their silviculture processes.</p> <p>The Project is not expected to result in invasive species that are harmful to a vulnerable species becoming introduced and established in the vulnerable species' habitat. The Project is not expected to lead to an increase in existing invasive species.</p> <p>Will not have a Significant Impact.</p>
<p>Introduce disease that may cause the species to decline</p>	<p>No diseases are listed as threats to LNP.</p> <p>The Project is not expected to introduce disease that may cause the species to decline.</p> <p>Will not have a Significant Impact.</p>

Interfere substantially with the recovery of the species	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and terrestrial habitat.</p> <p>The Project is not expected to interfere substantially with the recovery of the species.</p> <p>Will not have a Significant Impact.</p>
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Marginal habitat exists within the Project Area (PLA) for LNP and these remnant areas are avoided by the Project. No important populations are known to occur within the Project Area (PLA).

Nonetheless, should LNP occur in small pockets of dense remnant vegetation, these areas are avoided by the Project, and therefore the Project will not have a significant impact.

2.7 Turtles

Turtles considered to have a high potential to occur are listed in Table 25.

These species share similar potential habitat within the Project Area (PLA) and are therefore included in one SIA table (Table 26). As they are listed as CE and E they both have the same SIA criteria.

Table 25 Threatened Turtles Potentially Occurring in the Project Area (PLA)

Scientific Name	Common Name	EPBC Act ¹
<i>Elseya albagula</i>	Southern (white-throated) snapping turtle	CE
<i>Elusor macrurus</i>	Mary River Turtle	E

¹ – EPBC Act: CE – Critically endangered, E – Endangered, V – Vulnerable

2.7.1 Southern (white-throated) Snapping Turtle (EPBC Act – CE)

2.7.1.1 Survey Effort

Aquatic surveys were undertaken during some BUS assessments whilst traversing the site between survey locations. These rapid assessments included habitat assessments (including suitability for nesting) and visual observation for turtle activity, if considered possible habitat for threatened turtles.

2.7.1.2 Habitat and Populations

Southern (white-throated) snapping turtles (SWTST) are found only in Queensland in the Fitzroy, Mary and Burnett Rivers and associated smaller drainages in south eastern Queensland.

White throated snapping turtles do occur in non-flowing waters, but typically at much reduced densities (conservation advice, white-throated snapping turtle, 2014).

There are no previous records in the Project Area (PLA), although suitable habitat exists within the Project Area (PLA) within Tinana Creek and other smaller creeks with permanent water, where there are suitable shelters and refuges such as fallen trees. The SWTST is a cloacal ventilator (breathes oxygen through its anus) and historically these types of freshwater turtle do not do well in large standing water bodies. Hence it prefers permanent flowing streams where the water is well-oxygenated.

Principal threats to the white-throated snapping turtle include:

- the loss of eggs and hatchlings due to predation and trampling;
- the construction of dams and weirs which result in fragmentation of preferred habitat, obstruction of upstream and downstream migration within rivers, and injury and death during over-topping and water releases; and
- water regulation leading to insufficient flow to provide well oxygenated water for cloacal ventilation and food resources for the juvenile turtles, and inundation of traditional nesting areas and riparian vegetation overhanging riverine habitat due to impoundment of water (*The National Recovery Plan for the White-throated Snapping Turtle (Elseya albagula), Commonwealth of Australia 2017*).

2.7.1.3 Avoidance, Management and Mitigation

Avoidance is the guiding principle to minimise impacts on all flora and fauna, particularly MNES within the Project Area (PLA). Avoidance measures utilised in the Project to minimize impacts on SWTST include:

- The Project Area (PLA) is located within an existing exotic pine plantation and avoids waterways and riparian areas.
- Existing forestry tracks will be used to provide access within the Project Area (PLA) thereby avoiding disturbance and fragmentation of existing remnant vegetation and habitat within remnant areas.
- Wind farm infrastructure avoids riparian vegetation along waterways within the Project Area (PLA). Any potential bridge and/or culvert upgrades will involve minimal trimming of vegetation and works will be undertaken to avoid impacts on water quality, flows and aquatic habitat.
- The hydrology of Tinana Creek and associated tributaries will not be impacted by the Project.
- Best practice erosion and sediment control measures will further prevent impacts on water quality within the Project Area (PLA) particularly during construction.

2.7.2 Mary River Turtle (EPBC Act – E)

2.7.2.1 Survey Effort

Aquatic surveys were undertaken during some BUS assessments whilst traversing the Project Area (PLA) between survey locations. These rapid assessments included habitat assessments (including suitability for nesting) and visual observation for turtle activity, if considered possible habitat for threatened turtles.

2.7.2.2 *Habitat and Populations*

The Mary River Turtle (MRT) is restricted to permanent flowing streams and large pool habitats of the Mary River catchment. There are no previous records within the Project Area (PLA) however it is known to occur in Tinana Creek, upstream of Tallegalla Weir. An upstream portion of Tinana Creek runs through the western side of the Project Area (PLA) so it is therefore considered to potentially occur.

As per the SWTST, the MRT is also a cloacal ventilator and therefore prefers permanent flowing streams where the water is well-oxygenated.

Historically, illegal collection for the pet trade was a threatening process as an entire generation of turtles were removed from the wild, leaving an aging population (DES, 2020). Principal threats to the MRT are now egg predation and nest trampling as per the SWTST. Changes to flow regimes and removal of riparian trees which prevents logs and therefore instream structure are also threats to the MRT (DES, 2020).

2.7.2.3 *Avoidance, Management and Mitigation*

Avoidance is the guiding principle to minimise impacts on all flora and fauna, particularly MNES within the Project Area (PLA). Avoidance measures utilised in the Project to minimize impacts on MRT include:

- The Project Area (PLA) is located within an existing exotic pine plantation and avoids remnant riparian vegetation.
- No waterway barriers will be created on existing creeks within the Project Area (PLA).
- Existing forestry tracks will be used to provide access within the Project Area (PLA) thereby avoiding disturbance and fragmentation of existing remnant vegetation and habitat within remnant areas.
- Wind farm infrastructure avoids riparian vegetation along waterways within the Project Area (PLA). Any potential bridge and/or culvert upgrades will involve minimal clearing and works will be undertaken to avoid impacts on water quality, flows and aquatic habitat.
- The hydrology of Tinana Creek and associated tributaries will not be impacted by the Project.
- Best practice erosion and sediment control measures will further prevent impacts on water quality within the project area, particularly during construction.

Table 13 provides a SIA for SWTST and MRT undertaken in accordance with the *Matters of National Environmental Significance, Significant Impact Guidelines (1.1), Department of Environment (DoE), 2013*.

Table 26 Significant Impact Assessment for Southern (white-throated) Snapping Turtle (EPBC – CE) and Mary River Turtle (EPBC – E)

Impact Criteria	Assessment
An action is LIKELY to have a significant impact on an animal that is critically endangered or endangered if there is a real chance or possibility that it will:	

<p>Lead to a long-term decrease in the size of a population</p>	<p>Wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation, including remnant riparian areas by strategically placing wind turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation, including riparian and aquatic habitat.</p> <p>Some upgrades to creek crossings may be required. Minimal trimming of vegetation is expected to occur as crossings already exist. Management measures will be in place to avoid any impacts to water quality, flows or aquatic habitat during potential upgrades.</p> <p>The Project is not expected to lead to a long-term decrease in the size of a population, should the turtles exist within the remnant waterways such as Tinana Creek within the Project Area (PLA).</p> <p>Will not have a Significant Impact.</p>
<p>Reduce the extent of occupancy of the species</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation and particularly riparian vegetation by strategically placing wind turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant riparian vegetation and terrestrial and aquatic habitat. The Project will not create any waterway barriers or changes to the flow regimes of the existing waterways within and adjacent to the Project Area (PLA). Indirect impacts such as increased sedimentation will be managed through the project specific ESCP.</p> <p>The Project is not expected to reduce extent of occupancy of the species.</p> <p>Will not have a Significant Impact.</p>
<p>Fragment an existing population into two or more populations</p>	<p>The Project Area (PLA) is already extremely fragmented with a network of linear remnant corridors often associated with waterways, existing as a mosaic with the broader exotic pine plantation.</p> <p>Remnant vegetation in these areas is retained as project infrastructure has been strategically sited to avoid impacts on the remaining remnant vegetation on site, including the riparian areas</p> <p>The Project is not expected to fragment an existing population into two or more populations.</p> <p>Will not have a Significant Impact.</p>
<p>Adversely affect habitat critical to the survival of a species</p>	<p>Wind farm infrastructure within the Project Area (PLA) avoids waterways, wetlands and riparian vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant riparian vegetation and aquatic habitat.</p> <p>The Project will not create any waterway barriers or changes to the flow regimes of the existing waterways within or adjacent to the Project Area (PLA). Indirect impacts such as increased</p>

	<p>sedimentation will be managed through the project specific ESCP.</p> <p>The Project is therefore not expected to adversely affect habitat critical to the survival of a species.</p> <p>Will not have a Significant Impact.</p>
<p>Disrupt the breeding cycle of a population</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids waterways, wetlands and riparian vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant riparian vegetation and aquatic habitat.</p> <p>If these species occur within the Project Area (PLA) the principal threat to their breeding cycle is likely nest trampling by wild horses (brumbies). The Project will not result in an increase in wild horses.</p> <p>The pProject is therefore not expected to disrupt the breeding cycle of a population.</p> <p>Will not have a Significant Impact.</p>
<p>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids waterways, wetlands and riparian vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant riparian vegetation and aquatic habitat.</p> <p>The project will not create any waterway barriers or changes to the flow regimes of the existing waterways within or adjacent to the Project Area (PLA). Indirect impacts such as increased sedimentation will be managed through the project specific ESCP.</p> <p>The Project is therefore not expected to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p> <p>Will not have a Significant Impact.</p>
<p>Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat</p>	<p>Several invasive species which are a threat to turtles have been recorded on site during surveys including feral cats, wild dogs, pigs and wild horses. Wild horses are likely responsible for trampling turtle nests within the Project Area (PLA) as they were often observed in low-lying areas within the Project Area (PLA).</p> <p>The wild population of SWTST is composed primarily of aging adults due to almost 100% of eggs being predated or trampled by stock (SWTST Recovery Plan, 2017). Nest trampling by stock is also a principal threat to MRT. The observation of wild horses throughout the Project Area (PLA) including creek lines remains an existing threat to nesting success for both turtle species within the Project Area (PLA).</p> <p>The Project is not expected to result in invasive species that are harmful to a critically endangered or endangered species becoming</p>

	<p>established in the endangered or critically endangered species' habitat. The Project is not expected to increase the invasive species currently within the Project Area (PLA).</p> <p>Will not have a Significant Impact.</p>
Introduce disease that may cause the species to decline	<p>No diseases are listed as threats to SWTST or MRT.</p> <p>Will not have a Significant Impact.</p>
Interfere with the recovery of the species	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids waterways, wetlands and riparian vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant riparian vegetation and aquatic habitat.</p> <p>The Project is therefore not expected to interfere with the recovery of SWTST or MRT.</p> <p>Will not have a Significant Impact.</p>

There will be no impacts on water quality, flows, aquatic and riparian habitat within the Project Area (PLA), impacts on the above mentioned turtles are not expected, should these turtles occur.

2.8 Amphibians

Amphibians considered to have at least a moderate potential to occur are listed in Table 27.

Table 27 Threatened Amphibians Potentially Occurring in Project Area (PLA)

Scientific Name	Common Name	EPBC Act ¹
<i>Litoria olongburensis</i>	Wallum sedge frog	V
<i>Mixophyes iteratus</i>	Giant barred frog	E

¹ – EPBC Act: CE – Critically endangered, E – Endangered, V – Vulnerable

2.8.1 Wallum Sedge Frog (EPBC Act – V)

2.8.1.1 Survey Effort

A songmeter (SM4) was deployed across the Project Area (PLA) between 14 February 2019 and 26 March 2019. The SM4 records acoustic sounds such as frogs (and birds and flying-foxes). Thirty-four (34) nights of acoustic recording was collected across five creek / wetland locations during this 6-week period.

Nocturnal surveys were undertaken over a 2-night period in June 2019 within the NSF portion of the Project Area (PLA). Additional nocturnal surveys were undertaken 1 week later within the remnant areas, including creek lines within the Project Area (PLA). Locations for the acoustic recordings are shown as SM4 on Figure 3.

2.8.1.2 Habitat and Populations

Wallum sedge frog (WSF) are found in ephemeral, semi-permanent and permanent wetlands with emergent reeds, ferns and/or sedges, in undisturbed coastal wallum of South-East Queensland to northern NSW. Often not sympatric with *Litoria fallax* and generally found in fish free environments. They rarely occur if gambusia (mosquitofish) are present. In these areas, habitat has become highly fragmented, leaving small isolated populations.

There are no previous records of WSF within the Project Area (PLA) however there are previous records within Toolara State Forest and there is possible habitat in the fragmented remnant wetland area within the Project Area (PLA).

An important population of a species listed as vulnerable under the EPBC Act, such as the wallum sedge frog, is one that is necessary for the species' long-term survival and recovery (Draft referral guidelines for the vulnerable wallum sedge frog, *Litoria olongburensis*, 2011).

The DoE considers that it is difficult to define which wallum sedge frog populations may not be important for the species' long-term survival and recovery. A WSF population occurring in a degraded habitat may still be considered important if it is able to persist indefinitely. A population may persist in a degraded habitat indefinitely if:

- the extent, condition and ecological function of the habitat is retained and not directly altered by human activity,
- the habitat is resilient to existing levels of disturbance and/or is sufficiently recoverable to the extent that it enables the population to persist, and
- the potential for the influx of WSF to the population persists.

No WSF have previously been recorded on the Project Area (PLA) or were recorded during surveys.

2.8.1.3 Avoidance, Management, Mitigation

Avoidance is the guiding principle to minimising impacts on all flora and fauna, particularly MNES within the Project Area (PLA). Avoidance measures utilised in the Project to minimize impacts on WSF include:

- The Project Area (PLA) is located within an existing exotic pine plantation and avoids low-lying remnant wetland areas.
- Existing forestry tracks will be used to provide access within the Project Area (PLA) and therefore avoids disturbance and fragmentation of existing remnant vegetation and habitat within those areas.
- Wind farm infrastructure avoids riparian vegetation along waterways within the Project Area (PLA). Any potential bridge and/or culvert upgrades will involve minimal clearing and works will be undertaken to avoid impacts on water quality, flows and aquatic habitat.
- Best practice erosion and sediment control measures will further prevent impacts on water quality within the Project Area (PLA).

Table 28 provides a SIA for WSF undertaken in accordance with the *Matters of National Environmental Significance, Significant Impact Guidelines (1.1), Department of Environment (DoE), 2013* and the *Draft referral guidelines for the vulnerable wallum sedge frog, Litoria olongburensis, 2011*.

Table 28 Significant Impact Assessment for Wallum Sedge Frog (EPBC Act - V)

Impact Criteria	Assessment
<p>An action is LIKELY to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:</p>	
<p>Lead to a long-term decrease in the size of an important population</p>	<p>Wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation, including remnant riparian and wetland areas by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation, including riparian and wetland habitat.</p> <p>Some upgrades to creek crossings may be required. Minimal trimming of vegetation is expected to occur as the crossings already exist. Management measures will be in place to avoid any impacts to water quality, flows or aquatic habitat during potential upgrades.</p> <p>The extent, condition and ecological function of the existing remnant habitats is retained and not directly or indirectly altered by the Project.</p> <p>The Project is not expected to lead to a long-term decrease in the size of an important population, should the WSF exist within the remnant wetlands within the Project Area (PLA).</p> <p>Will not have a Significant Impact.</p>
<p>Reduce the area of occupancy of an important population</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation and particularly riparian and wetland vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and terrestrial and aquatic habitat.</p> <p>The Project will not impact the extent, condition and ecological function of the existing remnant habitats within the Project Area (PLA).</p> <p>The Project will not create any waterway barriers or changes to the flow regimes of the existing waterways within and adjacent to the Project Area (PLA). Indirect impacts such as increased sedimentation will be managed through the project specific ESCP.</p> <p>The Project is not expected to reduce the area of occupancy of an important population, should they occur within the Project Area (PLA).</p>

	Will not have a Significant Impact.
Fragment an existing important population into two or more populations	<p>The Project Area (PLA) is already extremely fragmented with a network of linear remnant corridors often associated with waterways, existing as a mosaic with the broader pine plantation.</p> <p>Remnant vegetation in these areas is retained as project infrastructure has been strategically sited to avoid impacts on the remaining remnant vegetation on site, including the low-lying and riparian areas</p> <p>No populations are known to occur within the Project Area (PLA), however if they were to occur within the Project Area (PLA), the Project avoids low-lying remnant areas and would not fragment an existing important population into two or more populations.</p> <p>Will not have a Significant Impact.</p>
Adversely affect habitat critical to the survival of a species	<p>Wind farm infrastructure within the Project Area (PLA) avoids waterways, wetlands and riparian vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant riparian vegetation and wetland habitat.</p> <p>The Project will not create any waterway barriers or changes to the flow regimes of the existing waterways, or changes to overland flow within or adjacent to the Project Area (PLA). Indirect impacts such as increased sedimentation will be managed through the project specific ESCP.</p> <p>The Project is therefore not expected to adversely affect habitat critical to the survival of a species.</p> <p>Will not have a Significant Impact.</p>
Disrupt the breeding cycle of an important population	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids waterways, wetlands and riparian vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and aquatic habitat.</p> <p>The Project will not alter the existing hydrology of the waterways, overland flow or low-lying areas within the Project Area (PLA).</p> <p>The Project is therefore not expected to disrupt the breeding cycle of an important population, should they occur within the Project Area (PLA).</p> <p>Will not have a Significant Impact.</p>
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids waterways, wetlands and riparian vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant</p>

<p>decline</p>	<p>riparian vegetation and aquatic habitat.</p> <p>The Project will not create any changes to the flow regimes and hydrology of the existing waterways and low-lying areas within or adjacent to the Project Area (PLA). Indirect impacts such as increased sedimentation will be managed through the project specific ESCP.</p> <p>The Project is therefore not expected to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p> <p>Will not have a Significant Impact.</p>
<p>Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat</p>	<p>Several invasive species which are a threat to amphibians have been recorded on site during surveys including pigs and wild horses. Wild horses are likely responsible for habitat degradation from trampling as they were often observed within the low-lying areas within the Project Area (PLA).</p> <p>The Project is not expected to result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat. The Project is not expected to increase the invasive species currently within the Project Area (PLA).</p> <p>Will not have a Significant Impact.</p>
<p>Introduce disease that may cause the species to decline</p>	<p>Chytridiomycosis is a disease caused by infection with the chytrid fungus (<i>Batrachochytrium dendrobatidis</i>) affecting amphibians worldwide. The Project is not expected to increase chytrid fungus within the Project Area (PLA).</p> <p>Will not have a Significant Impact.</p>
<p>Interfere substantially with the recovery of the species</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids waterways, wetlands and riparian vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant riparian vegetation and aquatic habitat.</p> <p>The Project is therefore not expected to interfere substantially with the recovery of WSF.</p> <p>Will not have a Significant Impact.</p>

A conservative approach has been taken with the SIA as there are no previous records of WSF and within the Project Area (PLA). Nonetheless, potential habitat exists for WSF within the mosaic of remnant wetlands and waterways remaining within the exotic pine plantations within the Project Area (PLA).

The Project has been designed to avoid remnant areas which offer the most suitable habitat for flora and fauna within the pine plantation. Should populations of WSF remain within remnant pockets within the current landscape of actively managed silviculture operations, the Project will not have a Significant Impact on these populations.

2.8.2 Giant Barred Frog (EPBC Act – E)

2.8.2.1 Survey Effort

A songmeter (SM4) was deployed across the Project Area (PLA) between 14 February 2019 and 26 March 2019. The SM4 records acoustic sounds such as frogs (and birds and flying-foxes). Thirty-four (34) nights of acoustic recording was collected across 5 creek / wetland locations during this 6-week period.

Nocturnal surveys were undertaken over a 2-night period in June 2019 within the NSF portion of the Project Area (PLA). Additional nocturnal surveys were undertaken 1 week later within the remnant areas, including creek lines within the Project Area (PLA). Locations for the acoustic recordings are shown as SM4 on Figure 2.

2.8.2.2 Habitat and Populations

In south-eastern Queensland, the giant barred frog (GBF) is known from Doongul Creek in the Burrum River catchment, at scattered locations in the Mary River catchment downstream to Kenilworth, the Upper Stanley River, Caboolture River and Coomera River.

Occurs along shallow rocky streams in rainforest, wet sclerophyll forest and farmland between 100 and 1000 m or deep, slow moving streams with steep banks in lowland areas. Rainforests, Antarctic beech or wet sclerophyll forests with rainforest understorey (Approved Conservation Advice (2017)).

Habitat loss and modification is the principal threat to GBF, while chytrid fungus is considered a potential threat (Approved Conservation Advice (2017)). Threats to GBF also include upstream clearing, changes in water flow regimes, degradation of water quality, disturbance to riparian vegetation, feral animals, domestic stock and weed invasion have been identified as potential threats to the GBF (DoE, 2020)

There is one (1) previous record within the Project Area (PLA) (Wildnet: 2014). Possible habitat occurs along Tinana Creek within the Project Area (PLA).

2.8.2.3 Avoidance, Management, Mitigation

Avoidance is the guiding principle to minimising impacts on all flora and fauna, particularly MNES within the Project Area (PLA). Avoidance measures utilised in the Project to minimize impacts on GBF include:

- The Project Area (PLA) is located within an existing exotic pine plantation and avoids low-lying remnant wetland areas.
- Existing forestry tracks will be used to provide access within the Project Area (PLA) and therefore avoids disturbance and fragmentation of existing remnant vegetation and habitat within remnant areas.
- Wind farm infrastructure avoids riparian vegetation along waterways within the Project Area (PLA). Any potential bridge and/or culvert upgrades will involve minimal clearing and works will be undertaken to avoid impacts on water quality, flows and aquatic habitat.
- Best practice sediment and erosion measures will further prevent impacts on water quality within the Project Area (PLA).

Table 28 provides a SIA for GBF undertaken in accordance with the *Matters of National Environmental Significance, Significant Impact Guidelines (1.1), Department of Environment (DoE), 2013*.

Table 29 Significant Impact Assessment for Giant Barred Frog (EPBC Act - E)

Impact Criteria	Assessment
<p>An action is LIKELY to have a significant impact on an animal that is critically endangered or endangered if there is a real chance or possibility that it will:</p>	
<p>Lead to a long-term decrease in the size of a population</p>	<p>Wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation, including remnant riparian and wetland areas by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation, including riparian and wetland habitat.</p> <p>Some upgrades to creek crossings may be required. Minimal trimming of vegetation is expected to occur as the crossings already exist. Management measures will be in place to avoid any impacts to water quality, flows or aquatic habitat during potential upgrades.</p> <p>The extent, condition and ecological function of the existing remnant habitats is retained and not directly or indirectly altered by the Project.</p> <p>The Project is not expected to lead to a long-term decrease in the size of a population, should the GBF exist within the Project Area (PLA) such as along Tinana Creek.</p> <p>Will not have a Significant Impact.</p>
<p>Reduce the area of occupancy of the species</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation and particularly riparian and wetland vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and terrestrial and aquatic habitat.</p> <p>The Project will not impact the extent, condition and ecological function of the existing remnant habitats within the Project Area (PLA).</p> <p>The Project will not create any waterway barriers or changes to the flow regimes of the existing waterways within and adjacent to the Project Area (PLA). Indirect impacts such as increased sedimentation will be managed through the project specific ESCP.</p> <p>The Project is not expected to reduce the area of occupancy of the species, should they occur within the Project Area (PLA).</p> <p>Will not have a Significant Impact.</p>

<p>Fragment an existing population into two or more populations</p>	<p>The Project Area (PLA) is already extremely fragmented with a network of linear remnant corridors often associated with waterways, existing as a mosaic with the broader exotic pine plantation.</p> <p>Remnant vegetation in these areas is retained as project infrastructure has been strategically sited to avoid impacts on the remaining remnant vegetation on site, including the low-lying and riparian areas</p> <p>No populations are known to occur within the Project Area (PLA), however if they were to occur within the Project Area (PLA), the Project avoids low-lying remnant areas and would not fragment an existing population into two or more populations.</p> <p>Will not have a Significant Impact.</p>
<p>Adversely affect habitat critical to the survival of a species</p>	<p>Wind farm infrastructure within the Project Area (PLA) avoids waterways, wetlands and riparian vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant riparian vegetation and wetland habitat.</p> <p>The project will not create any waterway barriers or changes to the flow regimes of the existing waterways within or adjacent to the Project Area (PLA). Indirect impacts such as increased sedimentation will be managed through the project specific ESCP.</p> <p>The Project is therefore not expected to adversely affect habitat critical to the survival of a species.</p> <p>Will not have a Significant Impact.</p>
<p>Disrupt the breeding cycle of a population</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids waterways, wetlands and riparian vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and aquatic habitat.</p> <p>The Project will not alter the existing hydrology of the waterways and low-lying areas within the Project Area (PLA).</p> <p>The Project is therefore not expected to disrupt the breeding cycle of an important population, should they occur within the Project Area (PLA).</p> <p>Will not have a Significant Impact.</p>
<p>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids waterways, wetlands and riparian vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant riparian vegetation and aquatic habitat.</p> <p>The Project will not create any changes to the flow regimes and hydrology of the existing waterways and low-lying areas within or</p>

	<p>adjacent to the Project Area (PLA). Indirect impacts such as increased sedimentation will be managed through the project specific ESCP.</p> <p>The Project is therefore not expected to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p> <p>Will not have a Significant Impact.</p>
<p>Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat</p>	<p>Several invasive species which are a threat to amphibians have been recorded on site during surveys including pigs and wild horses. Wild horses are likely responsible for habitat degradation from trampling as they were often observed within the low-lying areas within the Project Area (PLA).</p> <p>The Project is not expected to result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat. The Project is not expected to increase the invasive species currently within the Project Area (PLA).</p> <p>Will not have a Significant Impact.</p>
<p>Introduce disease that may cause the species to decline</p>	<p>Chytridiomycosis is a disease caused by infection with the chytrid fungus (<i>Batrachochytrium dendrobatidis</i>) affecting amphibians worldwide. The Project is not expected to increase chytrid fungus within the Project Area (PLA).</p> <p>Will not have a Significant Impact.</p>
<p>Interfere with the recovery of the species</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids waterways, wetlands and riparian vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant riparian vegetation and aquatic habitat.</p> <p>The Project is therefore not expected to interfere with the recovery of GBF.</p> <p>Will not have a Significant Impact.</p>

A conservative approach has been taken with the SIA as there is one (1) record for GBF within the Project Area (PLA). Nonetheless, potential habitat exists for GBF within the permanent waterways remaining within the exotic pine plantations within the Project Area (PLA).

The Project has been designed to avoid remnant areas which offer the most suitable habitat for flora and fauna within the pine plantation. Should populations of GBF remain within remnant pockets within the current landscape of actively managed silviculture operations, the Project will not have a Significant Impact on these populations.

2.9 Fish

Fish considered to have at least a moderate potential to occur are listed in Table 30.

Table 30 Threatened Fish Potentially Occurring in Project Area (PLA)

Scientific Name	Common Name	EPBC Act ¹	Likelihood of Occurrence
<i>Maccullochella mariensis</i>	Mary River cod	E	High potential to occur
<i>Nannoperca oxleyana</i>	Oxleyan Pygmy Perch	E	High potential to occur
<i>Neoceratodus forsteri</i>	Australian lungfish	V	High potential to occur
<i>Pseudomugil mellis</i>	Honey Blue Eye	V	Moderate potential to occur

¹ – EPBC Act: CE – Critically endangered, E – Endangered, V – Vulnerable

2.9.1 Mary River Cod (EPBC Act – E)

2.9.1.1 Survey Effort

Aquatic surveys were undertaken during some BUS assessments whilst traversing the PLA between survey locations. These rapid assessments included habitat assessments and dip-netting if considered possible habitat for threatened aquatic fauna.

Additional aquatic assessments were undertaken on 17-19 June 2019. Aquatic assessments involved dip-netting and habitat assessments for threatened aquatic species. Refer to Figure 5 for aquatic assessment sites.

An additional aquatic assessment was undertaken at the Raintree Bridge location on Tinana Creek in January 2020.

2.9.1.2 Habitat and Populations

The Mary River Cod (MRC) occurs in three natural subpopulations (Lake Macdonald, Tinana Creek and Coondoo Creek upstream of Tinana Barrage, and upper Obi Obi Creek) in different tributary systems of the Mary River which are isolated from one another by impoundments and the main river channel (Conservation Advice, 2016)

MRC occurs mainly in pools within relatively undisturbed tributaries, preferring relatively large and deep (0.8 to 3.2 m) shaded pools with abundant, slowly flowing water. Submerged logs and branches (snags) are used as cover from which to ambush prey, as resting sites, and as nesting sites (Conservation Advice, 2016).

There are previous records within Toolara and Tuan State Forests, and previous records in the Project Area (PLA) (1995) (Wildnet 2020). Potential habitat exists in Tinana Creek which runs through the south western portion of the Project Area (PLA).

The main threats to the MRC are impoundment of streams, loss of riparian vegetation and invasive fish (Conservation Advice, 2016).

2.9.1.3 Avoidance, Management and Mitigation

Avoidance is the guiding principle to minimising impacts on all flora and fauna, particularly MNES within the Project Area (PLA). Avoidance measures utilised in the Project to minimize impacts on MRC include:

- The Project Area (PLA) is located within an existing exotic pine plantation and avoids waterways and riparian areas.
- Existing forestry tracks will be used to provide access within the Project Area (PLA) and therefore avoids disturbance and fragmentation of existing remnant vegetation and habitat within remnant areas.
- Wind farm infrastructure avoids riparian vegetation along waterways within the Project Area (PLA). Any potential bridge and/or culvert upgrades will involve minimal trimming of vegetation and works will be undertaken to avoid impacts on water quality, flows and aquatic habitat.
- Best practice erosion and sediment control measures will further prevent impacts on water quality within the Project Area (PLA).

Table 31 provides a SIA for MRC undertaken in accordance with the *Matters of National Environmental Significance, Significant Impact Guidelines (1.1), Department of Environment (DoE), 2013*.

Table 31 Significant Impact Assessment for Mary River Cod (EPBC Act - E)

Impact Criteria	Assessment
An action is LIKELY to have a significant impact on an animal that is critically endangered or endangered if there is a real chance or possibility that it will:	
Lead to a long-term decrease in the size of a population	<p>Wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation, including remnant riparian and wetland areas by strategically placing wind turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation, including riparian and wetland habitat.</p> <p>Some upgrades to creek crossings may be required. Minimal trimming of riparian vegetation is expected to occur as the crossings already exist. Management measures will be in place to avoid any impacts to water quality, flows or aquatic habitat during potential upgrades.</p> <p>The extent, condition and ecological function of the existing remnant habitats is retained and not directly or indirectly altered by the project.</p>

	<p>The Project is not expected to lead to a long-term decrease in the size of a population.</p> <p>Will not have a Significant Impact.</p>
<p>Reduce the area of occupancy of the species</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation and particularly riparian and wetland vegetation by strategically placing wind turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and terrestrial and aquatic habitat.</p> <p>The Project will not impact the extent, condition and ecological function of the existing remnant habitats within the Project Area (PLA).</p> <p>The Project will not create any waterway barriers or changes to the flow regimes of the existing waterways within and adjacent to the Project Area (PLA). Indirect impacts such as increased sedimentation will be managed through the project specific ESCP.</p> <p>The Project is not expected to reduce the area of occupancy of the species, should they occur within the Project Area (PLA).</p> <p>Will not have a Significant Impact.</p>
<p>Fragment an existing population into two or more populations</p>	<p>The Project Area (PLA) is already extremely fragmented with a network of linear remnant corridors often associated with waterways, existing as a mosaic with the broader pine plantation.</p> <p>Remnant vegetation in these areas is retained as project infrastructure has been strategically sited to avoid impacts on the remaining remnant vegetation on site, including waterways and riparian areas</p> <p>It is possible MRC occur within the Project Area (PLA) within Tinana Creek as suitable habitat exists and there are known records within Tinana Creek. The Project avoids Tinana Creek and other waterways with permanent flows. There will no barriers on existing waterways within the Project Area (PLA) that would fragment an existing population. The Project will not fragment an existing population into two or more populations.</p> <p>Will not have a Significant Impact.</p>
<p>Adversely affect habitat critical to the survival of a species</p>	<p>Wind farm infrastructure within the Project Area (PLA) avoids Tinana Creek, other waterways and riparian vegetation by strategically placing wind turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding direct and indirect impacts to waterways and remnant riparian vegetation.</p> <p>The project will not create any waterway barriers or changes to the flow regimes of the existing waterways within or adjacent to the Project Area (PLA). Indirect impacts such as increased</p>

	<p>sedimentation will be managed through the project specific ESCP.</p> <p>The Project is therefore not expected to adversely affect habitat critical to the survival of a species.</p> <p>Will not have a Significant Impact.</p>
<p>Disrupt the breeding cycle of a population</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids waterways, wetlands and riparian vegetation by strategically placing wind turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and aquatic habitat.</p> <p>The Project will not alter the existing hydrology of the waterways within or adjacent to the Project Area (PLA).</p> <p>The Project is therefore not expected to disrupt the breeding cycle of a population.</p> <p>Will not have a Significant Impact.</p>
<p>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids waterways, wetlands and riparian vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to waterways, remnant riparian vegetation and aquatic habitat.</p> <p>The Project will not create any changes to the flow regimes and hydrology of the existing waterways and low-lying areas within or adjacent to the Project Area (PLA). Indirect impacts such as increased sedimentation will be managed through the project specific ESCP.</p> <p>The Project is therefore not expected to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p> <p>Will not have a Significant Impact.</p>
<p>Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat</p>	<p>Several invasive species which are a threat to MRC have been recorded on site during surveys including pigs and wild horses. Pigs and wild horses are likely responsible for habitat degradation from trampling as they were often observed within the low-lying areas within the Project Area (PLA). Disturbance by pigs and horses within and along waterways likely inhibits natural regeneration of native vegetation, which provides cover along creek channels which is habitat for MRC.</p> <p>Mosquitofish (<i>Gambusia holbrooki</i>) were recorded within Tinana Creek and other waterways within the Project Area (PLA). Mosquitofish are considered a threat to MRC as they are likely to compete with MRC larva for resources (Conservation Advice, 2016).</p> <p>The Project is not expected to result in invasive species that are harmful to a critically endangered or endangered species becoming</p>

	<p>established in the endangered or critically endangered species' habitat. The Project is not expected to increase the invasive species currently within the Project Area (PLA).</p> <p>Will not have a Significant Impact.</p>
<p>Introduce disease that may cause the species to decline</p>	<p>No diseases are listed as threats to MRC.</p> <p>The Project is not expected to introduce disease that may cause the species to decline.</p> <p>Will not have a Significant Impact.</p>
<p>Interfere with the recovery of the species</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids waterways, wetlands and riparian vegetation by strategically placing turbines, compounds (construction and operation) within the exotic pine plantations, therefore avoiding impacts to remnant riparian vegetation and aquatic habitat.</p> <p>The Project is therefore not expected to interfere with the recovery of MRC.</p> <p>Will not have a Significant Impact.</p>

Potential habitat exists for MRC within the Tinana Creek and other permanently flowing waterways with deep pools remaining within the Project Area (PLA).

The Project has been designed to avoid waterways and remnant riparian areas. The Project will not create waterway barriers or impoundments. Indirect impacts such as degradation in water quality will be mitigated by project specific ESCP. The Project will not have a Significant Impact on MRC.

2.9.2 Oxleyan Pygmy Perch (EPBC Act – E)

2.9.2.1 Survey Effort

Aquatic surveys were undertaken during some BUS assessments whilst traversing the Project Area (PLA) between survey locations. These rapid assessments included habitat assessments and dip-netting if considered possible habitat for Oxleyan Pygmy Perch (OPP).

Additional aquatic assessments were undertaken on 17-19 June 2019. Aquatic assessments involved dip-netting and habitat assessments for threatened aquatic species. Refer to Figure 2 for aquatic assessment sites.

An additional aquatic assessment was undertaken at the Raintree Bridge location on Tinana Creek in January 2020.

2.9.2.2 Habitat and Populations

OPP are confined primarily to dystrophic (brown acidic water, low oxygen), acidic, freshwater systems draining through sandy coastal lowlands and 'wallum' heaths (Banksia dominated heathlands) (Conservation Advice, 2016). Their specific habitat requirements include fresh, acidic waters with abundant aquatic vegetation. Even within areas of their habitat, their

distribution is patchy and despite extensive searching, the species has only been found in a relatively small number of locations in NSW and Queensland (Conservation Advice, 2016). They are generally found only in slow-flowing pools and backwaters of river channels and tributaries as well as in swampy drainages, lakes, ponds and dams. In wallum heath water bodies, OPP are generally found at sites with a high level of instream cover and no visible flow or very low flows.

There are previous records within Toolara State Forest and a previous record within the Project Area (PLA) (1994) (Wildnet 2020). They have the potential to occur in smaller creeks and pools within the waterways and pools within the remnant wallum areas of the Project Area (PLA).

The main threats to the OPP are loss of wallum heath, invasive fish and illegal collection. Most of the historical potential habitat (coastal wallum heaths) within the Project Area (PLA) have been historically cleared for the pine plantation leaving a mosaic of small pockets amongst the exotic pine plantation landscape. Whilst surrounded by ongoing actively managed pine plantations, these small pockets offer possible habitat for OPP.

2.9.2.3 Avoidance, Management and Mitigation

Avoidance is the guiding principle to minimising impacts on all flora and fauna, particularly MNES within the Project Area (PLA). Avoidance measures utilised in the Project to minimize impacts on OPP include:

- The Project Area (PLA) is located within an existing exotic pine plantation and avoids waterways and water bodies within any small pockets of remaining remnant wallum heath areas.
- Existing forestry tracks will be used to provide access within the Project Area (PLA) and therefore avoids disturbance and fragmentation of existing remnant vegetation and habitat within remnant areas such as wallum heath areas.
- Wind farm infrastructure avoids waterways and waterbodies within the Project Area (PLA). Any potential bridge and/or culvert upgrades will involve minimal trimming of vegetation and works will be undertaken to avoid impacts on water quality, flows and aquatic habitat.
- Any potential culvert upgrades are expected to be minor, however should be undertaken in accordance with an approved EMP or SMP to ensure impacts to water quality and potential habitat are mitigated.
- Best practice erosion and sediment control measures will further prevent impacts on water quality within the Project Area (PLA).

Table 32 provides a SIA for OPP undertaken in accordance with the *Matters of National Environmental Significance, Significant Impact Guidelines (1.1), Department of Environment (DoE), 2013*.

Table 32 Significant Impact Assessment for Oxleyan Pygmy Perch (EPBC Act - E)

Impact Criteria	Assessment
An action is LIKELY to have a significant impact on an animal that is critically endangered or endangered if there is a real chance or possibility that it will:	
Lead to a long-term decrease in the size of a population	Wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation, including remnant riparian and wetland areas by strategically placing wind turbines, compounds (operation and

	<p>construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and waterbodies within small pockets of low-lying wallum heath areas.</p> <p>Some upgrades to creek crossings and drainage lines may be required. Minimal trimming of riparian vegetation is expected to occur as the crossings already exist. Management measures will be in place to avoid any impacts to water quality, flows or aquatic habitat during potential upgrades.</p> <p>The extent, condition and ecological function of the existing remnant habitats is retained and not directly or indirectly altered by the project.</p> <p>The Project is not expected to lead to a long-term decrease in the size of a population.</p> <p>Will not have a Significant Impact.</p>
<p>Reduce the area of occupancy of the species</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation, including low-lying pockets of wallum heath areas by strategically placing wind turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and terrestrial and aquatic habitat.</p> <p>The Project will not impact the extent, condition and ecological function of the existing remnant habitats within the Project Area (PLA).</p> <p>The Project will not create any waterway barriers or changes to the flow regimes of the existing waterways within and adjacent to the Project Area (PLA). Indirect impacts such as increased sedimentation will be managed through the project specific ESCP.</p> <p>The Project is not expected to reduce the area of occupancy of the species, should they occur within the Project Area (PLA).</p> <p>Will not have a Significant Impact.</p>
<p>Fragment an existing population into two or more populations</p>	<p>The Project Area (PLA) is already extremely fragmented with a network of linear remnant corridors often associated with waterways, existing as a mosaic with the broader pine plantation.</p> <p>Remnant vegetation in these areas is retained as project infrastructure has been strategically sited to avoid impacts on the remaining remnant vegetation on site, including waterways and riparian areas</p> <p>There will no barriers on existing waterways within the Project Area (PLA) that would fragment an existing population. The Project will not fragment an existing population into two or more populations.</p> <p>Will not have a Significant Impact.</p>

<p>Adversely affect habitat critical to the survival of a species</p>	<p>Wind farm infrastructure within the Project Area (PLA) avoids the small pockets of low-lying remnant vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding direct and indirect impacts to waterways low-lying remnant vegetation.</p> <p>The Project will not create any waterway barriers or changes to the flow regimes of the existing waterways within or adjacent to the Project Area (PLA). Indirect impacts such as increased sedimentation will be managed through the project specific ESCP.</p> <p>The project is therefore not expected to adversely affect habitat critical to the survival of a species.</p> <p>Will not have a Significant Impact.</p>
<p>Disrupt the breeding cycle of a population</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids waterways, wetlands and riparian vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and aquatic habitat.</p> <p>The Project will not alter the existing hydrology of the waterways within or adjacent to the Project Area (PLA).</p> <p>The Project is therefore not expected to disrupt the breeding cycle of a population.</p> <p>Will not have a Significant Impact.</p>
<p>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids waterways, wetlands and riparian vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to waterways, remnant riparian vegetation and aquatic habitat.</p> <p>The Project will not create any changes to the flow regimes and hydrology of the existing waterways and low-lying areas within or adjacent to the Project Area (PLA). Indirect impacts such as increased sedimentation will be managed through the project specific ESCP.</p> <p>The Project is therefore not expected to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p> <p>Will not have a Significant Impact.</p>
<p>Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat</p>	<p>Several invasive species which are a threat to OPP have been recorded on site during surveys including pigs, wild horses and mosquitofish. Pigs and wild horses are likely responsible for habitat degradation from trampling as they were often observed within the low-lying areas within the Project Area (PLA). Trampling would also inhibit the natural regeneration of native vegetation including wallum heath which is the known habitat of OPP (Conservation</p>

	<p>Advice, 2016).</p> <p>Mosquitofish (<i>Gambusia holbrooki</i>) were recorded within waterways, including non-flowing pools within the Project Area (PLA). Mosquitofish are considered a threat to OPP as they are likely to compete for resources.</p> <p>The Project is not expected to result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat. The Project is not expected to increase the invasive species currently within the Project Area (PLA).</p> <p>Will not have a Significant Impact.</p>
Introduce disease that may cause the species to decline	<p>No diseases are listed as threats to OPP.</p> <p>The Project is not expected to introduce disease that may cause the species to decline.</p> <p>Will not have a Significant Impact.</p>
Interfere with the recovery of the species	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids waterways, wetlands and riparian vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant riparian vegetation and aquatic habitat.</p> <p>The Project is therefore not expected to interfere with the recovery of OPP.</p> <p>Will not have a Significant Impact.</p>

Most of the wallum heath has been historically cleared for the exotic pine plantation, however potential habitat exists for OPP within the small low-lying pockets of remnant wallum heath remaining within the Project Area (PLA).

The Project has been designed to avoid these low-lying remnant pockets of wallum heath by siting infrastructure within the exotic pine plantations. Existing access tracks will be utilised within the Project Area (PLA). Any upgrades to existing tracks or culverts in low-lying areas will be undertaken in accordance approved EMPs to ensure impacts to water quality and potential habitat are mitigated. The Project will not change the hydrology of the existing waterways. Indirect impacts such as degradation in water quality will be mitigated by project specific ESCP. The Project will not have a Significant Impact on OPP.

2.9.3 Australian Lungfish (EPBC Act – V)

2.9.3.1 Survey Effort

Aquatic surveys were undertaken during some BUS assessments whilst traversing the Project Area (PLA) between survey locations. These rapid assessments included habitat assessments and dip-netting if considered possible habitat for threatened aquatic fauna.

Additional aquatic assessments were undertaken on 17-19 June 2019. Aquatic assessments involved dip-netting and habitat assessments for threatened aquatic species. Refer to Figure 5 for aquatic assessment sites.

An additional aquatic assessment was undertaken at the Raintree Bridge location on Tinana Creek in January 2020.

2.9.3.2 Habitat and Populations

The Australian Lungfish natural distribution is the Mary, Burnett and Brisbane River systems and (possibly) the Pine River system but translocated populations persist in the Coomera, Condamine, Albert and Logan Rivers (Approved Conservation Advice, 2014).

The species is restricted to areas of permanent water and cannot live in saline waters or migrate through sea water. Still or slow-flowing, shallow, vegetated pools with clear or turbid water are required to spawn and feed. Emergent or submerged vegetation are essential for successful deposition of eggs and for providing refuges for juveniles (Approved Conservation Advice, 2014).

There are previous records (1992) in the Project Area (PLA) (Wildnet 2019). Suitable habitat exists within Tinana Creek which runs through the south west portion of the Project Area (PLA).

The main threat to Australian lungfish is loss of habitat and barriers to movement caused by the construction of man-made dams and weirs along waterways without effective fish passage facilities (Approved Conservation Advice, 2014).

2.9.3.3 Avoidance, Management and Mitigation

Avoidance is the guiding principle to minimising impacts on all flora and fauna, particularly MNES within the Project Area (PLA). Avoidance measures utilised in the Project to minimize impacts on Australian lungfish include:

- The Project Area (PLA) is located within an existing exotic pine plantation and avoids waterways and riparian areas.
- Existing forestry tracks will be used to provide access within the Project Area (PLA) and therefore avoids disturbance and fragmentation of existing remnant vegetation and habitat within remnant areas.
- Wind farm infrastructure avoids riparian vegetation along waterways within the Project Area (PLA). Any potential bridge and/or culvert upgrades will involve minimal trimming of vegetation and works will be undertaken to avoid impacts on water quality, flows and aquatic habitat.
- Best practice erosion and sediment control measures will further prevent impacts on water quality within the Project Area (PLA).

Table 33 provides a SIA for Australian lungfish undertaken in accordance with the *Matters of National Environmental Significance, Significant Impact Guidelines (1.1), Department of Environment (DoE), 2013*.

Table 33 Significant Impact Assessment for Australian lungfish (EPBC Act - V)

Impact Criteria	Assessment
<p>An action is LIKELY to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:</p>	
<p>Lead to a long-term decrease in the size of an important population</p>	<p>Wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation, including remnant riparian and wetland areas by strategically placing wind turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation, including waterways and riparian habitat.</p> <p>Some upgrades to creek crossings may be required. Minimal trimming of vegetation is expected to occur as the crossings already exist. Management measures will be in place to avoid any impacts to water quality, flows or aquatic habitat during potential upgrades. No waterway barriers or changes in hydrology will occur as a result of potential crossing upgrades.</p> <p>The extent, condition and ecological function of the existing remnant habitat within and along Tinana Creek is retained and not directly or indirectly altered by the project.</p> <p>The Project is not expected to lead to a long-term decrease in the size of an important population.</p> <p>Will not have a Significant Impact.</p>
<p>Reduce the area of occupancy of an important population</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation and particularly waterway and riparian habitat by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation, waterways and aquatic habitat.</p> <p>The Project will not impact the extent, condition and ecological function of the existing remnant habitat within and along Tinana Creek within the Project Area (PLA), including upstream and downstream of the Project Area (PLA).</p> <p>The Project will not create any waterway barriers or changes to the flow regimes of the existing waterways within and adjacent to the Project Area (PLA). Indirect impacts such as increased sedimentation will be managed through the project specific ESCP.</p> <p>The Project is not expected to reduce the area of occupancy of an important population.</p> <p>Will not have a Significant Impact.</p>
<p>Fragment an existing important population into two or more</p>	<p>The Project Area (PLA) is already extremely fragmented with a network of linear remnant corridors often associated with waterways, existing as a mosaic with the broader pine plantation. Tinana Creek</p>

<p>populations</p>	<p>runs through the south western portion of the Project Area (PLA) and is not impact by the project. No changes to flow, hydrology, habitat (such as instream structure) will occur to Tinana Creek as a result of the Project as it is being specifically avoided.</p> <p>Remnant vegetation in riparian areas, including Tinana Creek is retained as project infrastructure has been strategically sited to avoid impacts on the remaining remnant vegetation on site, including waterways and riparian areas.</p> <p>It is possible Australian lungfish occur within the Project Area (PLA) within Tinana Creek as suitable habitat exists and there are known records within Tinana Creek. The Project avoids Tinana Creek and other waterways with permanent flows. There will no barriers on existing waterways within the Project Area (PLA) that would fragment an existing population. The Project will not fragment an existing important population into two or more populations.</p> <p>Will not have a Significant Impact.</p>
<p>Adversely affect habitat critical to the survival of a species</p>	<p>Wind farm infrastructure within the Project Area (PLA) avoids Tinana Creek, other waterways and riparian vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding direct and indirect impacts to waterways and remnant riparian vegetation.</p> <p>The Project will not create any waterway barriers or changes to the flow regimes of the existing waterways (including Tinana Creek) within or adjacent to the Project Area (PLA). Indirect impacts such as increased sedimentation will be managed through the project specific ESCP.</p> <p>The Project is therefore not expected to adversely affect habitat critical to the survival of a species.</p> <p>Will not have a Significant Impact.</p>
<p>Disrupt the breeding cycle of an important population</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids waterways, wetlands and riparian vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and aquatic habitat.</p> <p>The Project will not alter the existing hydrology of the waterways within or adjacent to the Project Area (PLA).</p> <p>The Project is therefore not expected to disrupt the breeding cycle of an important population.</p> <p>Will not have a Significant Impact.</p>
<p>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids waterways, wetlands and riparian vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to waterways,</p>

<p>decline</p>	<p>remnant riparian vegetation and aquatic habitat.</p> <p>The Project will not create any changes to the flow regimes and hydrology of the existing waterways and low-lying areas within or adjacent to the Project Area (PLA). Indirect impacts such as increased sedimentation will be managed through the project specific ESCP.</p> <p>The Project is therefore not expected to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p> <p>Will not have a Significant Impact.</p>
<p>Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat</p>	<p>The Project is not expected to result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.</p> <p>The Project is not expected to increase the invasive species currently within the Project Area (PLA).</p> <p>Will not have a Significant Impact.</p>
<p>Introduce disease that may cause the species to decline</p>	<p>No diseases are listed as threats to Australian lungfish.</p> <p>The Project is not expected to introduce disease that may cause the species to decline.</p> <p>Will not have a Significant Impact.</p>
<p>Interfere substantially with the recovery of the species</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids waterways, wetlands and riparian vegetation by strategically placing turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant riparian vegetation and aquatic habitat.</p> <p>No Project is not expected to cause barriers to movement or changes in hydrology.</p> <p>The Project is therefore not expected to interfere substantially with the recovery of Australian lungfish</p> <p>Will not have a Significant Impact.</p>

Potential habitat exists for Australian lungfish within the Tinana Creek and other permanently flowing waterways that feed into Tinana Creek within the Project Area (PLA).

The Project has been designed to avoid waterways and remnant riparian areas. The Project will not create waterway barriers or impoundments. Indirect impacts such as degradation in water quality will be mitigated by project specific ESCP. The Project will not have a Significant Impact on Australian lungfish.

2.9.4 Honey Blue-Eye (EPBC Act – V)

2.9.4.1 Survey Effort

Aquatic surveys were undertaken during some BUS assessments whilst traversing the site between survey locations. These rapid assessments included habitat assessments and dip-netting if considered possible habitat for Honey blue-eye.

Additional aquatic assessments were undertaken on 17-19 June 2019. Aquatic assessments involved dip-netting and habitat assessments for threatened aquatic species. Refer to Figure 2 for aquatic assessment sites.

An additional aquatic assessment was undertaken at the Raintree Bridge location on Tinana Creek in January 2020.

2.9.4.2 Habitat and Populations

Inhabits slightly acidic (pH 4.4–6.8), clear and tannin-stained lakes, streams and wetlands with sandy or muddy bottoms in coastal heath (wallum) ecosystem. The species usually occurs where there is little or no flow, and the fish can find shelter in dense, aquatic vegetation (Approved Conservation Advice, 2008).

No previous records however potential to occur in remnant creeks and pools within the waterways and pools within the remnant wallum areas of the Project Area (PLA). The honey blue-eye occurs within the Mellum Creek Scientific Reserve, Great Sandy National Park (Cooloola Section) and Great Sandy National Park (Fraser Island Section) (DoE, 2020).

The main identified threats to honey blue-eye include habitat clearing and/or degradation for residential, forestry and agriculture developments; collection for aquariums; and competition from introduced Mosquito Fish (*Gambusia holbrooki*) (Approved Conservation Advice, 2008). Most of the historical potential habitat (coastal wallum heaths) within the Project Area (PLA) have been historically cleared for the pine plantation leaving a mosaic of small pockets amongst the pine plantation landscape in low-lying areas. Despite no previous records and surrounded by ongoing actively managed pine plantations, these small pockets offer possible habitat for honey blue-eye.

2.9.4.3 Avoidance, Management and Mitigation

Avoidance is the guiding principle to minimising impacts on all flora and fauna, particularly MNES within the Project Area (PLA). Avoidance measures utilised in the Project to minimize impacts on honey blue-eye include:

- The Project Area (PLA) is located within an existing exotic pine plantation and avoids waterways and water bodies within any small pockets of remaining remnant wallum heath areas.
- Existing forestry tracks will be used to provide access within the Project Area (PLA) and therefore avoids disturbance and fragmentation of existing remnant vegetation and habitat within remnant areas such as wallum heath areas.
- Wind farm infrastructure avoids waterways and waterbodies within the Project Area (PLA). Any potential bridge and/or culvert upgrades will involve minimal trimming of vegetation and works will be undertaken to avoid impacts on water quality, flows and aquatic habitat.

- Any potential culvert upgrades are expected to be minor, however should be undertaken in accordance with an approved EMP or SMP to ensure impacts to water quality and potential habitat are mitigated.
- Best practice sediment and erosion measures will further prevent impacts on water quality within the Project Area (PLA).

Table 34 provides a SIA for honey blue-eye undertaken in accordance with the *Matters of National Environmental Significance, Significant Impact Guidelines (1.1), Department of Environment (DoE), 2013*.

Table 34 Significant Impact Assessment for Honey Blue-Eye (EPBC Act - V)

Impact Criteria	Assessment
<p>An action is LIKELY to have a significant impact on an animal that is vulnerable if there is a real chance or possibility that it will:</p>	
<p>Lead to a long-term decrease in the size of an important population</p>	<p>Wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation, including remnant riparian and wetland areas by strategically placing wind turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and waterbodies within small pockets of low-lying wallum heath areas.</p> <p>Some upgrades to creek crossings and drainage lines may be required. Minimal trimming of vegetation is expected to occur as the crossings already exist. Management measures will be in place to avoid any impacts to water quality, flows or aquatic habitat during potential upgrades.</p> <p>The extent, condition and ecological function of the existing remnant habitats is retained and not directly or indirectly altered by the Project.</p> <p>The Project is not expected to lead to a long-term decrease in the size of an important population, should they occur within the Project Area (PLA).</p> <p>Will not have a Significant Impact.</p>
<p>Reduce the area of occupancy of an important population</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation, including low-lying pockets of wallum heath areas by strategically placing wind turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and terrestrial and aquatic habitat.</p> <p>The Project will not impact the extent, condition and ecological function of the existing remnant habitats within the Project Area (PLA).</p> <p>The Project will not create any waterway barriers or changes to the flow regimes of the existing waterways within and adjacent to the Project Area (PLA). Indirect impacts such as increased</p>

	<p>sedimentation will be managed through the project specific ESCP.</p> <p>The Project is not expected to reduce the area of occupancy of an important population, should they occur within the Project Area (PLA).</p> <p>Will not have a Significant Impact.</p>
<p>Fragment an existing important population into two or more populations</p>	<p>The Project Area (PLA) is already extremely fragmented with a network of linear remnant corridors often associated with waterways, existing as a mosaic with the broader pine plantation.</p> <p>Remnant vegetation in these areas is retained as project infrastructure has been strategically sited to avoid impacts on the remaining remnant vegetation on site, including waterways and riparian areas</p> <p>There will no barriers on existing waterways within the Project Area (PLA) that would fragment an existing population. The Project will not fragment an existing important population into two or more populations.</p> <p>Will not have a Significant Impact.</p>
<p>Adversely affect habitat critical to the survival of a species</p>	<p>Wind farm infrastructure within the Project Area (PLA) avoids the small pockets of low-lying remnant vegetation by strategically placing wind turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding direct and indirect impacts to waterways low-lying remnant vegetation.</p> <p>The Project will not create any waterway barriers or changes to the flow regimes of the existing waterways within or adjacent to the Project Area (PLA). Indirect impacts such as increased sedimentation will be managed through the project specific ESCP.</p> <p>The Project is therefore not expected to adversely affect habitat critical to the survival of a species.</p> <p>Will not have a Significant Impact.</p>
<p>Disrupt the breeding cycle of an important population</p>	<p>There are no known important populations within the Project Area (PLA). Nonetheless, as above, wind farm infrastructure within the Project Area (PLA) avoids waterways, wetlands and riparian vegetation by strategically placing wind turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and aquatic habitat.</p> <p>The Project will not alter the existing hydrology of the waterways within or adjacent to the Project Area (PLA).</p> <p>The Project is therefore not expected to disrupt the breeding cycle of an important population.</p> <p>Will not have a Significant Impact.</p>

<p>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids waterways, wetlands and riparian vegetation by strategically placing wind turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to waterways, remnant riparian vegetation and aquatic habitat.</p> <p>The Project will not create any changes to the flow regimes and hydrology of the existing waterways and low-lying areas within or adjacent to the Project Area (PLA). Indirect impacts such as increased sedimentation will be managed through the project specific ESCP.</p> <p>The Project is therefore not expected to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p> <p>Will not have a Significant Impact.</p>
<p>Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat</p>	<p>Several invasive species which are a threat to honey blue-eye have been recorded on site during surveys including pigs, wild horses and mosquitofish. Pigs and wild horses are likely responsible for habitat degradation from trampling as they were often observed within the low-lying areas within the Project Area (PLA). Trampling would also inhibit the natural regeneration of native vegetation including wallum heath which is the known habitat of honey blue-eye.</p> <p>Mosquitofish (<i>Gambusia holbrooki</i>) were recorded within waterways, including non-flowing pools within the Project Area (PLA). Mosquitofish are considered a threat to honey blue-eye as they are likely to compete for resources.</p> <p>The Project is not expected to result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat. The Project is not expected to increase the invasive species currently within the Project Area (PLA).</p> <p>Will not have a Significant Impact.</p>
<p>Introduce disease that may cause the species to decline</p>	<p>No diseases are listed as threats to honey blue-eye.</p> <p>The Project is not expected to introduce disease that may cause the species to decline.</p> <p>Will not have a Significant Impact.</p>
<p>Interfere substantially with the recovery of the species</p>	<p>As above, wind farm infrastructure within the Project Area (PLA) avoids waterways, wetlands and riparian vegetation by strategically placing wind turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant riparian vegetation and aquatic habitat.</p> <p>The Project is therefore not expected to interfere substantially with the recovery of honey blue-eye.</p>

	Will not have a Significant Impact.
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Most of the wallum heath has been historically cleared for the pine plantation, however potential habitat exists for honey blue-eye within the small low-lying pockets of remnant wallum heath remaining within the Project Area (PLA).

The Project has been designed to avoid these low-lying remnant pockets of wallum heath by siting infrastructure within the exotic pine plantations. Existing access tracks will be utilised within the Project Area (PLA). Any upgrades to existing tracks or culverts in low-lying areas will be undertaken in accordance approved EMPs to ensure impacts to water quality and potential habitat are mitigated. The Project will not change the hydrology of the existing waterways and low-lying remnant areas. Indirect impacts such as degradation in water quality will be mitigated by the project specific ESCP. The Project will not have a Significant Impact on honey blue-eye.

2.10 Threatened Flora

Table 35 provides threatened flora species at least moderately likely to occur in the Project Area (PLA). Other than *Macrozamia pauli-guilielmi* (pineapple zamia) and *Acacia attenuata*, all species (if present) would be restricted to the mosaic of remnant vegetation remaining within the larger pine plantation area. Wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation by strategically placing wind turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and terrestrial and aquatic habitat. Existing forestry tracks will be used to provide access within the Project Area (PLA) and therefore avoids disturbance to remnant vegetation and habitat. *Fontainea rostrata*, *Macadamia integrifolia*, *Samadera bidwillii* (Quassia) and *Xanthostemon oppositifolius* (southern penda) if present, would be restricted to the riparian notophyll forest (lowland rainforest) along Tinana Creek which is avoided by the Project and therefore not impacted by the Project. *Samadera bidwillii* (Quassia) whilst more commonly found in lowland rainforest, has the potential to occur in other forest types such as open forest and woodland (which are also avoided by the Project).

Phaius australis (lesser swamp orchid) are associated with coastal wet heath/sedgeland wetlands, swampy grassland or swampy forest and often where broad-leaved paperbark (*Melaleuca leucadendra*) or swamp mahogany (*Eucalyptus robusta*) are found (*Phaius australis* Conservation Advice, 2014). Whilst there are no previous or current records and low-lying areas are avoided by Project Infrastructure such as wind turbines and compounds (operation and construction), an SIA has been undertaken to ensure the potential occurrence is considered whilst upgrading any culverts in low-lying areas for the Project.

The Project is not expected to impact on any potentially occurring threatened flora species.

Table 35 Threatened Flora Species Likely to Occur in the Project Area (PLA)

Scientific Name	Common Name	EPBC Act	Likelihood of Occurrence
<i>Acacia attenuata</i>	-	V	High Potential
<i>Fontainea rostrata</i>	-	V	High Potential
<i>Macadamia integrifolia</i>	Macadamia nut	V	Moderate Potential
<i>Macrozamia pauli-guilielmi</i>	Pineapple Zamia	E	Known to Occur
<i>Phaius australis</i>	Lesser swamp orchid	E	Moderate Potential
<i>Samadera bidwillii</i>	Quassia	V	High Potential
<i>Xanthostemon oppositifolius</i>	Southern Penda	V	High Potential

¹ – EPBC Act: CE – Critically endangered, E – Endangered, V – Vulnerable

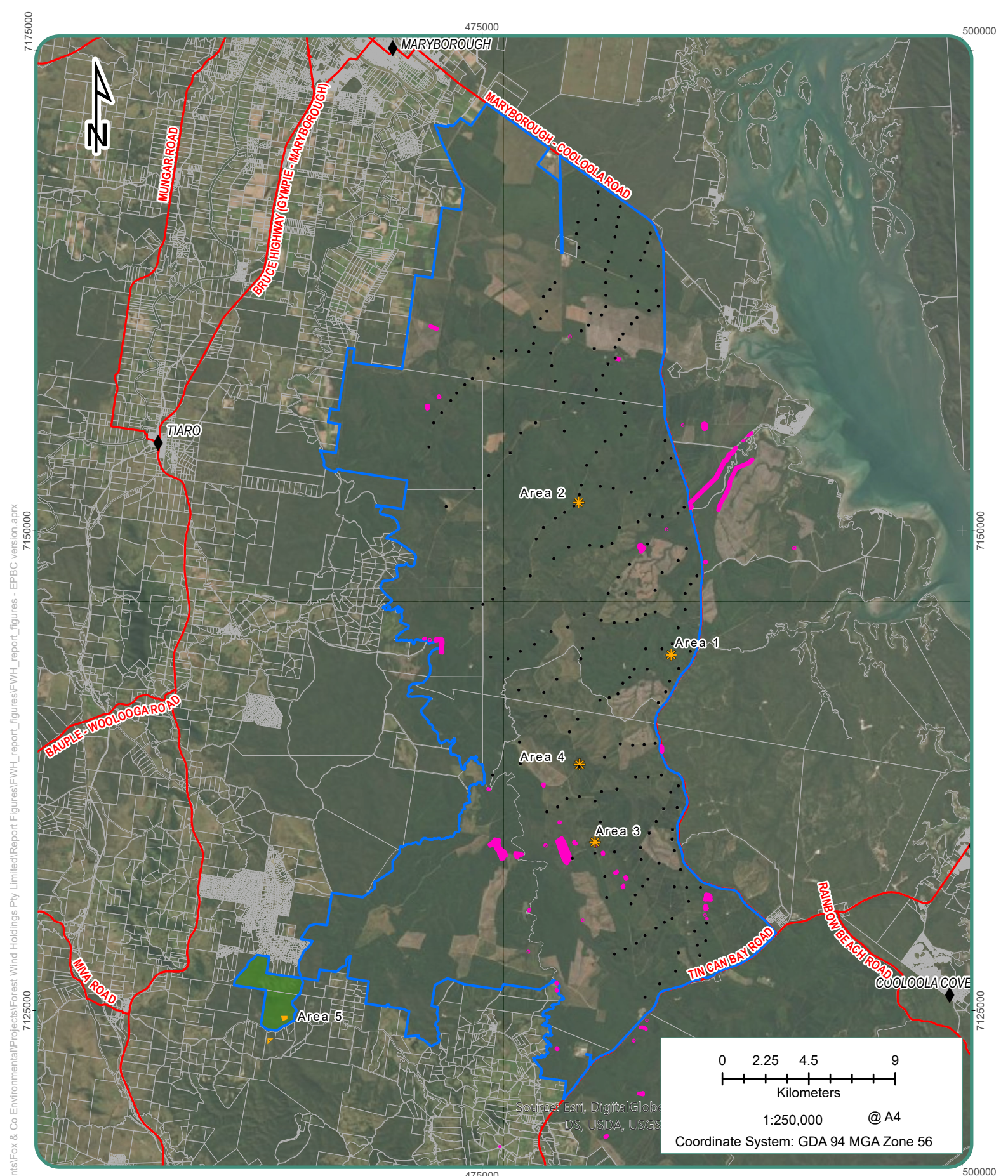
2.10.1 Pineapple Zamia (EPBC Act – E)

2.10.1.1 Survey Effort

Flora and vegetation surveys were undertaken on:

- 2-3 April 2019 (NSF property described as lot 1419 on FTY1697);
- 17-19 June 2019 (inclusive) across the Project Area (PLA).

The surveys were undertaken to ground-truth mapped regional ecosystems (RE) and identify flora species, including threatened flora. Opportunistic flora surveys were undertaken across 16 days within the Project Area (PLA) whilst traversing the site between BUS assessment and aquatic survey locations. Flora surveys were not undertaken within the exotic pine plantations due to the commercial forestry operations and the regular management practices undertaken within the pine plantations. The regular management practices have enabled the Plantation Licensee to locate and delineate areas of pineapple zamia within the Project Area (PLA). Given the regular disturbance by slashing and burning during plantation operations, additional pre-clearance protected plant surveys will be undertaken prior to commencing construction to further inform location of infrastructure (micro-siting) and avoid pineapple zamia populations as required. Refer to Figure 4 for pineapple zamia locations within the Project Area (PLA).



TITLE:

Pineapple Zamia locations within Project Area (PLA)

MAP NO: Figure 3

PROJECT: Forest Wind Holdings Pty Ltd

LEGEND

- ◆ Populated places
- Nominal turbine locations
- State controlled roads
- ▭ Project Area (PLA)
- ▭ Property boundaries
- ★ Pineapple Zamia
- ▭ Pineapple Zamia
- ▭ Pineapple Zamia – Plantation Licensee
- ▭ Native state forest



Date: 20/02/2020

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

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2.10.1.2 Habitat and Populations

Pineapple zamia is found in the Wide Bay district, south-east Queensland, from near the Isis River in the north, to near Wolvi in the south, in lowland open forest or woodland (wallum) dominated by banksias or eucalypts, often on stabilised sand dunes (Recovery Plan, 2007).

The National Multi-species Recovery Plan for the cycads, *Cycas megacarpa*, *Cycas ophiolitica*, *Macrozamia cranei*, *Macrozamia lomandroides*, *Macrozamia pauli-guilielmi* and *Macrozamia platyrhachis*. Queensland Herbarium, 2007 (Cycad Recovery Plan, 2007) has identified known populations of pineapple zamia within a distribution range, including those within the Project Area (PLA).

Pineapple zamia was recorded in the Project Area (PLA) during surveys, mostly within remnant vegetation however they were also identified within the pine plantation.

Area 1 – Remnant vegetation (2 adults) – area avoided by project

Area 2 – Remnant vegetation (7 adults, 1 juvenile (10 cm high)) – area avoided by project

Area 3 – Remnant vegetation (2 adults) – area avoided by project

Area 4 - Pine plantation (2 adults) – area avoided by project

Area 5 – Native State Forest (up to 50 adults) – area avoided by project

The Plantation Licensee has also identified and delineated 34 populations of pineapple zamia within the Project Area (PLA) as part of their environmental stewardship. These locations have been provided to FWH so project infrastructure can be sited to avoid impacts to known populations of pineapple zamia within the Project Area (PLA). Refer Figure 4 for locations of pineapple zamia within the Project Area (PLA).

The population within Tuan State Forest is referred to as Population 8 within the Cycad Recovery Plan (2007) and is included in Figure 4 (east of the Project Area (PLA)). As of 2007, this population includes 1,224 adult plants and has an area of occupancy of 2.4 ha. It is considered to be part of a single, much fragmented metapopulation within Tuan State Forest. The other populations which form part of the same metapopulation are Population 14 (3,600 adults) and Population 17 (1,950 adults) and both are in remnant vegetation with Tuan State Forest (total population 6,774 individuals as of 2007). These populations are highly fragmented by historical clearing for the pine plantation.

Pineapple zamia is known from at least 27 populations (outside of the Project Area (PLA)), over a latitudinal – longitudinal range of approximately 120 km x 40 km, with an estimated area of occupancy of at least 35 ha and with at least 13,131 individuals. The populations range in size from a single adult plant to at least 3600 individuals.

Important populations are those considered to be viable in the long-term. The lack of knowledge about the biology of this species makes it extremely difficult to estimate a minimum viable population size. Most of the populations of pineapple zamia show evidence of insect pollination with local seedling recruitment. However, there is no information available on dispersal for pineapple zamia. Seedling recruitment appears to be localized, with the seedlings often being clumped in close proximity to the parent plants (Recovery Plan, 2007). The minimum viable population size for any cycad species is not known at this time, however healthy viable populations generally are considered to have large numbers of individuals (more than 500 adults), a diversity of individual size classes, and obvious seedling recruitment (Recovery Plan, 2007).

Only four (4) populations of pineapple zamia are currently considered to be viable in the long-term. Populations 8, 14 and 17 occurring in Tuan State Forest are considered to be part of a single, significantly fragmented metapopulation. Population 8 occurs in an area of pine plantations, while populations 14, 17, and 19 (Toolara) occur in remnant vegetation (Recovery Plan, 2007).

Pineapple zamia recorded within the Project Area (PLA) are likely to be part of the same important, significantly fragmented population as 8, 14 and 17 within Tuan State Forest.

Specific threats from land clearing activities for pineapple zamia include:

- proposed road corridors in the Poona, Tuan State Forest 915 (within the Project Area (PLA)) and Cooloola Way road systems;
- quarrying in the vicinity of Tuan State Forest;
- proposed housing development in the vicinity of Tin Can Bay, Poona, Maryborough, Buxton and Isis River areas.

Many Queensland cycads occur in state forests, including pine plantations, where sporadic timber harvesting is carried out using heavy machinery. This may result in physical damage to cycad stems that is similar to that produced from storms, although it has the added stress of soil compaction caused by vehicle tracks. Cycads have demonstrated resilience to this type of disturbance, including the ability to resprout from broken stems (Recovery Plan, 2007). There is often little impact on species with subterranean stems such as pineapple zamia (Recovery Plan, 2007). New management practices have been implemented to minimise the impact of forestry practices on cycads within Queensland State Forests (DoE, 2020).

Populations of pineapple zamia currently affected by timber harvesting include those in the vicinity of Tuan State Forest. Population 8 (within Tuan State Forest) of pineapple zamia have existed within exotic pine plantations for approximately 40 years (Jian Wang pers. comm. 2005 (Recovery Plan, 2007)). Nonetheless, as they are still within areas of non-remnant vegetation (not protected under the Queensland State legislation such as the *Vegetation Management Act 1999* (VM Act)) the populations within the pine plantations in Poona, Tuan and Toolara, are considered under the most immediate threat from clear felling and habitat destruction (Recovery Plan, 2007).

The proposed area of clearing within the exotic pine plantation for the Project is likely to be less than 1% of the total plantation area. Approximately 3,000 ha of crop is cleared per year under the current harvesting program by the licensee.

2.10.1.3 Avoidance, Management and Mitigation

Avoidance is the guiding principle to minimise impacts on all flora, particularly MNES within the Project Area (PLA). Avoidance measures utilised in the Project to minimize impacts on pineapple zamia include:

- All existing areas of known pineapple zamia within the Project Area (PLA) have been delineated and used to inform the siting of project infrastructure such as wind turbines, construction and operation compounds and connection cables. Project infrastructure will not be sited in areas of known populations of pineapple zamia.
- Existing forestry tracks will be used to provide access within the Project Area (PLA) and therefore largely avoids disturbance of existing remnant and non-remnant vegetation.
- Electrical cabling will mostly be underground along existing access tracks which will further reduce the likelihood of impact from clearing. Any above-ground cabling will

span known areas of pineapple zamia populations either within remnant or non-remnant areas.

- Once on site, prior to construction, a final on-ground assessment and pre-clear survey shall be undertaken to ground truth and micro-site each wind turbine. Pineapple zamia will be avoided during the micro-siting process of the wind turbines.
- Pre-clearance surveys undertaken prior to any track widening or clearing along roadsides or within pine plantation areas to ensure pineapple zamia are avoided where possible.
- All known areas of pineapple zamia proximate to any proposed works such as track widening will be clearly delineated and fenced off in an exclusion zone.
- All vehicles involved in construction will have GPS tablets installed. These tablets will have loaded the areas of known pineapple zamia (zones of sensitivity / exclusion), with associated buffers as agreed by the EMP. On approaching the buffer the operators have a visual and audible queue that this zone is no-go and at that point work is stopped. Any trucks or machinery will then need to negotiate and avoid the exclusion area until on the other side and outside the corresponding no-go buffer.
- Sensitive area locations included in tool-box meetings prior to construction works.
- The Forest Wind Project further reduces the threat to these populations by further identifying locations of pineapple zamia within the Project Area (PLA) and therefore delineating areas to avoid by the Project or, for the Plantation Licensee to manage timber harvesting under the new forestry harvesting practices.

In the unlikely event that individuals of pineapple zamia remain within an area of proposed impact following all avoidance measures, translocation of those individuals will be undertaken under an Approved Pineapple Zamia Translocation Management Plan. This follows the avoidance and mitigation hierarchy of:

1. Project infrastructure is specifically sited to avoid known areas of pineapple zamia within the Project Area (PLA)
2. Pre-clearance surveys to inform micro-siting and spanning if required.
3. If avoidance through spanning and micro-siting is not feasible, translocation of individuals to protected remnant areas within the Project Area (PLA) where known populations occur. The magnitude of this given the avoidance measures is expected to be between 0 individuals and singles or “10’s” of individuals. Given that the larger metapopulation with Tuan State Forest is estimated at a total population of at least 6,774 individuals (as this does not include additional individuals identified during surveys and plantation data), the potential translocation of a small number of individuals into known areas of protected habitat, is considered unlikely to impact the population.

Table 36 provides the SIA for pineapple zamia undertaken in accordance with the *Matters of National Environmental Significance, Significant Impact Guidelines (1.1), Department of Environment (DoE), 2013*.

Table 36 Significant Impact Assessment for Pineapple Zamia (EPBC Act – E)

Impact Criteria	Assessment
An action is LIKELY to have a significant impact on a species that is critically endangered or endangered if there is a real chance or possibility that it will:	
<p>Lead to a long-term decrease in the size of a local population</p>	<p>Locations of pineapple zamia within the Project Area (PLA) are well known. These areas are avoided by the Project. Pre-clearance surveys and micro-siting of wind turbines are proposed to further avoid any impacts on the population of pineapple zamia within the Project Area (PLA). Known areas include:</p> <ul style="list-style-type: none"> • Area 1 – Remnant vegetation (2 adults) – area avoided by Project • Area 2 – Remnant vegetation (7 adults, 1 possible juvenile (10cm high)) – area avoided by Project • Area 3 – Remnant vegetation (2 adults) - area avoided by Project • Area 4 – Pine plantation (2 adults) – area avoided by Project • Area 5 – Native State Forest (up to 50 adults) – area avoided by Project • Plantation Licensee (34 areas delineated within Project Area (PLA))– no surveys of individuals undertaken due to existing pine plantation operations however areas will be avoided by Project. <p>These populations may be part of a larger metapopulation that is highly fragmented by historical clearing for the pine plantation. The Project will avoid these areas.</p> <p>Individual pineapple zamia may be required to be translocated if they cannot be avoided by micro siting of proposed infrastructure. The magnitude of this given the avoidance measures is expected to be between 0 individuals and singles or “10’s” of individuals. Given that the larger metapopulation within Tuan State Forest was estimated at a total population at 2007 of at least 6,774 individuals (as this does not include additional individuals identified during surveys and plantation data), the potential translocation of a small number of individuals into known areas of protected habitat, is considered unlikely to impact the population.</p> <p>The Project is not expected to lead to a long-term decrease in the size of a local population as pineapple zamia are avoided or managed through translocation of isolated individual plants</p> <p>Will not have a Significant Impact.</p>
<p>Reduce the area of occupancy</p>	<p>Pineapple zamia within the non-remnant and remnant areas within the Project Area (PLA) are considered part of a single, highly</p>

<p>of the species</p>	<p>fragmented metapopulation which occurs within Tuan State Forest. The number of adults within this single population was estimated to be 6,774 individuals (within known populations 8, 14 and 17) as of 2007 (Cycad Recovery Plan, 2007).</p> <p>Pineapple zamia locations are known within the Project Area (PLA) and project infrastructure has therefore been sited to avoid these areas.</p> <p>Access tracks within the Project Area (PLA) already exist and micro-siting of turbines will allow opportunities to avoid individuals, if required.</p> <p>The Project is not expected to reduce the area of occupancy of the species.</p> <p>Will not have a Significant Impact.</p>
<p>Fragment an existing population into two or more populations</p>	<p>The pineapple zamia within the Project Area (PLA) are considered to be part of a highly fragmented metapopulation within remnant and non-remnant areas of Tuan State Forest. The Project has been designed to avoid known populations of pineapple zamia in the Project Area (PLA). Any translocated individuals would be translocated to known areas of pineapple zamia within the protected remnant areas within the Project Area (PLA).</p> <p>Access tracks within the Project Area (PLA) already exist and micro-siting of turbines will allow opportunities to avoid individuals.</p> <p>The population is highly fragmented and the project is not expected to fragment an existing population into two or more populations.</p> <p>Will not have a Significant Impact.</p>
<p>Adversely affect habitat critical to the survival of a species</p>	<p>The pineapple zamia within the Project Area (PLA) and areas adjacent to the Project Area (PLA) occur in remnant and non-remnant areas. They have been recorded in actively managed pine plantations within Tuan State Forest for more than 40 years and appear to demonstrate resilience to this type of disturbance, including the ability to resprout from broken stems. There is often little impact on species with subterranean stems such as pineapple zamia.</p> <p>Nonetheless, the Project is avoiding known areas of pineapple zamia and pre-clearance surveys will further allow micro-siting of infrastructure to avoid any pineapple zamia not previously identified (due to the highly changing landscape of an actively managed pine plantation)</p> <p>The Project is not expected to adversely affect habitat critical to the survival of the species.</p> <p>Will not have a Significant Impact.</p>
<p>Disrupt the breeding cycle of a</p>	<p>Although there is no data on time to reach maturity for pineapple zamias, it is known from cultivation of other cycads that it can take</p>

<p>population</p>	<p>2–30 years to reach maturity. However, such time has been noted to be shorter amongst pineapple zamia plants in cultivation (DoE, 2019).</p> <p>All cycads exist in a symbiotic relationship with blue-green algae within their coralloid roots. The algae help to ‘fix’ nitrogen from the air.</p> <p>Insect pollinators are important to ensure pollen is transferred between male and female individuals for successful fertilization and seed production.</p> <p>There is no information available on dispersal or recruitment for pineapple zamia, however seedling recruitment appears to be localized, with the seedlings often being clumped in close proximity to the parent plants. Evidence of recruitment was observed in Area 2 (within remnant vegetation) with one small juvenile plant observed. All other pineapple zamia observed within the Project Area (PLA) were adults.</p> <p>The Project is not expected to disrupt any of these relationships and therefore is not considered to disrupt the breeding cycle of a population.</p> <p>Will not have a Significant Impact.</p>
<p>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</p>	<p>Clearing for pine plantations has historically been a major threat to pineapple zamia. The populations within the Project Area (PLA) within remnant and non-remnant vegetation (pine plantation) are considered part of a single, highly fragmented metapopulation which occurs within Tuan State Forest.</p> <p>Approximately 3,000 ha of plantation is cleared per year under the current harvesting program by the licensee. The proposed area of pine plantation clearing for the Project is likely to be less than 1% of the total plantation area with known areas of pineapple zamia avoided. Additional pre-clearance surveys and micro-siting of infrastructure will further ensure existing pineapple zamia are avoided by project works.</p> <p>The Project is not expected to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p> <p>Will not have a Significant Impact.</p>
<p>Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species’ habitat</p>	<p>No invasive species are listed as a threat to pineapple zamia.</p> <p>Will not have a Significant Impact.</p>

<p>Introduce disease that may cause the species to decline</p>	<p>No diseases are listed as a threat for pineapple zamia.</p> <p>Will not have a Significant Impact.</p>
<p>Interfere with the recovery of the species</p>	<p>Wind farm infrastructure within the Project Area (PLA) avoids known populations of pineapple zamia by strategically placing wind turbines, compounds (operation and construction) outside of known areas of occurrence. Pre-clearance surveys and micro-siting further mitigates any potential impacts to pineapple zamia within the Project Area (PLA).</p> <p>While some small fragmented populations may not be viable in the long-term, they may represent significant genetic variation across the range of the species and also form part of a larger single, highly fragmented population within Tuan State Forest. As such, the Project is designed to avoid these small populations and therefore is not considered to interfere with the recovery of the species.</p> <p>Will not have a Significant Impact.</p>

The Project has been designed to avoid known populations of pineapple zamia occurring within the Project Area (PLA). Additional individual pineapple zamia are known to occur within the Project Area (PLA). They occur in both remnant and non-remnant vegetation (pine plantation). Populations within the Project Area (PLA) are likely part of a highly fragmented metapopulation known to occur within Tuan State Forest (both within the pine plantations and remnant areas). As of 2007, the population of this larger population is estimated at 6,774 individuals within Tuan State Forest (Forest 915).

Given the avoidance measures proposed, the Project will not have a significant impact on pineapple zamia and is more likely to introduce further protection measures for the individuals within the pine plantations which are considered more at threat due to silvicultural practices (National Cycad Recovery Plan, 2007).

2.10.2 Acacia attenuata (EPBC Act – V)

2.10.2.1 Survey Effort

Flora and vegetation surveys were undertaken on:

- 2-3 April 2019 (NSF property described as lot 1419 on FTY1697);
- 17-19 June 2019 (inclusive) across the Project Area (PLA).

The surveys were undertaken to ground-truth mapped REs, identify flora species, including threatened flora. Opportunistic flora surveys were undertaken across 16 days within the Project Area (PLA) whilst traversing the site between BUS assessments and aquatic survey locations.

2.10.2.2 Habitat and Populations

This species occurs on flat coastal lowland plains, at altitudes of lower than 30 m above sea level, typically occurring in seasonally waterlogged areas of wet heathland or heathland margins, open forest and woodland communities, and specifically on sandy poorly drained soils or peat swamps which are infertile. The species has been recorded growing in shrublands with

Leptospermum whitei and *Baeckea frutescens*; in wallum with *Banksia aemula* and *Eucalyptus robusta*; in woodlands with *Corymbia trachyphloia*, *E. umbra* and *Banksia oblongifolia*; and in open forests of *E. umbra*, *E. racemosa* and *Melaleuca quinquenervia* and has been found in disturbed environments, such as roadsides subject to vegetation control (Department of the Environment, 2019).

Acacia attenuata shows a close association with the ecotone between wet heathland and open eucalypt forest communities (National Recovery Plan, 2007). In these low-lying coastal habitats, soils are sandy / peaty and sites are seasonally waterlogged. These conditions and respective communities are considered essential for the survival of this species as they represent potential habitat for population expansion and corridors for pollinator movement (National Recovery Plan, 2007).

The species has been observed at sites recently cleared of native vegetation, along power line easements and disturbed by slashing and road grading and as an emergent at newly logged sites and on soil stock piles. Although cleared areas and roadsides are not the preferred habitat, the species' ability to tolerate some level of disturbance has enabled it to persist in these areas (National Recovery Plan, 2007).

There are previous records within Toolara State Forest (Wildlife Online) and within the Project Area (PLA) (Wildnet: 2010). *A. attenuata* has a restricted geographic range and as of 2007 was known from 24 wild populations (National Recovery Plan, 2007). Four of the five known populations in the north of its range (Wide Bay Burnett region) are within protected estates (National Parks or Forest Reserves). The other population is on unprotected freehold land in Moore Park, near Bundaberg. No important populations are known within the Project Area (PLA).

Species such as *A. attenuata* have been found in disturbed areas such as roadsides subject to vegetation control (outside of the Project Area (PLA)). As such, it is possible this species may occur in low-lying roadside areas within the Project Area (PLA), yet outside of remnant areas. The Plantation Licensee undertakes plantation maintenance of woody weeds every 3 – 4 years using machines and/or prescribed burning and eventually (year 27) clear fells the compartment. Nonetheless, as they are known to occur in disturbed roadside areas, it is possible *A. attenuata* may be present in the low-lying plantations.

The commercial forestry operation regularly undertakes slashing and herbicide treatment within the pine plantations which reduces the likelihood of threatened species such as *A. attenuata* to occur in the actual pine plantation stands of timber.

The proposed area of pine plantation clearing for the Project is likely to be less than 1% of the total plantation area. Approximately 3,000 ha of crop is cleared per year under the current harvesting program by the licensee.

The principal threat is loss and fragmentation of suitable habitat through urban development along the coastal plains of south-east Queensland. Other known threats include inappropriate fire regimes, habitat degradation from conflicting land use activities in urban areas, weed invasion and competition and damage inflicted by site maintenance operations. Potential threats include modification of hydrological regimes and small population size (National Recovery Plan, 2007).

2.10.2.3 Avoidance, Management and Mitigation

Avoidance is the guiding principle to avoiding impacts on all flora, particularly MNES within the Project Area (PLA). Avoidance measures utilised in the Project to minimize impacts on *Acacia attenuata* include:

- The Project Area (PLA) is located within an existing exotic pine plantation and avoids typical habitat in low-lying areas such as seasonally waterlogged areas of wet heathland or heathland margins, open forest and woodland communities.
- As it is known to be tolerant to disturbance, pre-clearance surveys are required along existing access tracks should they require additional widening for the Project. These tracks will be identified prior to development.
- Surveys along access tracks would be in areas below 30 m above sea level (ie. in areas where previous suitable habitat may have occurred).
- Existing forestry tracks will be used to provide access within the Project Area (PLA) and therefore avoids disturbance and fragmentation of existing remnant vegetation and habitat within remnant areas such as heathland or heathland margins, open forest and woodland communities.
- Wind farm infrastructure avoids waterways and low-lying areas within the Project Area (PLA). Any potential bridge and/or culvert upgrades will involve minimal trimming of vegetation. Pre-clearance surveys will be undertaken prior to any potential culvert and/or bridge upgrades.

Table 37 provides the SIA for *Acacia attenuata* undertaken in accordance with the *Matters of National Environmental Significance, Significant Impact Guidelines (1.1), Department of Environment (DoE), 2013*.

Table 37 Significant Impact Assessment for *Acacia attenuata* (EPBC Act – V)

Impact Criteria	Assessment
An action is LIKELY to have a significant impact on a species that is vulnerable if there is a real chance or possibility that it will:	
Lead to a long-term decrease in the size of an important population of a species	<p><i>A. attenuata</i> has a restricted geographic range and is currently known from 24 wild populations.</p> <p>No known important populations are within the Project Area (PLA)</p> <p>The Project is not expected to lead to a long-term decrease in the size of an important population of the species.</p> <p>Will not have a Significant Impact.</p>
Reduce the area of occupancy of an important population	<p><i>A. attenuata</i> has a restricted geographic range and as of 2007 is known from 24 wild populations. No known important populations occur within the Project Area (PLA). No individuals were recorded during flora surveys.</p> <p>Wind farm infrastructure within the Project Area (PLA) avoids remnant vegetation, including low-lying pockets of seasonally waterlogged areas of wet heathland or heathland margins, open forest and woodland communities by strategically placing wind turbines, compounds (operation and construction) within the exotic pine plantations, therefore avoiding impacts to remnant vegetation and terrestrial and aquatic habitat.</p> <p>As no important populations are known to occur within the Project Area (PLA) the Project is not expected to reduce the area of</p>

	<p>occupancy of an important population of this species.</p> <p>Will not have a Significant Impact.</p>
<p>Fragment an existing important population into two or more populations</p>	<p>The Project Area (PLA) is already extremely fragmented with a network of linear remnant corridors often associated with waterways, existing as a mosaic with the broader exotic pine plantation.</p> <p>Remnant vegetation in these areas is retained as project infrastructure has been strategically sited to avoid impacts on the remaining remnant vegetation on site, including low-lying areas.</p> <p>There are no known populations within the Project Area (PLA) and therefore the Project is not expected to fragment an existing population into two or more populations.</p> <p>Will not have a Significant Impact.</p>
<p>Adversely affect habitat critical to the survival of a species</p>	<p>Remnant vegetation is retained as project infrastructure has been strategically sited to avoid impacts on the remaining remnant vegetation on site, including low-lying areas.</p> <p>There are no known populations within the Project Area (PLA) and low-lying remnant areas are avoided, therefore the project is not expected to adversely affect habitat critical to the survival of the species.</p> <p>Will not have a Significant Impact.</p>
<p>Disrupt the breeding cycle of an important population</p>	<p>There are no known important populations of <i>A. attenuata</i> within the Project Area (PLA), therefore the Project is not considered to disrupt the breeding cycle of an important population.</p> <p>Will not have a Significant Impact.</p>
<p>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</p>	<p>Approximately 3,000 ha of plantation is cleared per year under the current harvesting program by the licensee. The proposed area of pine plantation clearing for the Project is likely to be less than 1% of the total plantation area. Although not detected during surveys, additional pre-clearance surveys will ensure that any potential <i>Acacia attenuata</i> are avoided by project works and infrastructure.</p> <p>The Project is not expected to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p> <p>Will not have a Significant Impact.</p>
<p>Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat</p>	<p>No invasive species are listed as a threat to <i>Acacia attenuata</i>.</p> <p>Will not have a Significant Impact.</p>

Introduce disease that may cause the species to decline	No diseases are listed as a threat for <i>Acacia attenuata</i> . Will not have a Significant Impact.
Interfere substantially with the recovery of the species	No important populations are known within the Project Area (PLA). Wind farm infrastructure within the Project Area (PLA) avoids low-lying remnant areas by strategically placing turbines, compounds (operation and construction) outside of low-lying remnant areas. The Project is not considered to interfere substantially with the recovery of the species. Will not have a Significant Impact.

Most of the low-lying pockets of seasonally waterlogged areas of wet heathland or heathland margins, open forest and woodland communities has been historically cleared within the Project Area (PLA) for the pine plantation. However potential habitat exists for *Acacia attenuata* within the small low-lying pockets of remnant vegetation remaining within the Project Area (PLA). As *A. attenuata* is tolerant to some level of disturbance, there is the potential for this species to maintain populations within the non-remnant areas in low-lying areas (previous wallum habitat – pre-clear extent).

The Project has been designed to avoid these low-lying remnant pockets of wet heathland or heathland margins, open forest and woodland communities by siting infrastructure within the exotic pine plantations. Existing access tracks will be utilised within the Project Area (PLA). Any upgrades to existing tracks or culverts in low-lying areas will be undertaken in accordance approved EMPs to ensure impacts to these areas are mitigated. Pre-clearance surveys will be undertaken prior to any track widening or clearing along roadsides or within exotic pine plantation areas to determine if *Acacia attenuata* are present and if further avoidance measures are required. Additional measures may include seed collection, propagation and planting out in suitable remnant areas within the Project Area (PLA).

The Project will not to have a Significant Impact on *Acacia attenuata*.

2.10.3 Lesser Swamp Orchid (EPBC Act – E)

2.10.3.1 Survey Effort

Flora and vegetation surveys were undertaken on:

- 2-3 April 2019 (NSF property described as lot 1419 on FTY1697);
- 17-19 June 2019 (inclusive) across the Project Area (PLA).

The surveys were undertaken to ground-truth mapped REs and identify flora species, including threatened flora. Opportunistic flora surveys were undertaken across 16 days within the Project Area (PLA) whilst traversing the site between BUS assessments and aquatic survey locations. Flora surveys were not undertaken within the exotic pine plantations due to the commercial forestry operations and the regular management practices undertaken within the plantations.

2.10.3.2 Habitat and Populations

Phaius australis (lesser swamp orchid) is associated with coastal wet heath/sedgeland wetlands, swampy grassland or swampy forest and often where broad-leaved paperbark (*Melaleuca leucadendra*) or swamp mahogany (*Eucalyptus robusta*) are found (*Phaius australis* Conservation Advice, 2014). There are no previous or current records within the Project Area (PLA) however potential suitable habitat exists within the low-lying wet heath areas of remnant vegetation.

There are 14 known populations of this species (seven in National Parks or Conservation Parks, one in State Forest, six on private land), though individual numbers are known for only 50% of these populations. Determining the number of plants in a population is difficult as this species grows in clumps of pseudobulbs and leafy stems, making it difficult to distinguish between individual plants (*Phaius australis* Conservation Advice, 2014). The main identified threats to the lesser swamp orchid are illegal collection for horticulture or cut flowers, habitat loss, through clearing and fragmentation and drainage for development, agriculture and road works. Invasion by weeds such as lantana (*Lantana camara*), umbrella tree (*Schefflera actinophylla*), groundsel (*Baccharis halmifolia*) and Brazilian cherry (*Eugenia uniflora*) is also an identified threat to this species (*Phaius australis* Conservation Advice, 2014). The main potential threats to lesser swamp-orchid include timber harvesting, mining, trampling and browsing by feral pigs and domestic livestock and inappropriate fire regimes (*Phaius australis* Conservation Advice, 2014).

2.10.3.3 Avoidance, Management and Mitigation

Avoidance is the guiding principle to minimise impacts on all flora, particularly MNES within the Project Area (PLA). Avoidance measures utilised in the Project to minimize impacts on *Phaius australis* include:

- The Project Area (PLA) is located within an existing exotic pine plantation and avoids typical lesser swamp orchid habitat in low-lying areas such as seasonally waterlogged areas of wet heathland or heathland margins, open forest and woodland communities.
- Existing forestry tracks will be used to provide access within the Project Area (PLA) and therefore avoids disturbance and fragmentation of existing remnant vegetation and habitat within remnant areas such as heathland or heathland margins.
- Wind farm infrastructure avoids waterways and low-lying areas within the Project Area (PLA). Any potential bridge and/or culvert upgrades will involve minimal trimming of vegetation. Pre-clearance surveys will be undertaken prior to any potential culvert and/or bridge upgrades.

Table 38 provides the SIA for *Phaius australis* undertaken in accordance with the *Matters of National Environmental Significance, Significant Impact Guidelines (1.1), Department of Environment (DoE), 2013*.

Table 38 Significant Impact Assessment for *Phaius australis* (EPBC Act – E)

Impact Criteria	Assessment
An action is LIKELY to have a significant impact on a species that is critically endangered or endangered if there is a real chance or possibility that it will:	
Lead to a long-term decrease in the size of a local population	<p>No local populations have previously or recently been recorded within the Project Area (PLA).</p> <p>Nonetheless, if they were to occur within the Project Area (PLA) they would be restricted to the low-lying remnant wet heath areas which are avoided by the Project. Existing access tracks will be utilised through these areas.</p> <p>The Project is not expected to lead to a long-term decrease in the size of a local population.</p> <p>Will not have a Significant Impact.</p>
Reduce the area of occupancy of the species	<p>No local populations have previously or recently been recorded within the Project Area (PLA).</p> <p>Nonetheless, if they were to occur within the Project Area (PLA) they would be restricted to the low-lying remnant wet heath areas which are avoided by the Project.</p> <p>Access tracks within the Project Area (PLA) already exist and will be utilised through for access through the low-lying remnant areas.</p> <p>The Project is not expected to reduce the area of occupancy of the species.</p> <p>Will not have a Significant Impact.</p>
Fragment an existing population into two or more populations	<p>The project is not expected to fragment an existing population into two or more populations.</p> <p>No local populations have previously or recently been recorded within the Project Area (PLA).</p> <p>Nonetheless, if they were to occur they would be restricted to the low-lying remnant wet heath areas within the Project Area (PLA) which are avoided by the Project.</p> <p>Access tracks within the Project Area (PLA) already exist and will be utilised through for access through the low-lying remnant areas.</p> <p>Will not have a Significant Impact.</p>
Adversely affect habitat critical to the survival of a	<p>No local populations have previously or recently been recorded within the Project Area (PLA).</p>

species	<p>Nonetheless, if they were to occur they would be restricted to the low-lying remnant wet heath areas within the Project Area (PLA) which are avoided by the Project.</p> <p>Access tracks within the Project Area (PLA) already exist and will be utilised through for access through the low-lying remnant areas.</p> <p>The Project is not expected to adversely affect habitat critical to the survival of the species.</p> <p>Will not have a Significant Impact.</p>
Disrupt the breeding cycle of a population	<p>No local populations have previously or recently been recorded within the Project Area (PLA).</p> <p>Nonetheless, if they were to occur within the Project Area (PLA) they would be restricted to the low-lying remnant wet heath areas which are avoided by the Project.</p> <p>Access tracks within the Project Area (PLA) already exist and will be utilised through for access through the low-lying remnant areas.</p> <p>The Project is not expected to disrupt any of these relationships and therefore is not considered to disrupt the breeding cycle of a population.</p> <p>Will not have a Significant Impact.</p>
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	<p>No local populations have previously or recently been recorded within the Project Area (PLA).</p> <p>Nonetheless, if they were to occur within the Project Area (PLA) they would be restricted to the low-lying remnant wet heath areas which are avoided by the Project.</p> <p>Access tracks within the Project Area (PLA) already exist and will be utilised through for access through the low-lying remnant areas.</p> <p>The Project is not expected to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p> <p>Will not have a Significant Impact.</p>
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	<p>Invasion by weeds such as lantana (<i>Lantana camara</i>), umbrella tree (<i>Schefflera actinophylla</i>), groundsel (<i>Baccharis halmifolia</i>) and Brazilian cherry (<i>Eugenia uniflora</i>).</p> <p>Lantana and groundsel were recorded within the Project Area (PLA) during flora surveys.</p> <p>The Project will not increase the invasive species already present or result in an invasive species that are harmful to a critically endangered or endangered species becoming introduced and established in the endangered or critically endangered species' habitat.</p>

	Will not have a Significant Impact.
Introduce disease that may cause the species to decline	No diseases are listed as a threat for lesser swamp orchid. Will not have a Significant Impact.
Interfere with the recovery of the species	No local populations have previously or recently been recorded within the Project Area (PLA). Nonetheless, if they were to occur within the Project Area (PLA) they would be restricted to the low-lying remnant wet heath areas which are avoided by the Project. Access tracks within the Project Area (PLA) already exist and will be utilised through for access through the low-lying remnant areas. The Project is not considered to interfere with the recovery of the species. Will not have a Significant Impact.

Phaius australis have not previously or recently been recorded within the Project Area (PLA). Potential habitat within the Project Area (PLA) exists in the remnant low-lying wet heath areas.

The Project has been designed to avoid these low-lying remnant pockets of wet heathland or heathland margins by siting infrastructure within the exotic pine plantations. Existing access tracks will be utilised within the Project Area (PLA). Any upgrades to existing tracks or culverts in low-lying areas will be undertaken in accordance approved EMPs to ensure impacts to these areas are mitigated. Pre-clearance surveys will be undertaken prior to any potential culvert upgrades to determine if *Phaius australis* are present and if further avoidance measures are required.

3. REFERENCE LIST

Bamford M, Watkins D, Bancroft W, T. G. and J. W. (2008). *Migratory Shorebirds of the East Asian - Australasian Flyway; Population Estimates and Internationally Important Sites*.

Biosis Research (2005). Modelled cumulative impacts on the White-bellied Sea-eagle of wind farms across the species' Australian range

BirdLife International (2020) Species factsheet: *Hirundapus caudacutus*. Downloaded from <http://www.birdlife.org> on 18/02/2020

Brownlie, H. 2007. National Recovery Plan for *Acacia attenuata*. Report to Department of the Environment and Water Resources, Canberra. Queensland Parks and Wildlife Service, Brisbane

Commonwealth of Australia, Department of the Environment (2015). *Draft referral guideline for 14 birds listed as migratory species under the EPBC Act*.

Department of the Environment (2020). *Apus pacificus* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: <http://www.environment.gov.au/sprat>. Accessed Tue, 25 Feb 2020 13:12:14 +1100.

Department of the Environment (2019). *Charadrius mongolus* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: <http://www.environment.gov.au/sprat>. Accessed Wed, 7 Aug 2019 11:43:37 +1000.

Department of the Environment (2016). Conservation Advice *Charadrius mongolus* lesser sand plover

Department of the Environment (2019). *Hirundapus caudacutus* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: <http://www.environment.gov.au/sprat>. Accessed Wed, 7 Aug 2019 09:37:22 +1000.

Department of the Environment (2019). *Limosa lapponica* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: <http://www.environment.gov.au/sprat>. Accessed Tue, 13 Aug 2019 22:23:44 +1000.

Department of the Environment (2016). Threatened Species Scientific Committee. Conservation Advice, *Maccullochella mariensis*

Department of the Environment (2019). *Macrozamia pauli-guilielmi* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: <http://www.environment.gov.au/sprat>. Accessed Tue, 27 Aug 2019 12:18:42 +1000.

Department of the Environment (2020). *Merops ornatus* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: <http://www.environment.gov.au/sprat>. Accessed Tue, 25 Feb 2020 16:33:50 +1100

Department of the Environment (2017). Threatened Species Scientific Committee. Conservation Advice *Mixophyes iteratus* Giant Barred Frog

Department of the Environment (2020). *Mixophyes iteratus* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: <http://www.environment.gov.au/sprat>. Accessed Wed, 19 Feb 2020 10:35:37 +1100.

Department of Environment (2016). Threatened Species Scientific Committee. Conservation Advice *Nannaperca oxleyana* Oxleyan pygmy perch

Department of Environment (2014). Approved Conservation Advice for *Neoceratodus forsteri* (Australian lungfish)

Department of the Environment (2019). Threatened Species Scientific Committee. Conservation Advice *Potorous tridactylus tridactylus* Long-nosed potoroo

Department of the Environment (2019). *Numenius madagascariensis* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: <http://www.environment.gov.au/sprat>. Accessed Thu, 3 Oct 2019 11:37:57 +1000

Department of the Environment (2019). *Numenius phaeopus* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: <http://www.environment.gov.au/sprat>. Accessed Wed, 7 Aug 2019 11:46:37 +1000.

Department of the Environment (2016). Threatened Species Scientific Committee. Conservation Advice *Petauroides Volans* Greater Glider

Department of the Environment. (2014d). *Phascolarctos cinereus* (combined populations of Qld, NSW and the ACT). Retrieved from <http://www.environment.gov.au/sprat>

Department of the Environment (2014). Approved Conservation Advice for *Phaius australis* (common swamp orchid)

Department of the Environment (2020). *Pseudomugil mellis* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: <http://www.environment.gov.au/sprat>. Accessed Tue, 25 Feb 2020 18:55:54 +1100

Department of the Environment (2019). *Pteropus poliocephalus* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: <http://www.environment.gov.au/sprat>. Accessed Tue, 6 Aug 2019 16:53:52 +1000.

Department of the Environment (2019). *Rostratula australis* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: <http://www.environment.gov.au/sprat>. Accessed Tue, 27 Aug 2019 12:06:17 +1000.

Department of the Environment (2019). *Tringa brevipes* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: <http://www.environment.gov.au/sprat>. Accessed Wed, 7 Aug 2019 11:29:51 +1000.

Department of the Environment (2019). *Tringa nebularia* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: <http://www.environment.gov.au/sprat>. Accessed Wed, 7 Aug 2019 11:36:41 +1000.

Department of the Environment (2019). *Xenus cinereus* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: <http://www.environment.gov.au/sprat>. Accessed Wed, 7 Aug 2019 11:20:59 +1000.

Department of the Environment and Resource Management 2010. National recovery plan for the water mouse (false water rat) *Xeromys myoides*. Report to Department of Sustainability, Environment, Water, Population and Communities, Canberra. Department of the Environment and Resource Management, Brisbane

Department of Sustainability, Environment, Water, Population and Communities (2011). Draft Referral Guidelines for the Vulnerable Wallum Sedge Frog, *Litoria olongburensis*.

Hull C L, Stark E M, Peruzzo S and Sims C C (2013) Avian collisions at two wind farms in Tasmania, Australia: taxonomic and ecological characteristics of colliders versus non-colliders, New Zealand Journal of Zoology, 40:1, 47-62

Morcombe, M. (2003). *Field Guide to Australian Birds*. Archerfield: Steve Parish Publishing Pty Ltd.

Piersma, T; Zwarts, L and Bruggemann, J H (1990) Behavioural aspects of the departure of waders before long distance flights: flocking, vocalisations, flight paths and diurnal timing. *Ardea* 78: 157-184

Piersma, T; Hedenstrom, A and Bruggemann, J H (1997) Climb and flight speeds of shorebirds embarking on an intercontinental flight; do they achieve the predicted optimal behaviour? *Ibis* 139: 299-304

Queensland Government (2020). Department of Environment and Science. Threatened Species Mary River Turtle. Accessed 18 February 2020.

Queensland Herbarium (2007). National Multi-species Recovery Plan for the cycads, *Cycas megacarpa*, *Cycas ophiolitica*, *Macrozamia cranei*, *Macrozamia lomandroides*, *Macrozamia pauli-guilielmi* and *Macrozamia platyrhachis* Report to Department of the Environment and Water Resources, Canberra. Queensland Parks and Wildlife Service, Brisbane

The National Recovery Plan for the White-throated Snapping Turtle (*Elseya albagula*), Commonwealth of Australia (2017)

Threatened Species Scientific Committee (July 2019), Conservation Advice, *Hirundus caudacutus* (White-throated Needletail) Conservation Advice



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