

# Appendix I: Biobank Credit Assessment Report



## **CRUDINE RIDGE WIND FARM**

# Indicative Biobanking Assessment Report

Prepared for  
Wind Prospect CWP

February 2012



# Crudine Ridge Wind Farm

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## Indicative Biobanking Assessment Report

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**PREPARED FOR**      **Wind Prospect CWP**

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**PROJECT NO**        **11SYDECO-0018**

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# Abbreviations

ABBREVIATION	DESCRIPTION
CEEC	Critically Endangered Ecological Community
CRWF	Crudine Ridge Wind Farm
DECCW	NSW Department of Environment, Climate Change and Water now OEH
EA Report	Environmental Assessment Report
EEC	Endangered Ecological Community
ELA	Eco Logical Australia Pty Ltd
OEH	Office of Environment and Heritage
Study Area	Defined by the 200 corridor in which the development footprint is contained
TSC Act	NSW <i>Threatened Species Conservation 1995</i>

# 1. Introduction

An indicative Biobanking Assessment has been conducted for the proposed Crudine Ridge Wind Farm (CRWF) (Figure 16) to inform the “quantum” of biodiversity offsets required to meet and improve, or maintain, the outcome in accordance with the Office of Environment and Heritage’s (OEH) interim policy on Biodiversity Offsets for Part 3A and Major Projects (OEH 2011). While not a formal application for a Biobanking Statement, the approach has utilised the Biobanking Assessment Methodology (and the associated DECCW Improve or Maintain (IoM) principle) to calculate the area required to offset the ecological impact of the proposed Crudine Ridge Wind Farm to fully meet a Tier 1 outcome.

In terms of the ecological impact associated with two proposed wind farm options, this assessment represents the ‘worst case’ scenario, Layout Option A. The assessment has assumed that the maximum turbine layout (106 turbines) will be selected, and has also incorporated the 6m wide road design with 12m wide passing bays in the calculations. The impact of the wind farm may actually be less than calculated in this report should the final design utilise a smaller number of turbines associated with Layout Option B. A full description of the proposal, including turbine and road design options, is provided in the Part 3A Environmental Assessment Report (EA Report) (ELA 2012).

The data used to undertake the indicative assessment is outlined in this report. Any assumptions made have been clearly identified and the credits required calculated. Due to the large geographic area of the proposal, and the relatively small area of vegetation impacted, the demonstration of vegetation zones, threatened species sub zones and management zones using figures within this report could not be displayed effectively. Eco Logical Australia (ELA) can provide all data and the shapefiles created for OEH to review the information contained in this report should they be required.

Although not an official application for a Biobanking Statement, the assessment has been conducted by an accredited Biobanking Assessor and follows the Biobanking Assessment Methodology and Credit Calculator Operational Manual (DECC 2009) for most aspects of the assessment. A minor amendment to the methodology, involving the use of 3 assessment circles to assess landscape scores rather than the 11 required under the strict methodology, was based on an agreed approach between OEH and ELA for a previous wind farm proposal. All vegetation zones have the correct number of plots.

The accredited assessor details are as follows:

<b>Assessors Names:</b>	Darren James and Jennifer Powell
<b>Accreditation Numbers:</b>	0032 and 0092
<b>Biobanking Credit Calculator Version:</b>	1.2

In summary, the calculations conducted as part of this assessment identified that 103.1 hectares of impact by this proposal will require 4,270 ecosystem credits, with the largest credit requirements being for “Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest on the NSW South Western Slopes Bioregion” (3,979 credits). Using the OEH credit converter, this credit requirement will translate to an offset area requirement of approximately 459 hectares.

In addition, an impact on 13.05 hectares to potential Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*) breeding habitat will require 290 species credits. This translates to an offset of approximately 48 hectares, which can be obtained at the same location as the ecosystem credits.

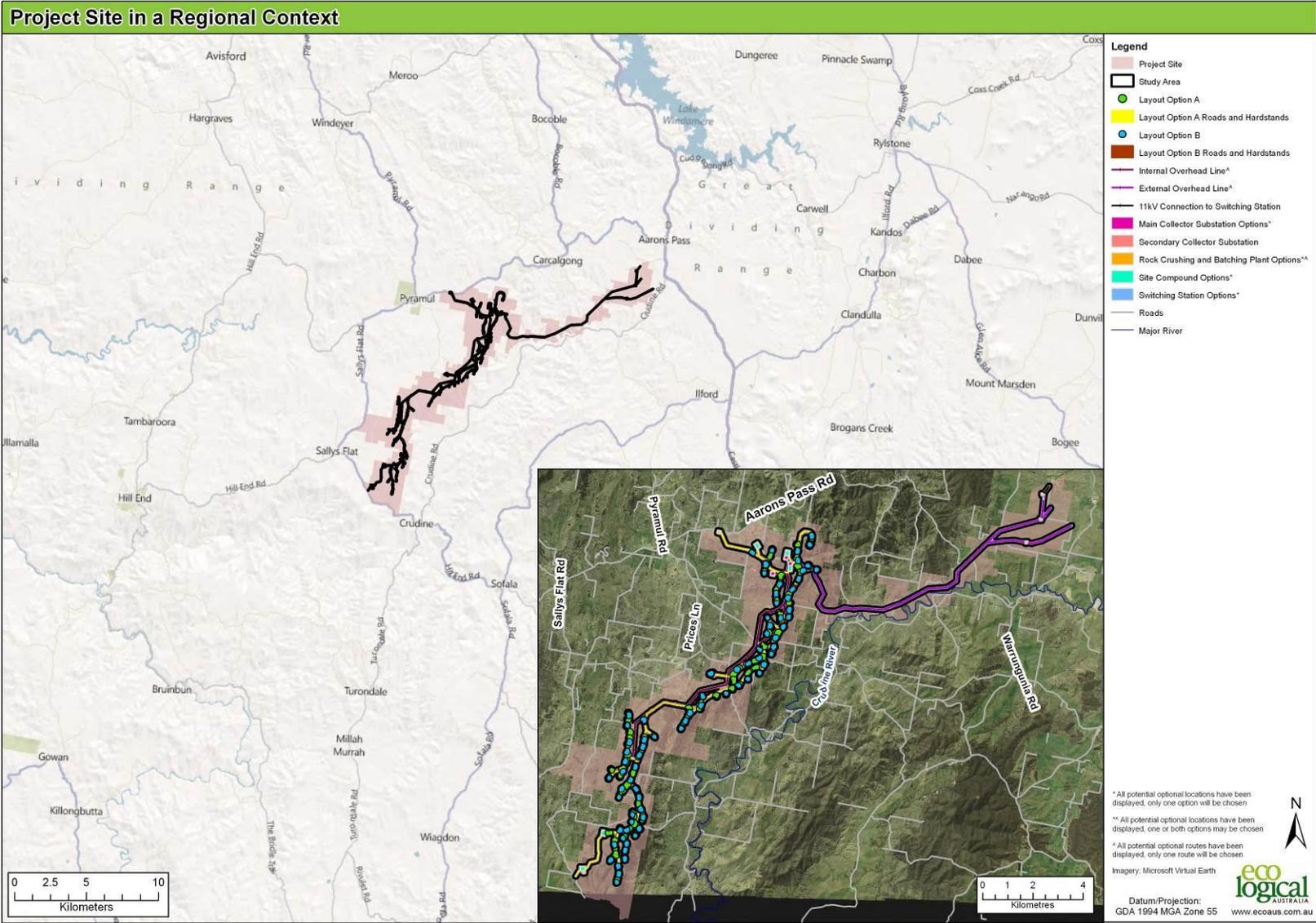


Figure 16: Study Area

## 2. Biobanking Assessment

The following sections provide the information collected and entered into the Biobanking credit calculator in order to complete the Biobanking Assessment for the Crudine Ridge Wind Farm. Any limitations, amendments to the methodology, or assumptions are provided.

The project is fully described in the EA Report (ELA 2012)

### 2.1 IMPACT AREA

The impact area for the wind farm was divided into two broad categories, those with permanent loss and those areas with temporary loss. Areas of permanent loss include:

- Turbine footings;
- Footprints of a main and secondary substation;
- Area of permanent access roads from public roads to turbine and substation locations (including cut and fill);
- Loss of vegetation due to the construction of overhead powerlines.

Areas of temporary loss are those areas that are to be cleared, but then revegetated with local provenance native vegetation and managed, and include:

- Area of temporary roads (including cut and fill);
- Concrete batching plants;
- Site office and construction compound;
- Rock crushing plants and rock crushing facilities.

Different reductions in future site value score are recorded for both the permanent and temporary loss scenarios. These can be seen in Section 0. Impacts have been avoided where possible by locating infrastructure outside ecologically sensitive areas. Clearance of hollow-bearing trees has been avoided as far as possible, and a buffer has been maintained between turbines and hollow-bearing trees to minimise the likelihood of bird and bat strike during operation.

### 2.2 VEGETATION TYPES

Biometric vegetation types were mapped on site and are mandatory when applying the Biobanking Methodology. Four revised Biometric vegetation types have been mapped on site, and all of these are impacted by the proposal (Table 37).

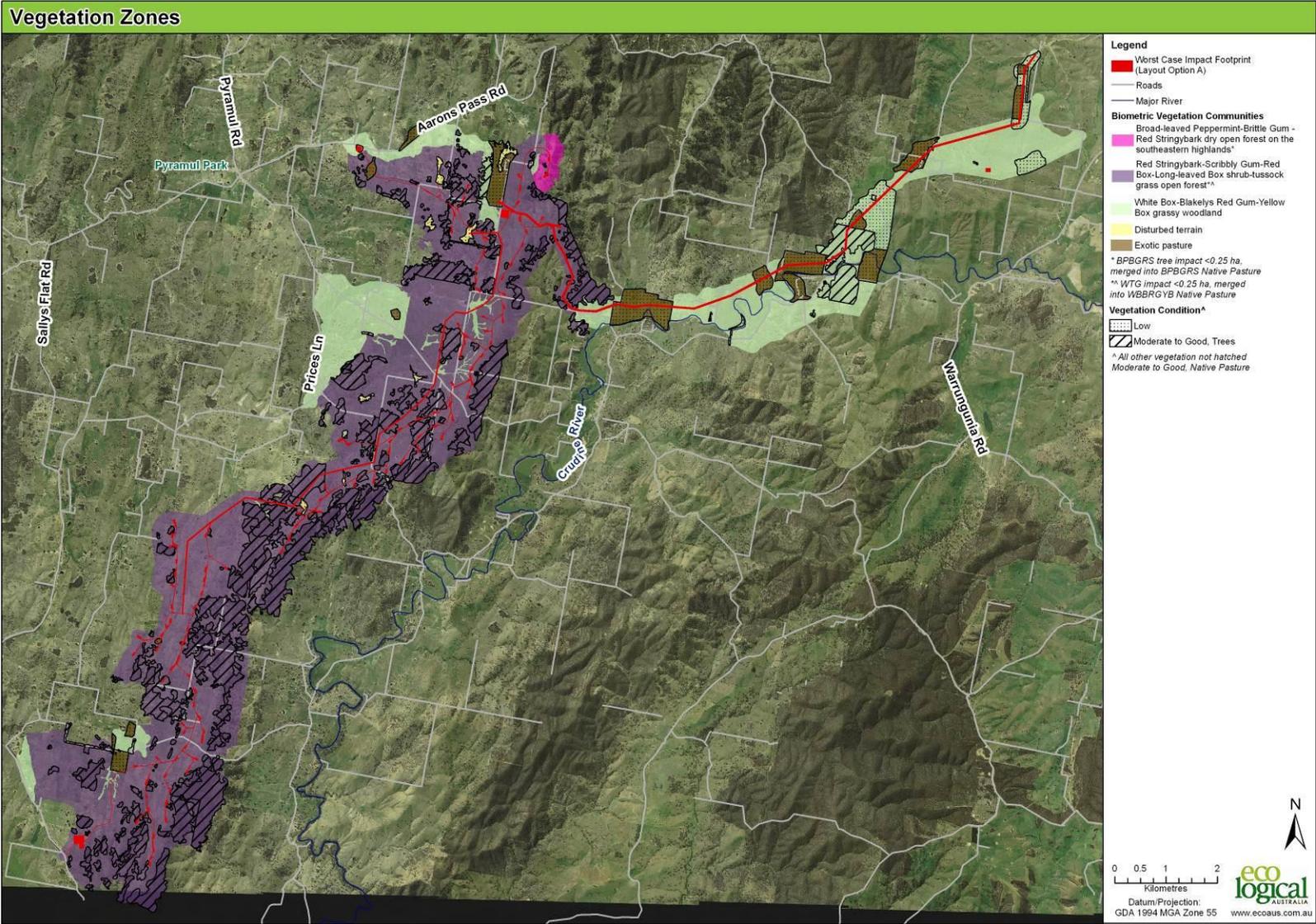
1. Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest of the South Eastern Highlands
2. Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)
3. White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282)

4. Wet tussock grasslands of cold air drainage areas of the tablelands

However, as an impact of only 0.1 hectares occurs to “*Wet tussock grasslands of cold air drainage areas of the tablelands*”, which is too small to be assessed using the Biobanking methodology, it was added to the vegetation type that it most closely resembles: “White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282)”. These three vegetation types have been stratified into six vegetation zones (see Section 10.7 and Figure 17).

**Table 37: Revised Biometric Vegetation Types and Impact**

Revised Biometric Vegetation Type	Area of Permanent Loss (ha)	Area of Temporary Loss (ha)	Total Loss (ha)
CW117: Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands	0.8	0.4	1.2
CW176: Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)	65.5	31	96.5
CW209: White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282)	5.3	0.1	5.4
<b>Total</b>	<b>71.6</b>	<b>31.5</b>	<b>103.1</b>



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Figure 17: Vegetation Zones

### 2.3 CMA REGION, CMA SUBREGION and MITCHELL LANDSCAPE

The site occurs within the **Upper Slopes** CMA Subregion of the **Central West** CMA region (Figure 18).

The study site, as it is long and linear, straddles four Mitchell Landscapes. The dominant Mitchell Landscape on site, where the majority of impact is occurring, is **Ophir – Hargraves Plateau** Mitchell Landscape (Figure 19). The Mitchell Landscapes Version 3 data layer was used for this assessment.

### 2.4 ASSESSMENT CIRCLES

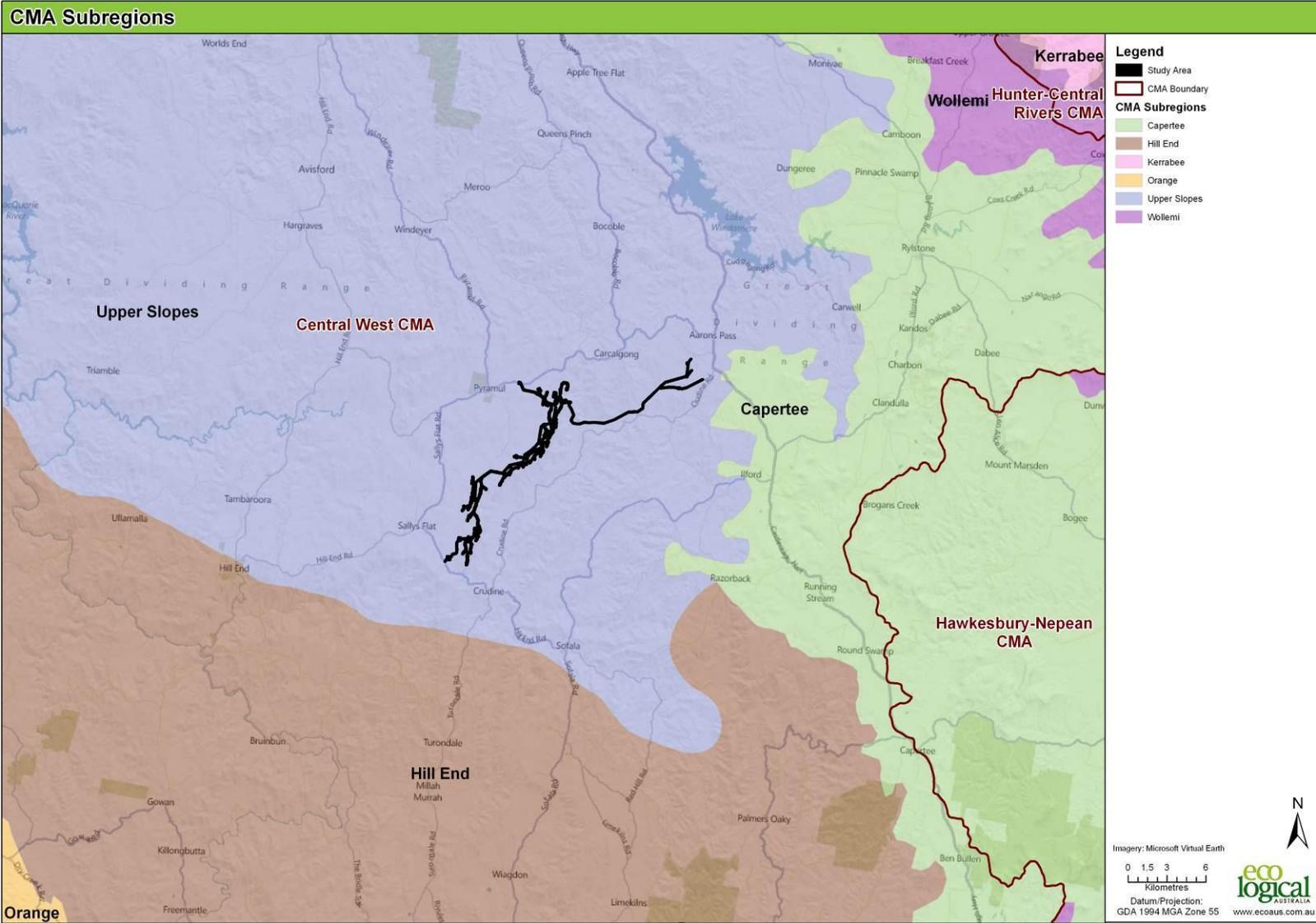
In a standard Biobanking Assessment, enough 1000ha assessment circles (and associated 100ha assessment circles) are required to completely cover the whole development impact area, although OEH are considering an amendment to this methodology for long, linear projects such as wind farms and roads (John Seidel pers. comm.).

Due to the extremely large geographic extent of the proposal, up to eleven 1000ha assessment circles would require entry into the credit calculator, with associated Threatened Species Sub Zones, to strictly follow the Biobanking Assessment Methodology. As the impact across each of the 1000ha circles is relatively minor, and this assessment is indicative, an alternate approach was agreed between the OEH and ELA for a previous wind farm assessment. Three 1000ha assessment circles were identified for the proposal to allow for the full range of threatened species filtering across the site, while minimising data entry requirements. The three categories identified are **0-10%**, **21-30%** and **31-40%**. Each of the eleven circles were allocated to one of these categories (based on each circle's vegetation cover), and the vegetation zones entered into the appropriate circle within the Biobanking Credit Calculator (**Figure 20**).

For the purposes of this assessment, and due to the relatively small impact of the proposal within each 1000ha circle, the pre-development and post-development categories for native vegetation do not change for the 1000ha circles. However, as the relative impact of the proposal is larger on the 100ha circles, it was agreed with the OEH for the previous wind farm proposal that the 100ha circles would drop one native vegetation cover class category. Therefore the 100ha circles drop from **51-60%** (pre-development) to **41-50%** (post-development) (**Table 38**).

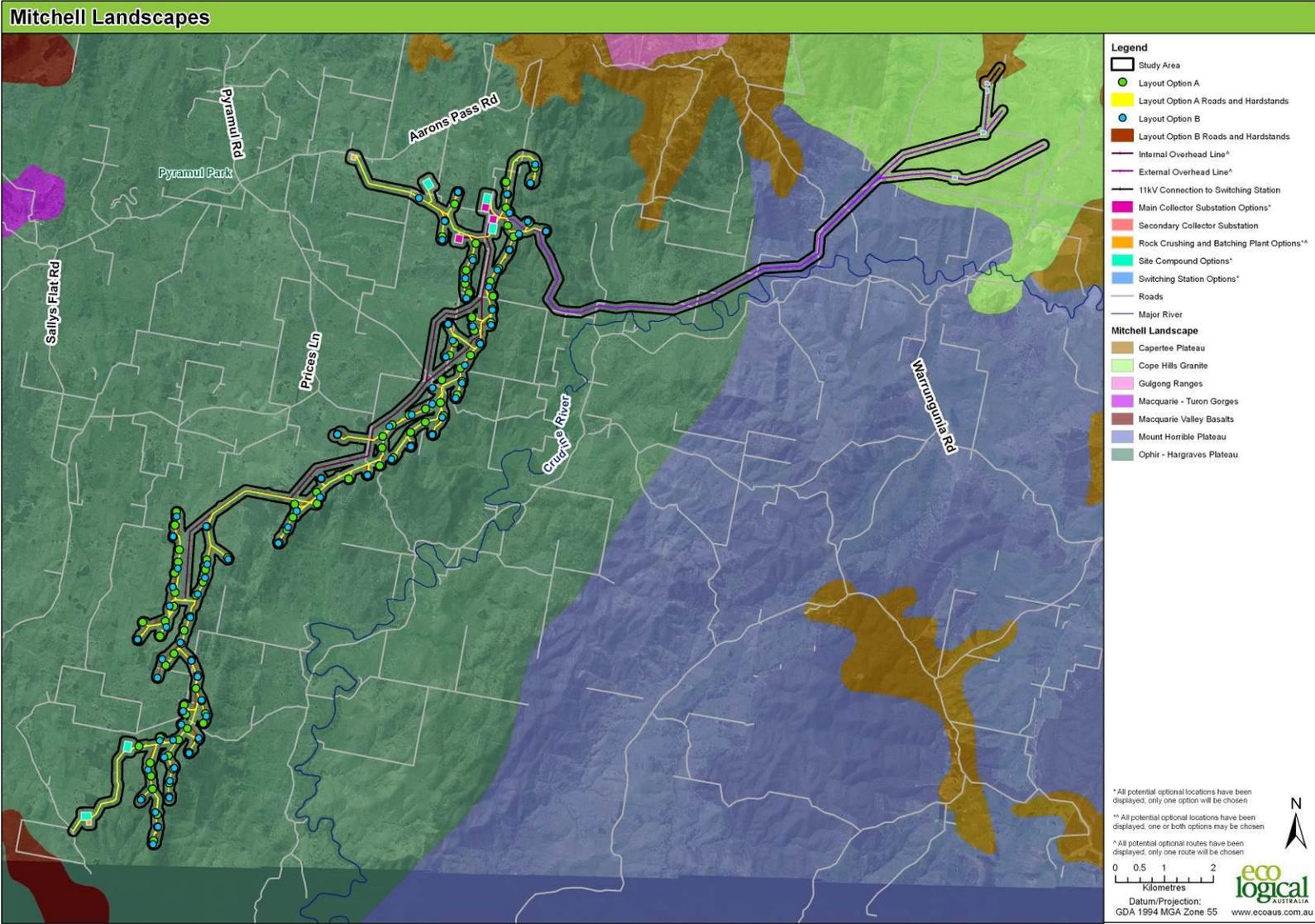
**Table 38: Area of Native Vegetation in Each Assessment Circle**

Circle Number	Circle Size	Native Vegetation Cover Class- Before Development (%)	Native Vegetation Cover Class- After Development (%)
1	1000ha Circle	0-10%	0-10%
1	100ha Circle	51-60%	41-50%
2	1000ha Circle	21-30%	21-30%
2	100ha Circle	51-60%	41-50%
3	1000ha Circle	31-40%	31-40%
3	100ha Circle	51-60%	41-50%



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Figure 18: CMA Subregions



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Figure 19: Mitchell Landscapes

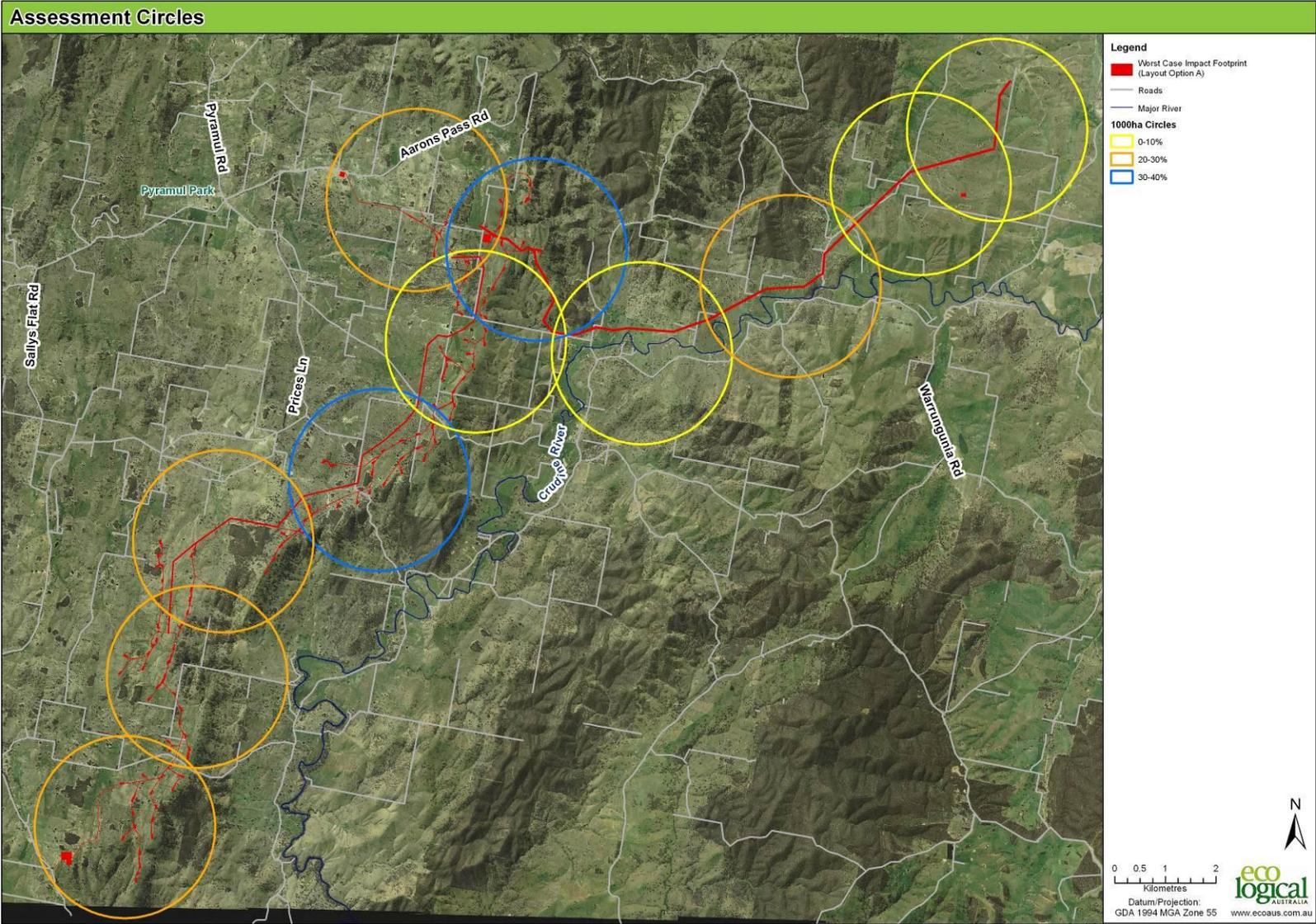


Figure 20: Assessment Circles

## 2.5 CONNECTIVITY ASSESSMENT

A connectivity assessment was conducted for the proposal using the technique outlined in the Biobanking Methodology. The following aspects were considered:

- The width of the current and future connecting link
- The condition of the current and future connecting link (over-storey and mid-storey/ground cover)

As the proposed development is contiguous, and any assessment circles would overlap, the Biobanking Methodology stipulates that only one connectivity assessment be conducted for the proposal.

Vegetated connections run off the site in all directions, and are extremely difficult to assess due to the lack of over-storey cover and the extremely large study area. The understorey, however, is generally in moderate/good condition as defined by the Biobanking Methodology.

Below is a description of the connectivity width assessment and connectivity condition assessment.

### 2.5.1 Connectivity Width Assessment

In pasture areas, much of the over-storey vegetation has been removed from the site. However, field survey has confirmed that most of the vegetation remains in moderate/good condition due to the abundance of a native under-storey.

Due to the large extent of moderate/good vegetation, the current corridor width (before development) has been measured to the maximum width of **>500m**. This width occurs across the site.

The proposed development, with an average impact width of approximately 20m, does not break any connection as defined by the Biobanking Methodology (i.e. all connected vegetation remains within 100m of another patch). Therefore, the connectivity width remains unchanged at >500m after development (**Table 39**).

**Table 39: Connectivity Width Classes Before and After Development**

	Width Class (Before Development)	Width Class (After Development)
Connectivity Value (Width)	>500m	>500m

### 2.5.2 Connectivity Condition Assessment

The connectivity condition assessment was undertaken on woody vegetation, as woody vegetation types dominate the site. Two measures were used to assess the condition of the connection;

1. The condition of over-storey vegetation before and after development
2. The condition of ground cover vegetation before and after development

Over-storey vegetation has been cleared over much of the site and surrounding areas, however some areas of tree cover do remain. The average condition of the over-storey has therefore been assessed

as “PFC <25% of lower benchmark”. The impact on the condition of the over-storey vegetation on site will be minimal. It is therefore expected that the average over-storey condition after development will remain the same at “PFC <25% of lower benchmark”.

Ground cover vegetation across the site and surrounding areas for the woody vegetation types is in a similar condition to the over-storey, with significant native ground cover identified. From the field surveys, the average condition of the ground cover has been measured as “PFC mid-storey/ground cover <25% of lower benchmark”. Again, the impact of the development will be minimal and the ground cover will remain at “PFC mid-storey/ground cover <25% of lower benchmark” after development (**Table 40**).

**Table 40: Condition Classes Before and After Development**

Storey	Condition Class (Before Development)	Condition Class (After Development)
Connectivity Value (Over-storey Condition)	PFC <25% of lower benchmark	PFC <25% of lower benchmark
Connectivity Value (Ground Cover Condition)	PFC mid-storey/ground cover <25% of lower benchmark	PFC mid-storey/ground cover <25% of lower benchmark

## 2.6 GEOGRAPHIC AND HABITAT FEATURES

The following questions were asked in Step 2 of the calculator (**Table 41**). The default answer for these questions is “Yes”, however an answer of “No” was given when confirmed after a field visit.

**Table 41: Geographic and Habitat Questions and Answers**

Question	Answer
Does any part of the development impact on:	
land containing a forb-rich grassy groundcover	Yes
land containing caves of similar structures	No
land containing escarpments, cliffs, caves, deep crevices, old mine shafts or tunnels	No
land containing granite boulders on rocky outcrops	Yes
land within 1 km of rock outcrops or cliff lines	Yes
land within 100 m of stream or creek banks	Yes
seasonally wet/boggy sites (including table drains)	Yes
rocky outcrops/cliffs in Bathurst CMA subregion	No

## 2.7 VEGETATION ZONES

Vegetation zones are defined as areas of the same vegetation type and condition within the development area, and have been mapped for the study area. The area of each vegetation zone was determined by intersecting the broader study area vegetation zone data layer with the impact footprint derived from information provided by Wind Prospect CWP.

ELA have assigned condition categories to all vegetation, with vegetation being assessed as “moderate/good” or “low” as per the Biobanking Methodology. In addition, the ancillary codes of “Pasture” (i.e. native pasture) and “Trees” have been used to further stratify the site and differentiate areas of differing vegetation cover. In total six vegetation zones have been identified, with the area of each vegetation zone and its condition detailed in **Table 42**. “Broad-leaved Peppermint – Brittle Gum – Red Stringybark dry open forests on the South Eastern Highlands” supported trees but, given the total impact area is less than 0.25 ha, treed areas were merged into pasture areas resulting in one vegetation zone for the community.

**Table 42: Vegetation Zones within Impact Area**

Veg Zone ID	Vegetation Type	Legal Cond.*	Ancillary Code	Area of Permanent Loss (ha)	Area of Temporary Loss (ha)	Total Impact (ha)
1	Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands	M/G	Pasture	0.79	0.41	1.2
2	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest of the NSW South Western Slopes Bioregion (Benson 290)	M/G	Trees	5	1.6	6.6
3	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest of the NSW South Western Slopes Bioregion (Benson 290)	M/G	Pasture	60.5	29.4	89.9
4	White Box – Blakely’s Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282)	M/G	Trees	3	0	3
5	White Box – Blakely’s Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282)	M/G	Pasture	2	0.1	2.1
6	White Box – Blakely’s Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282)	Low	Pasture	0.3	0	0.3
<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>71.6</b>	<b>31.5</b>	<b>103.1</b>

\*M/G- Moderate/Good

## 2.8 SITE SURVEY

The Biobanking Methodology requires field survey to be undertaken on-site to accurately calculate credits. Field survey consists of:

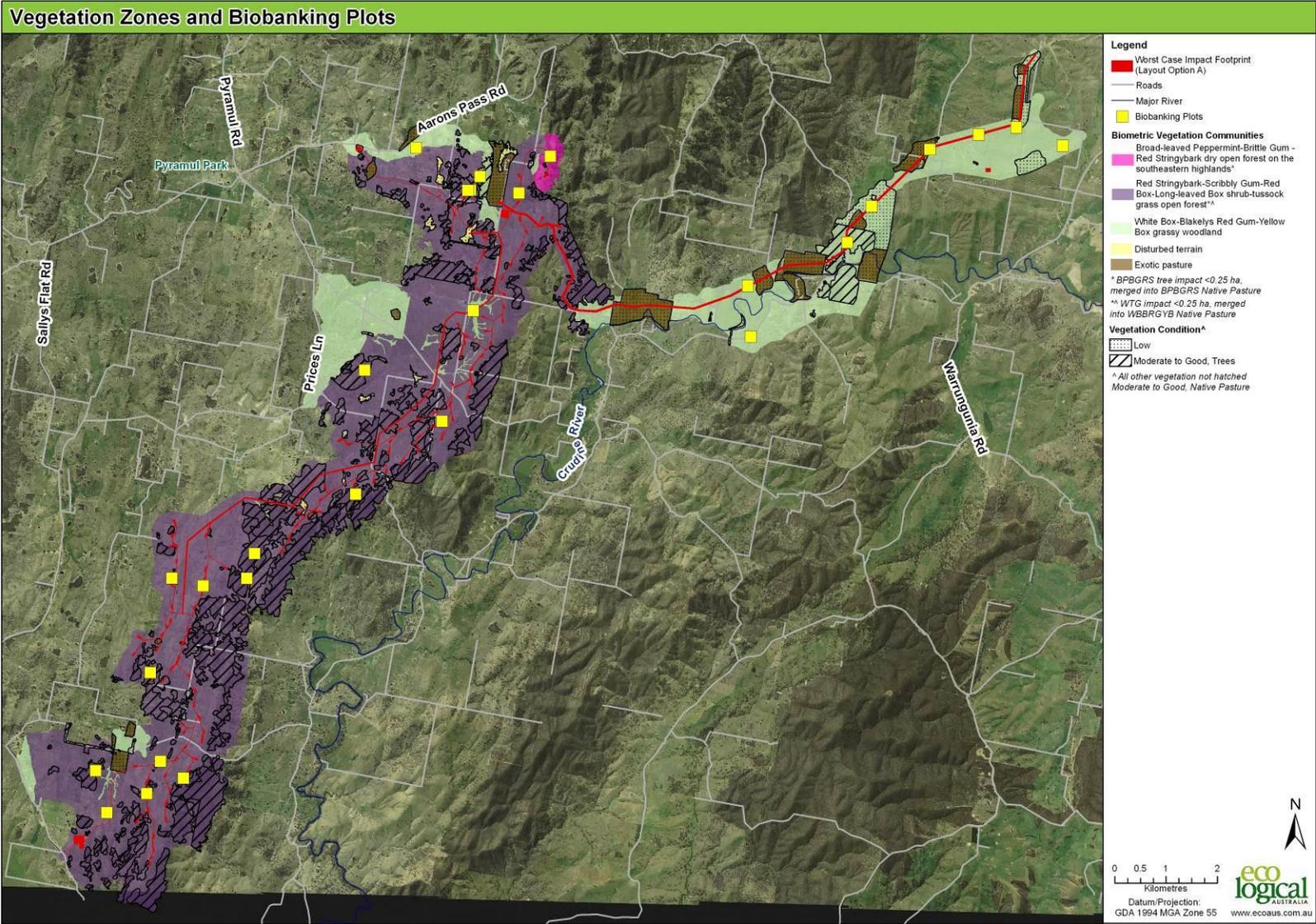
- Transects/plots to sample vegetation zones
- Targeted threatened species survey for species identified by the credit calculator

The details of these surveys can be found in the main body of the EA Report (ELA 2012).

### 2.8.1 Vegetation Plots

In total 27 plots were undertaken within the vegetation zones (a minimum of 14 plots are required for the proposed layout) (Table 43 and Figure 21). The minimum number of vegetation plots was completed for all vegetation zones, with some vegetation zones having more than the minimum number of plots completed. The completion of additional plots was generally caused by changes to the impact footprint, which has led to changes in the area of each vegetation zone, and therefore the number of plots required for each zone, being impacted. The attributes recorded for each plot are outlined in Appendix 1.

It is important to note that some of the plots have not been undertaken within the actual impact area of the wind farm, but have been undertaken within the broader vegetation zone mapped in the study area. It was not possible to undertake all plots within the wind farm footprint due to changes in the footprint and the size of the impact (narrow roads make it difficult to complete vegetation plots). This approach is consistent with large projects where the actual impact site is adjusted regularly during the planning phase.



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Figure 21: Vegetation Zones and Plots

**Table 43: Number of Plots Required**

Veg Zone ID	Vegetation Type	Legal Cond.	Ancill. Code	Total Impact (ha)	Plots Req.	Plots Collected
1	Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands	M/G	Pasture	1.2	1	1
2	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest of the NSW South Western Slopes Bioregion (Benson 290)	M/G	Trees	6.6	3	9
3	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest of the NSW South Western Slopes Bioregion (Benson 290)	M/G	Pasture	89.9	5	7
4	White Box – Blakely’s Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282)	M/G	Trees	3	2	3
5	White Box – Blakely’s Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282)	M/G	Pasture	2.1	2	5
6	White Box – Blakely’s Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282)	Low	Pasture	0.3	1	2
<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>103.1</b>	<b>14</b>	<b>27</b>

### 2.8.2 Targeted Threatened Species Surveys

The Biobanking Credit Calculator identified 15 threatened species requiring survey. During the project 13 of these species were targeted during survey. Table 44 identifies the species requiring survey, the appropriate time of year for the survey (specified by the Biobanking Tool), and the year and month when the actual survey took place. *Goodenia macbarronii* (Narrow Goodenia) was identified by the Biobanking Tool as a species requiring survey. However, this species has now been delisted from the TSC Act, and as such was not considered a target species. In addition, surveys were not undertaken for *Litoria booroolongensis* (Booroolong Frog) as potential habitat for this species was not present at the site.

The targeted threatened species surveys were conducted throughout the study area in a manner consistent with the draft DEC Threatened Species Survey Guidelines (DEC 2004), and occurred between the months of October to November 2008, January and February 2009, March, April September, and October 2011. Full details on the survey undertaken can be seen in Section 4.0 of the EA Report (ELA 2012).

In addition to the species requiring survey, some threatened fauna species are “predicted” on the site and included in the calculation of ecosystem credits. Although predicted species do not require survey

in a Biobank assessment, some species did undergo survey as part of the broader environmental assessment process. Findings can be seen in Appendix 2.

**Table 44: Species Requiring Targeted Survey**

Species Name	Common Name	Underwent Targeted Survey	Species Recorded in Previous Studies of Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<b>Flora</b>															
<i>Acacia ausfeldii</i>	Ausfeld's Wattle	Yes	No								Yes	Yes	Yes		
<i>Eucalyptus alligatrix</i> subsp. <i>miscella</i>		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Eucalyptus cannonii</i>	Capertee Stringybark	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Eucalyptus robertsonii</i> subsp. <i>hemisphaerica</i>	Robertson's Peppermint	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
* <i>Goodenia macbarronii</i>	Narrow Goodenia	No	No	Yes	Yes							Yes	Yes	Yes	Yes
<i>Grevillea divaricata</i>		No	No	Yes											
<i>Persoonia marginata</i>	Clandulla Geebung	Yes	No	Yes											
<i>Swainsona recta</i>	Small Purple-pea	Yes	Yes									Yes	Yes	Yes	Yes
<i>Swainsona sericea</i>	Silky Swainson-pea	Yes	Yes									Yes	Yes	Yes	Yes
<i>Zieria obcordata</i>		Yes	No	Yes											
<b>Fauna</b>															
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Species Name	Common Name	Underwent Targeted Survey	Species Recorded in Previous Studies of Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<i>Circus assimilis</i>	Spotted Harrier	Yes	No	Yes											
<i>Hieraaetus morphnoides</i>	Little Eagle	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Litoria booroolongensis</i>	Booroolong Frog	No	Yes												
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	Yes	No	Yes											

 Survey January 2009  
 Survey March – April 2011  
 Survey October to November 2008 and September and October 2011

## 2.9 CHANGE IN FUTURE SITE VALUE SCORES

Each vegetation zone has been split into several management zones reflecting whether the impact of the development is permanent (roads, turbine pads, etc) or temporary (areas that will undergo revegetation works including road edges, batching plants, and earthworks). For each of these areas several assumptions have been made when determining the future site value score.

The maximum future scores for each of the 10 attributes are listed below, along with the assumptions that have been made (**Table 45** and **Table 46**). Different scores are assigned to zones with native pasture from that assigned to the areas with trees, as impacts are likely to be different between these areas (e.g. impacts on over-storey tree species will not occur in native pasture areas, but may occur in treed areas).

**Table 45: Future Site Value Scores- Trees**

Attribute	Maximum Future Site Value-Permanent Loss	Reason	Maximum Future Site Value-Temporary Loss	Reason
Native Species Richness	0	Will be removed	1	Impact will avoid mature trees, where possible, and revegetation will replace some ground cover species
Native Over-Storey	0	Will be removed	1	Mature trees are to be avoided, but some impact may occur
Native Mid-Storey	0	Will be removed	1	Mid-storey is to be avoided, but some impact may occur
Ground Cover-Grasses	0	Will be removed	1	Revegetation will return some ground cover-grasses
Ground Cover-Shrubs	0	Will be removed	1	Revegetation will return some ground cover-shrubs
Ground Cover-Other	0	Will be removed	1	Revegetation will return some ground cover- other
Exotic Cover	0	Will be removed	Current score retained	Management is short term and weeds are persistent in grassy woodland communities
Hollows	0	Will be removed	0	Hollow trees will be avoided, but impacts will occur
Over-storey Regeneration	0	Will be removed	1	Revegetation will return some over-storey regeneration
Fallen Logs	0	Will be removed	1	Fallen logs will be returned where initially present

**Table 46: Future Site Value Scores- Pasture**

Attribute	Maximum Future Site Value- Permanent Loss	Reason	Maximum Future Site Value- Temporary Loss	Reason
Native Species Richness	0	Impact will be permanent for ground cover, which is the predominant cover in native pasture and grassland areas	1	Revegetation will provide some species richness after clearing
Native Over-Storey	0	No native over-storey cover	0	No native over-storey cover currently therefore cannot be increased
Native Mid-Storey	0	No native mid-storey cover	0	No native mid-storey cover currently therefore cannot be increased
Ground Cover-Grasses	0	Will be removed	1	Revegetation will return some ground cover-grasses
Ground Cover-Shrubs	0	Will be removed	1	Revegetation and natural regeneration will return some ground cover-shrubs
Ground Cover-Other	0	Will be removed	1	Revegetation will return some ground cover- other
Exotic Cover	0	Will be removed	Current score retained	Management is short-term Weeds are persistent in grassy woodland communities
Hollows	1	Hollows will be avoided where possible	1	Hollows will be avoided where possible due to micro-siting
Over-storey Regeneration	0	Will be removed	1	Revegetation will return some over-storey regeneration
Fallen Logs	0	Will be removed	1	Fallen logs will be returned where initially present

## 2.10 THREATENED SPECIES SUB ZONES

Threatened species sub-zones, which form the base units of vegetation zones, were mapped for the impact. The threatened species sub-zones are the base units entered into the credit calculator, and allow the entry of data such as adjacent remnant area and patch size for individual vegetation polygons (**Table 47**). Different threatened species sub-zones are also required for different assessment circles.

As the vegetation on and surrounding the site is predominantly in moderate/good condition, and generally patches are within 100m or each other, the maximum Adjacent Remnant Area and Patch Size (including Low Condition) of 501 hectares has been entered into the credit calculator.

**Table 47: Threatened Species Sub Zones**

TS Sub Zone ID	Vegetation Type	Condition	Ancillary Code	Adjacent Remnant Area (ha)	Patch Size (ha)	Assessment Circles	Area (ha)
1	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)	M/G	Pasture	501	501	0-10%	11.4
2	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)	M/G	Trees	501	501	0-10%	0.2
3	White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282)	Low	Pasture	0	501	0-10%	0.2
4	White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282)	M/G	Pasture	501	501	0-10%	1.6
5	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)	M/G	Pasture	501	501	21-30%	49.6
6	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)	M/G	Trees	501	501	21-30%	2.9
7	White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282)	Low	Pasture	0	501	21-30%	0.1
8	White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282)	M/G	Pasture	501	501	21-30%	0.5

TS Sub Zone ID	Vegetation Type	Condition	Ancillary Code	Adjacent Remnant Area (ha)	Patch Size (ha)	Assessment Circles	Area (ha)
9	White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282)	M/G	Trees	501	501	21-30%	3
10	Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands	M/G	Pasture	501	501	31-40%	1.2
11	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)	M/G	Pasture	501	501	31-40%	28.9
12	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)	M/G	Trees	501	501	31-40%	3.5
<b>Total</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>103.1</b>

## 2.11 MANAGEMENT ZONES AND SITE SCORES

Management zones combine the mapping of vegetation zones with the final development outcome on site (**Table 48**). A figure has not been included for the management zones as they are too small to see at the scale of the project; however GIS files are available on request. They enable the assessor to increase, or decrease, the number of credits required depending on the final condition of the vegetation after development. As described in Section 0, two types of management zones have been identified for the project, including;

- Areas of permanent vegetation removal;
- Areas of temporary vegetation removal to be revegetated and managed as native vegetation.

Each management zone has received a current site value score calculated out of 100. This score has been determined using the transects/plots undertaken on site. The future scores have then been calculated using the rules outlined in Section 2.10. The area of each management zone, the final management outcome and the site values scores allocated are listed in Table 48 below.

**Table 48: Management Zone Site Value Scores**

Management Zone ID	Final Management Outcome	TS Sub Zone ID	Area (ha)	Current Site Value	Future Site Value	Loss in Site Value
1A	Permanent Loss	1	0.79	33	0	33
1B	Temporary Loss	1	0.41	33	12	21
2A	Permanent Loss	3	49.6	45	4	41

Management Zone ID	Final Management Outcome	TS Sub Zone ID	Area (ha)	Current Site Value	Future Site Value	Loss in Site Value
2B	Permanent Loss	3	10.9	45	4	41
2C	Temporary Loss	3	18	45	20	25
2D	Permanent Loss	1	11.4	45	20	25
3A	Permanent Loss	2	0.2	70	0	70
3B	Permanent Loss	2	2.9	70	0	70
3C	Permanent Loss	4	1.9	70	0	70
3D	Temporary Loss	4	1.6	70	49	24
4A	Permanent Loss	4	0.2	10	0	10
4B	Permanent Loss	4	0.1	10	0	10
5A	Permanent Loss	5	1.6	23	0	23
5B	Permanent Loss	5	0.4	23	0	23
5C	Temporary Loss	5	0.1	23	14	9
6A	Permanent Loss	6	3	72	0	72
<b>Total</b>	<b>N/A</b>	<b>N/A</b>	<b>103.1</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>

## 2.12 THREATENED SPECIES HABITAT

Fauna and flora survey locations are shown in Figures 4 and 5 of the EA Report (ELA 2012).

Six threatened bird species and up to six threatened microbats were recorded within the study area:

- *Climacteris picumnus victoriae* (Brown Treecreeper);
- *Glossopsitta pusilla* (Little Lorikeet);
- *Melanodryas cucullata cucullata* (Hooded Robin);
- *Petroica boodang* (Scarlet Robin);
- *Pyrrholaemus saggitatus* (Speckled Warbler);
- *Stagonopleura guttata* (Diamond Firetail)
- *Chalinolobus dwyeri* (Large-eared Pied Bat);
- *Chalinolobus picatus* (Little Pied Bat);
- *Miniopterus orianae oceanensis* (Eastern Bentwing-bat);
- *Saccolaimus flaviventris* (Yellow-bellied Sheath-tail-bat);
- *Vespadelus troughtoni* (Eastern Cave Bat); and
- *Nyctophilus corbeni* (Greater (Eastern) Long-eared Bat)\*.

\* The calls of the three *Nyctophilus* species, namely *N. geoffroyi*, *N. gouldi* or *N. corbeni*, are difficult to tell apart, and in the anabat analyses, were identified as *Nyctophilus* spp. For this reason, all three bat species have been included in the bat risk matrix and it has been assumed that *Nyctophilus corbeni* is present at the site as a precautionary measure for the assessment of impacts

The locations of these records are shown in Figure 9 of ELA (2012). All but one of the woodland bird and bat species listed above do not require species credits as they are considered during the calculation for ecosystem credits on site. However Yellow-bellied Sheathtail Bat is a split species with species credits applying to its breeding/roosting habitat (in the form of tree hollows and mammal burrows) and ecosystem credits applying to its foraging habitat.

One threatened flora species was identified on site and its location is shown in Figure 10 of ELA (2012).

- *Swainsona recta*

Species credits are not required for *Swainsona recta* (plant) as all impacts on these species will be avoided during construction and operation of the wind farm, however. species credits for potential impacts to the breeding habitat of the Yellow-bellied Sheathtail Bat have been included on the assumption that breeding habitat exists at the project site and will be impacted. The species was only detected foraging at the site.

**Table 49: Yellow-bellied Sheathtail Bat Breeding/Roosting Habitat Impacted**

Total Habitat Mapped in Study Area (ha)	Area of Habitat Impacted (ha)	Percentage of Habitat Impacted
1547	13.05	0.8

### 2.13 INDIRECT IMPACTS

Due to the relatively low impact of the development over the study area, the mitigation measures proposed and the revegetation of some areas with local provenance, significant indirect impacts on the lands surrounding the study site are considered unlikely. Therefore, the calculation of additional credits for indirect impacts was not required for the Crudine Ridge Wind Farm site.

### 2.14 RED FLAGS

A red flag is triggered in Biobanking when there is an impact on any of the following:

- A vegetation type >70% cleared in the CMA for which it is mapped (not in Low condition);
- A critically endangered or endangered ecological community (EEC) listed under the TSC Act or EPBC Act (not in Low condition);
- A threatened species that cannot withstand further loss

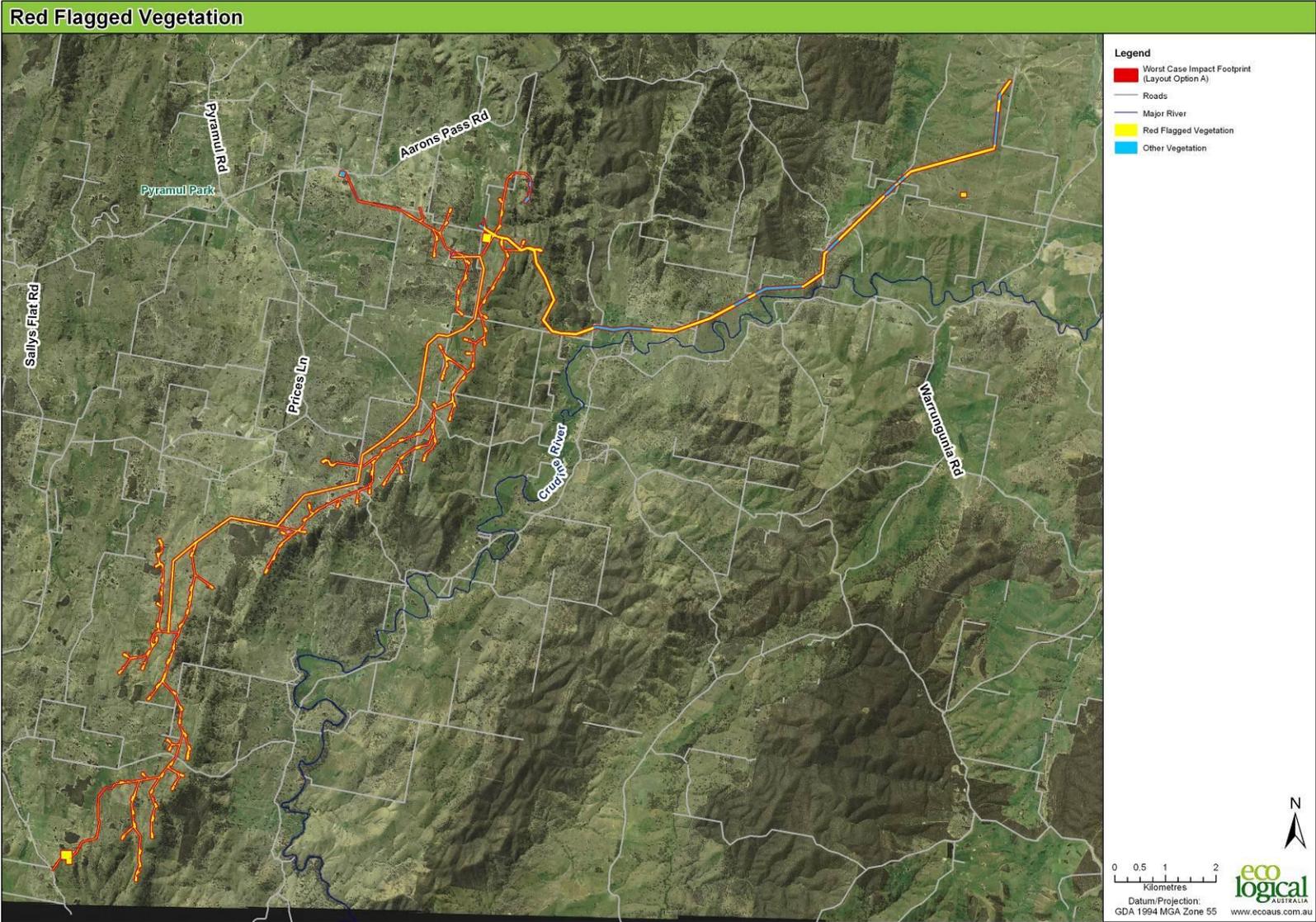
Significant effort has been made to avoid impacts on vegetation and habitat, particularly in red flag areas resulting in a number of different turbine layouts during the planning phase. Where possible impacts have been moved to cleared land, or areas of lower condition, to minimise the effect of the development, and parts of the development, such as roads and turbine locations, will also be moved to avoid the removal of mature over-storey trees.

One of the biometric vegetation types, White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282) and meets the definition of White Box - Yellow Box - Blakely's Red Gum grassy woodland is listed on the schedules of the EPBC Act and TSC Act as an CEE and EEC respectively). Another biometric vegetation type, Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290) has been cleared by an estimated 85% of its original distribution in the CMA.

In total 70.8 hectares of red flagged vegetation is to be permanently cleared by the proposal, with a further 31.1 hectares to be temporarily cleared (Table 50 and Figure 22).

**Table 50: Red Flag Vegetation**

Revised Biometric Vegetation Type	TSC Act EEC	EPBC Act EEC	Area Impacted-Permanent (ha)	Area Impacted-Temporary (ha)	Total Area Impacted (ha)	Reason for Red Flag
White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282)	White Box Yellow Box Blakely's Red Gum Woodland	White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box-Gum Woodland)	5.3	0.1	5.4	EEC and >70% cleared in CMA
Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)	N/A	N/A	65.5	31	96.5	>70% cleared in CMA
<b>Total</b>	<b>N/A</b>	<b>N/A</b>	<b>70.8</b>	<b>31.1</b>	<b>101.9</b>	<b>N/A</b>



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Figure 22: Red Flagged Vegetation

## 3. Credits Required

The results of the credit calculations, including the number of credits required and credit profile information, are summarised in the following sections. A copy of the credit report is provided in Appendix 4.

### 3.1 ECOSYSTEM CREDITS

A total of 4,270 ecosystem credits are required. In general credits can be obtained from a wide range of CMA Subregions and vegetation types for all vegetation communities impacted. The largest offsets will be required for Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290).

Further analysis has been conducted into the number of credits required for each vegetation type per hectare of impact (Table 51). The minimum number of credits required per hectare is 16.7 for Broad-leaved Peppermint – Brittle Gum – Red Stringybark dry open forest and the maximum number of credits required is 50.3 credits per hectare for White Box – Blakely's Red Gum – Yellow Box grassy woodland reflecting the condition states of these communities and the range of threatened fauna species predicted to occur.

**Table 51: Number of Credits Required Per Hectare**

Vegetation Type	Total Impact (ha)	Credits Required	Credits Required/ha
Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands	1.3	20	16.7
Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)	17.6	3,979	41.2
White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282)	240.9	271	50.3
<b>Total</b>	<b>259.8</b>	<b>4,270</b>	<b>41.4 av.</b>

### 3.2 SPECIES CREDITS

In total, 290 Yellow-bellied Sheathtail Bat species credits are required for the 13.05 hectares of potential breeding/roosting habitat impacted (**Table 52**).

**Table 52: Number of Yellow-bellied Sheathtail Bat Species Credits Required**

Habitat Type	Area Impacted	Credits Required
Breeding/Roosting	13.05	290

## 4. Indicative Area of Offset Required

The OEH Credit Converter was used to estimate the area of offset required to meet the calculated offset requirements. The OEH credit converter assumes that an offset site will generate 9.3 credits per hectare, thus the area of offset required to meet the number of credits calculated by the BAM is approximately 459 hectares. Preliminary inspections of potential offset properties have been undertaken as described in Section 6 of the EA report to confirm that they are capable of generating credits of the right vegetation type, condition and area.

### 4.1 ECOSYSTEM CREDITS

The assessed layout requires 4,270 ecosystem credits to offset the impact on the three impacted vegetation types.

**Table 53: Estimated Ecosystem Credit Offset**

Vegetation Type	Credits Req.	Total Impact (ha)	Credits/ha	Average No. Credits Generated for Offset Site	Offset Required (ha)
Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands	20	1.2	16.7	9.3	2.2
Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)	3,979	96.5	41.2	9.3	427.8
White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282)	271	5.4	50.3	9.3	29.1
<b>Total</b>	<b>4,270</b>	<b>103.1</b>	<b>41.4 av</b>	<b>9.3 av</b>	<b>459.1</b>

### 4.2 SPECIES CREDITS

In addition to the approximate 459 hectares of offset required for the ecosystem credits, approximately 48 hectares of offset is required for the Yellow-bellied Sheathtail Bat potential breeding habitat impacted by the proposal. This offset can be obtained from the same offset site as the ecosystem credits, or a different offset area should that be preferred or required (**Table 54**).

**Table 54: Estimated Species Credit Offset**

Habitat Type	Area Impacted (ha)	Credits Required	Average No. Credits Generated/ha	Offset Required (ha)
Potential	13.05	290	6	48

# References

DEC (2004) Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities. Working Draft November 2004. Department of Environment and Conservation (NSW).

DECC (2009). Biobanking Assessment Methodology and Credit Calculator Operational Manual. Department of Environment and Climate Change (NSW), Sydney.

ELA (2012). Crudine Ridge Wind Farm Part 3A Ecological Assessment. Report prepared for Wind Prospect CWP. Eco Logical Australia Pty Ltd.

OEH (2011). Interim Policy on assessing and offsetting biodiversity of Part 3A, State significant development (SSD) and State significant infrastructure (SSI) projects. Office of Environment and Heritage 25 June 2011

# Appendix 1: Plots

## Vegetation Zone: 1

Vegetation Type: Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands

Condition: M/G

Ancillary Code: Pasture

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Longitude	Latitude	Zone
BLPBGRSMGP1	18	0	0	46	0	4	10	0	1	0	751378	6356575	55

## Vegetation Zone: 2

Vegetation Type: Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest of the NSW South Western Slopes Bioregion (Benson 290)

Condition: M/G

Ancillary Code: Trees

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Longitude	Latitude	Zone
RSSGRBMGT1	10	21.5	0	0	2	4	0	4	1	22.5	742496	6344700	55
RSSGRBMGT2	9	30.5	0	8	0	0	0	10	1	52	743563	6346595	55
RSSGRBMGT3	20	33	4	16	0	0	0	9	0.75	43.5	743985	6348418	55
RSSGRBMGT4	34	24	1.5	16	2	8	0	6	0.5	86	745450	6348415	55
RSSGRBMGT5	34	22.5	0	20	0	10	0	7	0.5	72.5	745600	6348897	55
RSSGRBMGT6	11	34.5	0	2	2	2	0	16	0.33	84	747573	6350044	55
RSSGRBMGT7	22	11.5	0	40	0	10	24	2	0	42	747748	6352444	55
RSSGRBMGT8	12	22.5	0	14	0	4	8	11	0.5	90.5	749264	6351452	55
RSSGRBMGT9	36	19.5	1.5	18	6	12	10	3	0.67	19	749819	6355925	55

**Vegetation Zone: 3**

Vegetation Type: Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest of the NSW South Western Slopes Bioregion (Benson 290)

Condition: M/G

Ancillary Code: Pasture

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Longitude	Latitude	Zone
RSSGRBMGP1	12	0	0	44	0	2	6	0	0	3	742713	6343887	55
RSSGRBMGP2	16	0	0	82	0	4	12	0	1	0	743760	6344881	55
RSSGRBMGP3	18	0	0	24	0	6	4	1	0	160	744596	6348273	55
RSSGRBMGP4	14	0	0	82	2	6	36	0	0	0	750764	6355863	55
RSSGRBMGP5	30	0	14.5	42	2	0	20	0	0	1.5	743496	6344255	55
RSSGRBMGP6	27	6.5	0	48	2	10	26	2	0	53.5	744212	6344554	55
RSSGRBMGP7	34	3.5	1.5	34	4	12	0	0	0	20	749762	6355919	55

**Vegetation Zone: 4**

Vegetation Type: White Box – Blakely’s Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282)

Condition: Moderate to Good

Ancillary Code: Trees

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Longitude	Latitude	Zone
WBBRGYBMGT1	30	13	3	22	4	16	0	1	1	13	750005	6356189	55
WBBRGYBMGT2	28	7	2	22	8	20	2	1	1	20	757176	6354912	55
WBBRGYBMGT3	8	13	0	4	0	2	86	1	1	41	758790	6356711	55

**Vegetation Zone: 5**

Vegetation Type: White Box – Blakely’s Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282)

Condition: MG

Ancillary Code: Pasture

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Longitude	Latitude	Zone
WBBRGYBMGP1	16	0	0	66	0	6	32	0	1	0	748752	6356741	55
WBBRGYBMGP2	19	0	0	60	0	12	10	0	0	0	755233	6354070	55
WBBRGYBMGP3	18	0	0	54	2	6	18	0	0	0	755291	6353086	55
WBBRGYBMGP4	13	0	0	66	0	4	6	0	0	0	759741	6356999	55
WBBRGYBMGP5	11	0	0	74	0	12	30	0	0	0	761387	6356777	55

**Vegetation Zone: 6**

Vegetation Type: White Box – Blakely’s Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282)

Condition: Low

Ancillary Code: Pasture

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Longitude	Latitude	Zone
WBBRGYBLP1	11	0	0	42	0	2	62	0	0	0	757653	6355609	55
WBBRGYBLP2	9	0	0	22	0	6	52	0	0	0	760478	6357139	55

## Appendix 2: Species Predicted on Site

Common Name	Scientific Name	Surveyed on Site?	Found on Site?
Barking Owl	<i>Ninox connivens</i>	Yes	No
Black-chinned Honeyeater (eastern subspecies)	<i>Melithreptus gularis gularis</i>	Yes	No
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>	Yes	Yes
Bush Stone-curlew	<i>Burhinus grallarius</i>	Yes	No
Diamond Firetail	<i>Stagonopleura guttata</i>	Yes	Yes
Eastern Bentwing-bat	<i>Miniopterus schreibersii oceanensis</i>	Yes	Yes
Flame Robin	<i>Petroica phoenicea</i>	Yes	No
Glossy Black-cockatoo	<i>Calyptorhynchus lathami</i>	Yes	No
Greater Long-eared Bat (south eastern form)	<i>Nyctophilus timoriensis</i>	Yes	No
Grey-crowned Babbler (eastern subspecies)	<i>Pomatostomus temporalis temporalis</i>	Yes	
Koala	<i>Phascolarctos cinereus</i>	Yes	No
Little Lorikeet	<i>Glossopsitta pusilla</i>	Yes	Yes
Little Whip Snake	<i>Suta flagellum</i>	Yes	No
Masked Owl	<i>Tyto novaehollandiae</i>	Yes	No
Painted Honeyeater	<i>Grantiella picta</i>	Yes	No
Powerful Owl	<i>Ninox stenua</i>	Yes	No
Regent Honeyeater	<i>Xanthomyza phrygia</i>	Yes	No
Scarlet Robin	<i>Petroica boodang</i>	Yes	Yes
Speckled Warbler	<i>Pyrrholaemus saggitatus</i>	Yes	Yes
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>	Yes	No
Squirrel Glider	<i>Petaurus norfolcensis</i>	Yes	No
Superb Parrot	<i>Polytelis swainsonii</i>	Yes	No
Swift Parrot	<i>Lathamus discolor</i>	Yes	No
Turquoise Parrot	<i>Neophema pulchella</i>	Yes	Yes
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	Yes	Yes

In addition to the species predicted to occur by the Biobanking Credit Calculator, the following threatened species were also recorded (but not predicted to occur).

- *Melanodryas cucullata cucullata* (Hooded Robin);
- *Chalinolobus dwyeri* (Large-eared Pied Bat);
- *Chalinolobus picatus* (Little Pied Bat);
- *Miniopterus oriana oceanensis* (Eastern Bentwing-bat);
- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat); and
- *Vespadelus troughtoni* (Eastern Cave Bat).

# Appendix 3: Credit Report



## ***Biobanking Credit Report***

This report identifies the number and type of credits required at a DEVELOPMENT SITE.

Date of report: 09/02/2012 Time: 11:22 Tool Version: 1.2

### **Development Details**

**Proposal ID:** 0074/2011/D001  
**Development Name:** Crudine Ridge Wind Farm- Run 3 DJ  
**Development Location:** Sofala  
**Development Address:** Crudine Ridge Wind Farm

**CMA:** Central West

**Proponent Name:**  
**Proponent Address:**  
**Proponent Phone:**

**Assessor Name:** Darren James  
**Assessor Address:**  
**Assessor Phone:**  
**Assessor Accreditation Number:** 0032

The following information is required to be submitted with this BioBanking Statement (where ticked)

- Local reference data is required for the following vegetation zones**  
 Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands
- An Expert Report for the following species**
- The minimum number of plots were not entered for the following vegetation zones**



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## Improving or maintaining biodiversity values

An application for a red flag determination is required for the following red flag areas:

Red Flag	Reason
Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)	Vegetation type being > 70% cleared;
White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282)	Vegetation type being > 70% cleared; Vegetation type contains an endangered ecological community;
Yellow-bellied Sheathtail-bat	An impact greater than that allowed;

The application for a red flag determination should address the criteria set out in section 2.3 of the BioBanking Assessment Methodology. A BioBanking Statement cannot be issued unless the determination is approved.



## Ecosystem Credits

Vegetation Type	Area (ha)	Credits Required	Red Flag
Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands [CW117]	1.2	20	No
Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290) [CW176]	78.5	3,242	Yes
Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290) [CW176]	6.4	411	Yes
Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290) [CW176]	11.4	318	Yes
Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290) [CW176]	0.2	8	Yes
White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282) [CW209]	0.5	18	Yes
White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282) [CW209]	3.0	207	Yes
White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282) [CW209]	0.1	2	No
White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282) [CW209]	0.2	4	No
White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282) [CW209]	1.6	40	Yes

## Credit Profiles

**Group: 1** Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands

### Ecosystem credits: 20 credits

Total area of vegetation(s): 1.2 ha



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1. Surrounding vegetation cover	2. Patch size, including low condition
Description: Minimum surrounding vegetation cover in which the credits must be obtained.  <b>Minimum percent cover: 10%</b>	Description: Minimum area of contiguous vegetation in which credits must be obtained.  <b>Minimum area: 100 ha</b>

**3. CMA subregion & vegetation types**  
Credits must be obtained in any one or more of the following CMA Sub-regions and vegetation types:

**Central West**

**CMA Sub-Region(s)**

Capertee  
Hill End  
Kerrabee  
Upper Slopes  
Wollemi

**Veg Type(s)**

Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands (CW117)

**Group: 2** Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)

**Ecosystem credits: 3,242 credits**

Total area of vegetation(s): 78.5 ha

1. Surrounding vegetation cover	2. Patch size, including low condition
Description: Minimum surrounding vegetation cover in which the credits must be obtained.  <b>Minimum percent cover: 10%</b>	Description: Minimum area of contiguous vegetation in which credits must be obtained.  <b>Minimum area: 100 ha</b>

**3. CMA subregion & vegetation types**  
Credits must be obtained in any one or more of the following CMA Sub-regions and vegetation types:

**Central West**

**CMA Sub-Region(s)**

Capertee  
Hill End  
Kerrabee  
Liverpool Range  
Pilliga  
Upper Slopes

**Veg Type(s)**

Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290) (CW176)



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**Group: 3** Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)

**Ecosystem credits: 411 credits**

Total area of vegetation(s): 6.4 ha

1. Surrounding vegetation cover	2. Patch size, including low condition
Description: Minimum surrounding vegetation cover in which the credits must be obtained.  <b>Minimum percent cover: 10%</b>	Description: Minimum area of contiguous vegetation in which credits must be obtained.  <b>Minimum area: 100 ha</b>

3. CMA subregion & vegetation types
Credits must be obtained in any one or more of the following CMA Sub-regions and vegetation types:

**Central West**

CMA Sub-Region(s)	Veg Type(s)
Capertee	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290) (CW176)
Hill End	
Kerrabee	
Liverpool Range	
Pilliga	
Upper Slopes	

**Group: 4** Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)

**Ecosystem credits: 318 credits**

Total area of vegetation(s): 11.4 ha

1. Surrounding vegetation cover	2. Patch size, including low condition
Description: Minimum surrounding vegetation cover in which the credits must be obtained.  <b>Minimum percent cover: 0%</b>	Description: Minimum area of contiguous vegetation in which credits must be obtained.  <b>Minimum area: 5 ha</b>

3. CMA subregion & vegetation types
Credits must be obtained in any one or more of the following CMA Sub-regions and vegetation types:

**Central West**

CMA Sub-Region(s)	Veg Type(s)
Capertee	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290) (CW176)



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Hill End  
 Kerrabee  
 Liverpool Range  
 Pilliga  
 Upper Slopes

**Group: 5** Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)

**Ecosystem credits: 8 credits**

Total area of vegetation(s): 0.2 ha

1. Surrounding vegetation cover	2. Patch size, including low condition
Description: Minimum surrounding vegetation cover in which the credits must be obtained.  <b>Minimum percent cover: 0%</b>	Description: Minimum area of contiguous vegetation in which credits must be obtained.  <b>Minimum area: 5 ha</b>

3. CMA subregion & vegetation types
Credits must be obtained in any one or more of the following CMA Sub-regions and vegetation types:

**Central West**

**CMA Sub-Region(s)**

Capertee  
 Hill End  
 Kerrabee  
 Liverpool Range  
 Pilliga  
 Upper Slopes

**Veg Type(s)**

Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290) (CW176)

**Group: 6** White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282)

**Ecosystem credits: 18 credits**

Total area of vegetation(s): 0.5 ha

1. Surrounding vegetation cover	2. Patch size, including low condition
Description: Minimum surrounding vegetation cover in which the credits must be obtained.  <b>Minimum percent cover: 10%</b>	Description: Minimum area of contiguous vegetation in which credits must be obtained.  <b>Minimum area: 100 ha</b>



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**3. CMA subregion & vegetation types**  
Credits must be obtained in any one or more of the following CMA Sub-regions and vegetation types:

**Central West**

**CMA Sub-Region(s)**

Upper Slopes

**Veg Type(s)**

Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277) (CW112)  
White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282) (CW209)  
White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266) (CW216)

**Group: 7** White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282)

**Ecosystem credits: 207 credits**

Total area of vegetation(s): 3 ha

1. Surrounding vegetation cover	2. Patch size, including low condition
Description: Minimum surrounding vegetation cover in which the credits must be obtained.  <b>Minimum percent cover: 10%</b>	Description: Minimum area of contiguous vegetation in which credits must be obtained.  <b>Minimum area: 100 ha</b>

**3. CMA subregion & vegetation types**  
Credits must be obtained in any one or more of the following CMA Sub-regions and vegetation types:

**Central West**

**CMA Sub-Region(s)**

Upper Slopes

**Veg Type(s)**

Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277) (CW112)  
White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282) (CW209)  
White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266) (CW216)

**Group: 8** White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282)

**Ecosystem credits: 2 credits**

Total area of vegetation(s): 0.1 ha

1. Surrounding vegetation cover	2. Patch size, including low condition
Description: Minimum surrounding vegetation cover in which the credits must be obtained.  <b>Minimum percent cover: 10%</b>	Description: Minimum area of contiguous vegetation in which credits must be obtained.  <b>Minimum area: 25 ha</b>



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**3. CMA subregion & vegetation types**  
Credits must be obtained in any one or more of the following CMA Sub-regions and vegetation types:

**Central West**

**CMA Sub-Region(s)**

Upper Slopes

**Veg Type(s)**

Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277) (CW112)  
White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282) (CW209)  
White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266) (CW216)

**Group: 9** White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282)

**Ecosystem credits: 4 credits**

Total area of vegetation(s): 0.2 ha

1. Surrounding vegetation cover	2. Patch size, including low condition
Description: Minimum surrounding vegetation cover in which the credits must be obtained. <b>Minimum percent cover: 0%</b>	Description: Minimum area of contiguous vegetation in which credits must be obtained. <b>Minimum area: 5 ha</b>

**3. CMA subregion & vegetation types**  
Credits must be obtained in any one or more of the following CMA Sub-regions and vegetation types:

**Central West**

**CMA Sub-Region(s)**

Upper Slopes

**Veg Type(s)**

Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277) (CW112)  
White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282) (CW209)  
White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266) (CW216)

**Group: 10** White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282)

**Ecosystem credits: 40 credits**

Total area of vegetation(s): 1.6 ha

1. Surrounding vegetation cover	2. Patch size, including low condition
Description: Minimum surrounding vegetation cover in which the credits must be obtained. <b>Minimum percent cover: 0%</b>	Description: Minimum area of contiguous vegetation in which credits must be obtained. <b>Minimum area: 5 ha</b>



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**3. CMA subregion & vegetation types**  
 Credits must be obtained in any one or more of the following CMA Sub-regions and vegetation types:

<b>Central West</b>	
<b>CMA Sub-Region(s)</b>	<b>Veg Type(s)</b>
Upper Slopes	Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277) (CW112) White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282) (CW209) White Box grassy woodland on well drained podsolc clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266) (CW216)

**Species Credits**

Species credits are required for 1 species.

<b>Yellow-bellied Sheath-tail-bat</b>	<b>Saccolaimus flaviventris</b>
Number of species credits required:	290
Extent of impact:	13.05 ha
Identification method:	Survey
Impact on red flag area?	Yes
Reason for red flag area:	An impact greater than that allowed;



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# Appendix J: EPBC Significance Assessments

## ENDANGERED ECOLOGICAL COMMUNITIES

- Box Gum Woodland

## FLORA

- *Bothriochloa biloba* (Lobed Blue Grass);
- *Eucalyptus cannonii* (Cannon's Stringybark);
- *Eucalyptus robertsonii* subsp. *hemisphaerica* (Robertson Peppermint)
- *Prasophyllum* sp. *Wybong* (C. Phelps ORG 5269) (A Leek Orchid)
- *Swainsona recta* (Small Purple Pea)
- *Thesium australe* (Austral Toadflax)

## FAUNA

- *Anthochaera phrygia* (Regent Honeyeater);
- *Dasyurus maculatus maculatus* (SE mainland population) (Spotted-tailed Quoll)
- *Lathamus discolor* (Swift Parrot);
- *Chalinolobus dwyeri* (Large-eared Pied Bat);
- *Nyctophilus corbeni* (Greater (eastern) Long-eared Bat);
- *Polytelis swainsonii* (Superb Parrot);
- *Pteropus poliocephalus* (Grey-headed Flying-fox);
- *Ardea alba* (Great Egret);
- *Ardea ibis* (Cattle Egret).
- *Hirundapus caudacutus* (White-throated Needletail);
- *Merops ornatus* (Rainbow Bee-eater); and
- *Myiagra cyanoleuca* (Satin Flycatcher).
- *Aprasia parapulchella* (Pink-tailed Worm-lizard)

## ENDANGERED ECOLOGICAL COMMUNITIES

### White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box Gum Woodland)

Box-Gum Woodland (BGW) is listed as a Critically Endangered Ecological Community (CEEC) under the EPBC Act. A description for the community under the TSC Act is provided in Part 3A assessment for the community in Appendix H.

Some areas of woodland mapped as Box-Gum Woodland under the TSC Act met the criteria for the Critically Endangered Ecological Community BGW, listed under the EPBC Act. EPBC Act-listed BGW occurred in both the study area (in the area where the external overhead lines are proposed) and project site within the Pyramul Cluster.

**An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:**

**a) reduce the extent of an ecological community**

The proposal involves the permanent removal of up to 2.99 ha of moderate/good condition EPBC Act BGW. This removal represents 20.13% of the BGW mapped within the study area but only 4.55 % of BGW mapped within the project site. The proposal will not have any temporary impacts on BGW.

**b) fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines**

A history of agriculture on the project site has cleared much of the original woodland and forest, fragmenting remnant vegetation. Road and transmission lines form necessary components of the infrastructure supporting a wind farm, and these features, coupled with the actual turbine layout, form a linear study area with potential to increase fragmentation of the landscape, but only to a small extent. Only small areas of BGW will be impacted given the impacts will be in the area where the external overhead lines are proposed (only small areas will be impacted to install poles to support the overhead lines). Clearance will not be one consolidated block, and clearing would be unlikely to impact on dispersal mechanisms for BGW or prevent fauna movement between stands of vegetation. Management measures including a Weed Management Plan will be implemented to prevent degradation of adjacent remaining areas of BGW due to edge effects and weed invasion. Furthermore, areas of BGW and its habitat will remain within the study area (14.85 ha) and project site (65.74 ha) and offsets will be provided for all BGW cleared.

**c) adversely affect habitat critical to the survival of an ecological community**

**Note: Habitat critical to the survival of an ecological community refers to areas that are necessary:**

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

Given that only 20.13 % and 4.55 % of the BGW mapped within the study area and project site, respectively, will be cleared, the proposal is unlikely to prevent the recovery of the ecological community or long-term maintenance of BGW within the project site and the locality. The proposal is not considered to adversely affect critical habitat. Furthermore, no critical habitat for BGW has been declared on the Register of Critical Habitat in NSW.

**d) 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**

Other than where the external overhead powerlines are proposed, the study area is primarily located on ridge tops and, therefore, is largely not affected by the surrounding streams. Conversely, the proposal is not likely to significantly affect flooding or flow regimes for the study area. There may be small and localised alterations of surface water drainage patterns, in the form of an increase in run-off in areas where the ground within the construction area will be compacted, gravelled or concreted. Soil erosion and run-off control measures will be implemented as part of the mitigation measures undertaken for the proposal to avoid indirect impacts adjacent areas.

**e) cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example, through regular burning or flora or fauna harvesting**

The proposal is unlikely to cause a substantial change in the species composition of BGW. The composition of BGW could be affected through clearing, or changes in the fire or grazing regime. However, the extent of BGW clearing is low, and due to management measures included in the Weed Management Plan, weeds are unlikely to establish in BWG patches. Outside of the 2.99 ha of BGW that is proposed to be cleared, the proposal is not expected to cause a substantial change in the species assemblage.

The risk of fire with wind farms is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. The existing fire regime within the study area is not expected to change as a result of the proposed development. As an aside, the proposal may result in improved access for firefighting appliances in case of a bushfire within the project site, due to the construction of roads within the study area.

The site is grazed primarily by sheep and cattle. Grazing pressure and management varies across the landscape, and the proposal is unlikely to exacerbate over-grazing at the site and may, in fact, contribute to a more sustainable grazing regime through the mitigation measures proposed in some parts of the site. In the absence of fire, grazing can be an important form of disturbance to prevent the accumulation of biomass that may not be favourable to some native flora species. Rotational periods of grazing and spelling help to foster healthy native pastures in the absence of fire.

f) **cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:**

- **assisting invasive species, that are harmful to the listed ecological community, to become established, or**

**Note: An invasive species is an introduced species, including an introduced (translocated) native species, which out-competes native species for space and resources or which is a predator of native species. Introducing an invasive species into an area may result in that species becoming established. An invasive species may harm listed threatened species or ecological communities by direct competition, modification of habitat or predation.**

The integrity of BGW is influenced by continuous heavy grazing and trampling by grazing stock, invasion by non-native plants including noxious weeds, pasture species and environmental weeds, and invasion by feral animals, amongst other impacts (OEH 2011b).

The proposal will not increase the current grazing regime in the study area or result in the increased invasion of the study area by feral animals. Indeed, regarding the latter, the proposal is likely to assist with the management of feral animal species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites.

Measures to avoid the spread of weeds will be implemented from pre-construction works and throughout construction works and operation, until decommissioning, thereby reducing potential impacts of the proposal to potential habitat for BGW. These measures comprise:

- Piling of soil that may contain seeds of exotic species at least 50 m away from the creeks, drainage lines and other areas of native vegetation, where possible, to prevent spread into adjacent areas of ecological significance during rainfall or wind events;
  - Washing of all machinery, equipment and vehicles before entering and leaving a site;
  - Undertaking topsoil recovery in areas that have a high proportion of native vegetation and few weeds in the ground layer of vegetation;
  - Ensuring that any soil, rubble etc imported to the site is certified that it is free of weeds and weed seed;
  - Revegetating with locally native endemic species characteristic of the cleared vegetation type;
  - Implementing weed management measures to control perennial weed grasses;
  - Managing stock access during periods of vegetation and soil disturbance to prevent weed spread; and,
  - Making all onsite staff and contractors aware of noxious weeds present at the site and ways to prevent their spread.
- **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, or**

The proposal does not involve the regular release of chemicals or pollutants into areas occupied by the community. However, mitigation measures are in place for contained hazardous materials that are

required during the construction and operation of the wind farm:

- Hazardous materials must be stored on or off-site in specific lay-down/storage areas, and will be handled and stored according to regulatory requirements and Australian Standards AS1940; and,
- The transformer as part of the collector substation may contain upwards of 1,000 litres of oil. Provisions will be made as part of the design for containment of any oil which may leak or spill. Prevention and containment of any potential spills will be described in detail in the EMP.

**g) interfere with the recovery of an ecological community.**

Given that the proposal will require the removal of only 0.83 % of EPBC Act-listed BGW mapped within the project site, the proposal is not expected to interfere with the recovery of the ecological community. Furthermore, as the proposed vegetation removal is scattered (for the installation of poles to support overhead lines), rather than one consolidated stand, it is unlikely to interfere with the recovery of the community in the long-term under favourable climatic conditions and sustainable land management. The proposal will not increase the occurrence of weeds or feral animals, increase the intensity of grazing in the study area, or alter the current fire regime which would interfere with the recovery of BGW.

## THREATENED FLORA

### ***Bothriochloa biloba* (Lobed Blue-grass)**

*Bothriochloa biloba* is listed as a vulnerable species under the EPBC Act. It is an erect or decumbent grass to 1 m high known from the Darling Downs district in Queensland, south along the western slopes of the Great Dividing Range to North Star, Warialda, Bingara and Merriwa in NSW. It also occurs west to Dubbo and around the Hunter Valley. The species occurs within the Hunter–Central Rivers, Central West, Namoi, Northern Rivers and Border Rivers–Gwydir (NSW) and Border Rivers Maranoa–Balonne and Condamine (Queensland) CMAs (Threatened Species Scientific Committee 2008).

*Bothriochloa biloba* grows in cleared eucalypt forests and relict grassland, often dominated by *Aristida ramosa* (Purple Wiregrass), *Bothriochloa macra* (Red-leg Grass), *B. decipiens* (Red Grass), *Dicanthium sericeum* (Queensland Bluegrass) or *Austrostipa aristiglumis*. Dense stands of *Bothriochloa biloba* have been recorded in *Chloris truncata* (Windmill Grass) Grassland in the north-western slopes of NSW. *Bothriochloa biloba* prefers heavier-textured soils such as brown or black clay soils (Threatened Species Scientific Committee 2008).

Flowering occurs from November to June (Threatened Species Scientific Committee 2008).

There are conflicting views on the response of *Bothriochloa biloba* to grazing. *Bothriochloa biloba* has been found in locations that are regularly mown, slashed, grazed, cultivated for five years, and areas where grazing is restricted (Threatened Species Scientific Committee 2008).

Flora surveys and vegetation community validation were conducted across the proposed study area and project site during October and November 2008, January 2009, and March and April 2011. *Bothriochloa biloba* was not recorded during field survey. The species was predicted to occur by the Protected Matters search tool (DSEWPAC 2011a).

**An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:**

- a) **lead to a long-term decrease in the size of an important population of a species;**

**Note: An ‘important population’ 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;**

While there is potential for the species to occur in the study area and project site, *Bothriochloa biloba* was not recorded during the field surveys. There are no records for the species in the locality; the species was predicted to occur by the Protected Matters search tool (DSEWPAC 2011a), which includes a large area of predicted occurrence. Given that no individuals of *Bothriochloa biloba* were recorded in the study area or locality, it is unlikely that an important population occurs at the study area. Thus, the action is not expected to lead to a long-term decrease in the size of an important population of the species.

**b) reduce the area of occupancy of an important population;**

As detailed in part a), no individuals of *Bothriochloa biloba* were recorded during the field surveys, and it is unlikely that an important population occurs at the study area. As such, the proposal will not reduce the area of occupancy of an important population.

**c) fragment an existing important population into two or more populations;**

As detailed in part a), no individuals of *Bothriochloa biloba* were recorded during the field surveys, and it is unlikely that an important population occurs at the study area. As such, the proposal will not fragment an existing important population into two or more populations.

**d) adversely affect habitat critical to the survival of a species;**

**Note: Habitat critical to the survival of a species refers to areas that are necessary:**

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

Given that no individuals of *Bothriochloa biloba* were detected within the study area or project site during the field surveys, the study area is unlikely to represent habitat critical to the survival of the species, and thus, the proposal is unlikely to adversely affect habitat critical to the survival of the species. It is possible that field surveys did not detect the species; however, the action will remove only 103.08 ha of potential habitat for the species (71.52 ha permanently removed and 31.56 ha temporarily removed), representing 6.73 % of potential habitat in the study area and 2.63 % of potential habitat in the project site. This amount is considered to be minimal, and the proposal would leave ample potential habitat for the species and for the long-term maintenance of the species.

The potential habitat proposed to be removed does not constitute habitat identified in a recovery plan for the species, habitat critical for that species, or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act.

**e) disrupt the breeding cycle of an important population;**

As detailed in part a), no individuals of *Bothriochloa biloba* were recorded during the field surveys, and it is unlikely that an important population occurs at the study area. As such, the proposal will not disrupt the breeding / life cycle of an important population.

**f) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The action will permanently remove 71.52 ha and temporarily remove 31.56 ha of potential habitat for *Bothriochloa biloba*. However, removal of potential habitat will occur in linear fingers within clusters rather than one consolidated stand. No individuals of *Bothriochloa biloba* were recorded within the study area and only a small amount of potential habitat would be impacted 6.73 % of the potential habitat in the study area. The removal of a relatively small amount of potential habitat within the study area is unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline. It is also unlikely to isolate potential habitat for the species to the extent that the species is likely to decline. Potential impacts from the proposal on potential habitat e.g. soil movement or weed

spread will be managed.

- g) result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

**Note: An invasive species is an introduced species, including an introduced (translocated) native species, which out-competes native species for space and resources or which is a predator of native species. Introducing an invasive species into an area may result in that species becoming established. An invasive species may harm listed threatened species or ecological communities by direct competition, modification of habitat or predation.**

One of the key threats to *Bothriochloa biloba* is competition from exotic species such as *Hyparrhenia hirta* (Coolatai Grass), *Cyperus rotundus* (Nut Grass) and *Phyla nodiflora* (Lippia), while the main potential threat to *Bothriochloa biloba* includes competition from exotic grasses including *Eragrostis curvula* (African Lovegrass), *Paspalum dilatatum*, *Panicum maximum*, *Pennisetum villosum*, and *Sorghum halepense* (Threatened Species Scientific Committee 2008).

The proposal is unlikely to result in invasive weed species; however, control measures to avoid the spread of weeds will be implemented from pre-construction works, throughout construction and operation until decommissioning, thereby reducing potential impacts of the proposal to potential habitat for this species. These are detailed in **Table 17**.

- h) introduce disease that may cause the species to decline, or**

No diseases are known that threaten *Bothriochloa biloba*. The action is not expected to introduce any disease to the study area.

- i) interfere substantially with the recovery of the species.**

No individuals of *Bothriochloa biloba* were detected within the study area or project site during the field surveys which may be impacted by the proposal. Thus, the proposal is unlikely to interfere with the recovery of the species. However, should a population of the species be present, ample potential habitat would remain available for the species. The action would only remove 6.73 % of the potential habitat mapped within the study area for the species. The proposal will not increase the occurrence of weeds which would interfere with the recovery of *Bothriochloa biloba*.

***Eucalyptus cannonii* (Cannon's Stringybark)**

*Eucalyptus macrorhyncha* subsp. *cannonii*, also known as and hereafter referred to as *E. cannonii*, is listed as a vulnerable species under both the TSC Act and the EPBC Act. A description for the species is provided in Part 3A assessment for the species in Appendix H.

**An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:**

- a) lead to a long-term decrease in the size of an important population of a species;**

**Note: An 'important population' 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;**

While there is potential for the species to occur in the study area and project site, *E. cannonii* was not recorded during the field surveys. There are records for the species in the locality, mostly to the east, with the closest record located off the Castlereagh Highway, approximately 1.7 km away. Remaining records of the species have been recorded north toward Lake Windamere (2 records), and south east in the Ilford area (3 records), and east around the Clandulla area (2 records in Clandulla State Forest and 1 record at Charbon Colliery) (OEH 2011a, RBG 2011).

Given that no individuals of *E. cannonii* were recorded in the study area, it is unlikely that an important population occurs at the study area. Thus, the action is not expected to lead to a long-term decrease in the size of an important population of the species.

- b) reduce the area of occupancy of an important population;**

As detailed in part a), no individuals of *E. cannonii* were recorded during the field surveys, and as such, it is unlikely that an important population occurs at the study area. The 55 known locations for the species and 14 populations within conserved areas (NPWS 2000) will not be impacted. Thus, the proposal will not reduce the area of occupancy of an important population.

- c) fragment an existing important population into two or more populations;**

As detailed in part a), no individuals of *E. cannonii* were recorded during the field surveys, and as such, it is unlikely that an important population occurs at the study area. The 55 known locations for the species and 14 populations within conserved areas (NPWS 2000) will not be impacted. Thus, the proposal will not fragment an existing important population into two or more populations.

- d) adversely affect habitat critical to the survival of a species;**

**Note: Habitat critical to the survival of a species refers to areas that are necessary:**

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

Given that no individuals of *E. cannonii* were detected within the study area or project site during the field surveys, the study area is unlikely to represent habitat critical to the survival of the species, and thus, the proposal is unlikely to adversely affect habitat critical to the survival of the species. It is possible that field surveys did not detect the species; however, the action will remove only 97.70 ha of potential habitat for the species (66.25 ha permanently removed and 31.45 ha temporarily removed), representing 7.61 % of potential habitat in the study area and 2.99 % of potential habitat in the project site. This amount is considered to be minimal, and the proposal would leave ample potential habitat for the species and for the long-term maintenance of the species.

The potential habitat proposed to be removed does not constitute habitat identified in a recovery plan for the species, habitat critical for that species, or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act.

**e) disrupt the breeding cycle of an important population;**

As detailed in part a), no individuals of *E. cannonii* were recorded during the field surveys, and as such, it is unlikely that an important population occurs at the study area. The 55 known locations for the species and 14 populations within conserved areas (NPWS 2000) will not be impacted. Thus, the proposal will not disrupt the breeding / life cycle of an important population.

**f) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The action will permanently remove 66.25 ha and temporarily remove 31.45 ha of potential habitat for *E. cannonii*. However, removal of potential habitat will occur in linear fingers within clusters rather than one consolidated stand. No individuals of *E. cannonii* were recorded within the study area and only a small amount of potential habitat would be impacted (7.61 % of the potential habitat in the study area). The removal of a relatively small amount of potential habitat within the study area is unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline. It is also unlikely to isolate or modify potential habitat for the species (eg. through changed fire regimes) to the extent that the species is likely to decline. The risk of fire with wind farms is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. Potential impacts from the proposal on potential habitat e.g. soil movement or weed spread will be managed.

**g) result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

**Note: An invasive species is an introduced species, including an introduced (translocated) native species, which out-competes native species for space and resources or which is a predator of native species. Introducing an invasive species into an area may result in that species becoming established. An invasive species may harm listed threatened species or ecological communities by direct competition, modification of habitat or predation.**

The proposal is unlikely to result in invasive weed species which are harmful to *E. cannonii*; however, control measures to avoid the spread of weeds will be implemented from pre-construction works, throughout construction and operation until decommissioning, thereby reducing potential impacts of the proposal to potential habitat for this species. These are detailed in **Table 17**.

**h) introduce disease that may cause the species to decline, or**

*Eucalyptus cannonii* may be susceptible to Myrtle Rust (*Uredo rangelii*), a newly described fungus which is a serious pathogen affecting plants belonging to the family Myrtaceae. The action is not expected to introduce Myrtle Rust to the study area, given that all machinery, equipment and vehicles entering the project site will be washed before entering.

**i) interfere substantially with the recovery of the species.**

No individuals of *E. cannonii* were detected within the study area or project site during the field surveys which may be impacted by the proposal. Thus, the proposal is unlikely to interfere with the recovery of the species, particularly given the 55 known locations for the species and 14 populations within conserved areas (NPWS 2000) will not be impacted. However, should a population of the species be present, ample potential habitat would remain available for the species. The action would only remove 7.61 % of the potential habitat mapped within the study area for the species. The proposal would not increase the occurrence of weeds, increase the intensity of grazing, or alter the fire regime in the study area which would interfere with the recovery of *E. cannonii*.

***Eucalyptus robertsonii* subsp. *hemisphaerica* (Robertson Peppermint)**

*Eucalyptus robertsonii* subsp. *hemisphaerica* is listed as a vulnerable species under both the TSC Act and the EPBC Act. A description for the species is provided in Part 3A assessment for the species in Appendix H.

**An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:**

- a) **lead to a long-term decrease in the size of an important population of a species;**

**Note: An ‘important population’ 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;**

While there is potential for the species to occur in the study area and project site, *E. robertsonii* subsp. *hemisphaerica* was not recorded during the field surveys. There is a previous record for the species in the locality, to the north of the study area in the Calcagong area (OEH 2011a).

Given that no individuals of *E. robertsonii* subsp. *hemisphaerica* were recorded in the study area, it is unlikely that an important population occurs at the study area. Thus, the action is not expected to lead to a long-term decrease in the size of an important population of the species.

- b) **reduce the area of occupancy of an important population;**

As detailed in part a), no individuals of *E. robertsonii* subsp. *hemisphaerica* were recorded during the field surveys, and as such, it is unlikely that an important population occurs at the study area. Thus, the proposal will not reduce the area of occupancy of an important population.

- c) **fragment an existing important population into two or more populations;**

As detailed in part a), no individuals of *E. robertsonii* subsp. *hemisphaerica* were recorded during the field surveys, and as such, it is unlikely that an important population occurs at the study area. Thus, the proposal will not fragment an existing important population into two or more populations.

- d) **adversely affect habitat critical to the survival of a species;**

**Note: Habitat critical to the survival of a species refers to areas that are necessary:**

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

Given that no individuals of *E. robertsonii* subsp. *hemisphaerica* were detected within the study area or project site during the field surveys, the study area is unlikely to represent habitat critical to the survival of the species, and thus, the proposal is unlikely to adversely affect habitat critical to the survival of the species. It is possible that field surveys did not detect the species; however, the action will remove only

1.21 ha of potential habitat for the species (0.81 ha permanently removed and 0.40 ha temporarily removed), representing 7.79 % of potential habitat in the study area and 3.01 % of potential habitat in the project site. This amount is considered to be minimal, and the proposal would leave ample potential habitat for the species and for the long-term maintenance of the species.

The potential habitat proposed to be removed does not constitute habitat identified in a recovery plan for the species, habitat critical for that species, or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act.

**e) disrupt the breeding cycle of an important population;**

As detailed in part a), no individuals of *E. robertsonii* subsp. *hemisphaerica* were recorded during the field surveys, and as such, it is unlikely that an important population occurs at the study area. Thus, the proposal will not disrupt the breeding / life cycle of an important population.

**f) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The action will permanently remove 0.81 ha and temporarily remove 0.40 ha of potential habitat for *E. robertsonii* subsp. *hemisphaerica*. However, removal of potential habitat will occur in linear fingers within clusters rather than one consolidated stand. No individuals of *E. robertsonii* subsp. *hemisphaerica* were recorded within the study area and only a small amount of potential habitat would be impacted (7.79 % of the potential habitat in the study area). The removal of a relatively small amount of potential habitat within the study area is unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline. It is also unlikely to isolate or modify potential habitat for the species (e.g. through changed fire regimes or increased grazing intensity) to the extent that the species is likely to decline through lack of regeneration, a major threat for the species (OEH 2011b). The risk of fire with wind farms is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). The location of wind turbines away from tall vegetation in the study area minimises the risk of fire. Grazing pressure and management varies across the landscape, and the proposal is unlikely to exacerbate over-grazing at the site. It may, in fact, contribute to a more sustainable grazing regime through the mitigation and offset measures proposed in some parts of the site. Potential impacts from the proposal on potential habitat e.g. soil movement or weed spread will be managed.

**g) result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

**Note: An invasive species is an introduced species, including an introduced (translocated) native species, which out-competes native species for space and resources or which is a predator of native species. Introducing an invasive species into an area may result in that species becoming established. An invasive species may harm listed threatened species or ecological communities by direct competition, modification of habitat or predation.**

The proposal is unlikely to result in invasive weed species which are harmful to *E. robertsonii* subsp. *hemisphaerica*; however, control measures to avoid the spread of weeds will be implemented from pre-construction works, throughout construction and operation until decommissioning, thereby reducing potential impacts of the proposal to potential habitat for this species. These are detailed in **Table 17**.

**h) introduce disease that may cause the species to decline, or**

*Eucalyptus robertsonii* subsp. *hemisphaerica* may be susceptible to Myrtle Rust (*Uredo rangelii*), a newly described fungus which is a serious pathogen affecting plants belonging to the family Myrtaceae. The action is not expected to introduce Myrtle Rust to the study area, given that all machinery, equipment and vehicles entering the project site will be washed before entering.

**i) interfere substantially with the recovery of the species.**

No individuals of *E. robertsonii* subsp. *hemisphaerica* were detected within the study area or project site during the field surveys which may be impacted by the proposal. Thus, the proposal is unlikely to interfere with the recovery of the species, particularly given important known populations will not be impacted. However, should a population of the species be present, ample potential habitat would remain available for the species. The action would only remove 7.79 % of the potential habitat mapped within the study area for the species. The proposal would not increase the occurrence of weeds, increase the intensity of grazing, or alter the fire regime in the study area which would interfere with the recovery of *E. robertsonii* subsp. *hemisphaerica*.

***Prasophyllum* sp. Wybong (C. Phelps ORG 5269) (A Leek Orchid)**

*Prasophyllum* sp. Wybong (C. Phelps ORG 5269), also referred to as *Prasophyllum* sp. Wybong, is listed as a critically endangered species under the EPBC Act. It is a terrestrial orchid that grows to approximately 30 cm high and has a single, tubular, fleshy, dull-green leaf and a single flower spike with numerous fragrant flowers (DSEWPAC 2011b).

*Prasophyllum* sp. Wybong is endemic to NSW. It is known from at least 10, but up to 12, populations in eastern NSW (*pers comm.* Dr. Lachlan Copeland, Senior Botanist, Eco Logical Australia, 2011) although DSEWPAC (2011b) has recognised 7 populations of the species near Ilford, Premer, Muswellbrook, Wybong, Yeoval, Inverell and Tenterfield, occurring within the Border Rivers (Gwydir, Namoi, Hunter), Central Rivers and Central West CMAs. The extent of occurrence of *Prasophyllum* sp. Wybong is estimated to be 48,000 km<sup>2</sup> and its area of occupancy is estimated to be 1.5 km<sup>2</sup> (DSEWPAC 2011b).

*Prasophyllum* sp. Wybong is known to occur in open eucalypt woodland and grassland. It is a perennial orchid, appearing as a single leaf over winter and spring. The species flowers in spring and dies back to a tuber over summer and autumn (DSEWPAC 2011b).

Little is known of the species' relationship with mycorrhizal fungi and insect pollinators, or other aspects of its ecology and life history. However, native bees, wasps, flies and beetles are known to be effective pollinators of other *Prasophyllum* species given the scent of the flowers attract these insect pollinators (although some species can also be self-pollinating). Leek orchids are not known to reproduce vegetatively and recruitment is from seed (DSEWPAC 2011b). It is likely that this is also the case for *Prasophyllum* sp. Wybong.

The populations of this species are separated by large areas of cleared land, making cross pollination and genetic exchange highly unlikely (DSEWPAC 2011b).

Flora surveys and vegetation community validation were conducted across the proposed study area and project site during October and November 2008, January 2009, and March and April 2011. *Prasophyllum* sp. Wybong was not recorded during field survey although the closest population is located near the study area at Ilford. The species was predicted to occur by the Protected Matters search tool (DSEWPAC 2011a).

**An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:**

- a) lead to a long-term decrease in the size of a population;

**Note: A "population of a species" is defined under the EPBC Act as an occurrence of the species in a particular area. Occurrences include but are not limited to:**

- A geographically distinct regional population, or collection of local populations; or
- A population, or collection of local populations, that occurs within a particular bioregion.

While there is potential for the species to occur in the study area and project site, *Prasophyllum* sp. Wybong was not recorded during the field surveys. The closest known population of the species is located at Ilford, approximately 8 km from the study area to the south east. Given that no individuals/populations of *Prasophyllum* sp. Wybong were recorded in the study area, and the nearest

known population at Ilford will not be impacted, the action is not expected to lead to a long-term decrease in the size of a population.

**b) reduce the area of occupancy of the species;**

Under the proposal, a small amount of potential habitat for *Prasophyllum* sp. Wybong is proposed to be removed (71.52 ha permanently removed and 31.56 ha temporarily removed). *Prasophyllum* sp. Wybong is not currently known to occupy the study area or project site. The nearest population at Ilford will not be impacted. Furthermore, vegetation removal is to occur in linear fingers within clusters rather than one consolidated stand in the study area, and thus, would not significantly reduce the known area of occupancy for the species (estimated to be 1.5 km<sup>2</sup>; DSEWPAC 2011b), if present. Therefore, the proposal is not expected to reduce the area of occupancy of the species.

**c) fragment an existing population into two or more populations;**

No individuals/populations of *Prasophyllum* sp. Wybong were detected within the study area or project site during the field surveys. However, should a population be present, processes such as pollination (likely to be via insect pollinators; pers comm. Dr. Lachlan Copeland, Senior Botanist, Eco Logical Australia, 2011) would not be compromised given that access roads would be only 6 m wide. As such, the proposal is not expected to fragment an existing population into two or more populations.

**d) adversely affect habitat critical to the survival of a species;**

**Note: Habitat critical to the survival of a species refers to areas that are necessary:**

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

Given that no individuals/populations of *Prasophyllum* sp. Wybong were detected within the study area or project site during the field surveys, the study area is unlikely to represent habitat critical to the survival of the species, and thus, the proposal is unlikely to adversely affect habitat critical to the survival of the species. However, the species is cryptic and vegetative material is only present during a short period of time over winter and spring (DSEWPAC 2011b), and thus it is possible that field surveys did not detect the species.

Despite this, the action will remove only 103.08 ha of potential habitat for the species (71.52 ha permanently removed and 31.56 ha temporarily removed), representing 6.73 % of potential habitat in the study area and 2.63 % of potential habitat in the project site. This amount is considered to be minimal, and the proposal would leave ample potential habitat for the species and for the long-term maintenance of the species. The proposal would not impact on the likely pollinators of the species, and with access roads only 12 m wide, would not prevent pollinators from accessing any individuals of *Prasophyllum* sp. Wybong that might be present.

The potential habitat proposed to be removed does not constitute habitat identified in a recovery plan for the species, habitat critical for that species, or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act.

**e) disrupt the breeding cycle of a population;**

Given that no individuals/populations of *Prasophyllum* sp. Wybong were detected within the study area or project site during the field surveys, it is unlikely that individuals of the species would be impacted which would lead to a disruption of the life cycle of a population.

However, it is possible that the species was missed during the field surveys given the species is cryptic and vegetative material is present only during winter and spring, and thus individuals may be present in the study area within potential habitat. Despite this, the action will remove only 103.08 ha of potential habitat for the species (71.52 ha permanently removed and 31.56 ha temporarily removed), representing 6.73 % of potential habitat in the study area and 2.63 % of potential habitat in the project site. This amount is considered to be minimal. The proposal would leave ample potential habitat for individuals of the species, if present, to complete their life cycles. It is unlikely that flowering would be impacted given that the proposal would not include any slashing which could remove flower heads.

Regarding pollination, it is unlikely that *Prasophyllum* sp. Wybong would be impacted by the proposal. The species is likely to be pollinated by insects, including flies, bees and wasps, and these insects and their movements would not be impacted by the proposal. The proposal would remove only a small amount of potential habitat supporting mycorrhizal fungi required by the species for germination.

**f) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;**

The action will permanently remove 71.52 ha and temporarily remove 31.56 ha of potential habitat for *Prasophyllum* sp. Wybong. However, removal of potential habitat will occur in linear fingers within clusters rather than one consolidated stand. No individuals/populations of *Prasophyllum* sp. Wybong were recorded within the study area and only a small amount of potential habitat would be impacted (6.73 % of the potential habitat in the study area). The removal of a relatively small amount of potential habitat within the study area is unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline. It is also unlikely to isolate or modify potential habitat for the species (eg. through changed disturbance regimes) to the extent that the species is likely to decline. Potential impacts from the proposal on potential habitat e.g. soil movement or weed spread will be managed.

**g) result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;**

**Note: An invasive species is an introduced species, including an introduced (translocated) native species, which out-competes native species for space and resources or which is a predator of native species. Introducing an invasive species into an area may result in that species becoming established. An invasive species may harm listed threatened species or ecological communities by direct competition, modification of habitat or predation.**

One of the key threats to *Prasophyllum* sp. Wybong is weed invasion (DSEWPAC 2011b). The proposal is unlikely to result in invasive weed species; however, control measures to avoid the spread of weeds will be implemented from pre-construction works, throughout construction and operation until decommissioning, thereby reducing potential impacts of the proposal to potential habitat for this species. These are detailed in **Table 17**.

**h) introduce disease that may cause the species to decline, or**

No diseases are known to threaten *Prasophyllum* sp. Wybong. The action is not expected to introduce any disease to the study area.

**i) interfere with the recovery of the species.**

No individuals/populations of *Prasophyllum* sp. Wybong were detected within the study area or project site during the field surveys which may be impacted by the proposal. Thus, the proposal is unlikely to interfere with the recovery of the species. However, should a population of the species be present, ample potential habitat would remain available for the species. The action would only remove 6.73 % of the potential habitat mapped within the study area for the species. The proposal will not increase the occurrence of weeds, increase the intensity of grazing in the study area, or alter the current fire regime which would interfere with the recovery of *Prasophyllum* sp. Wybong.

***Swainsona recta* (Small Purple-pea)**

*Swainsona recta* is listed as an endangered species under the EPBC Act. A description for the species is provided in Part 3A assessment for the species in Appendix H.

**An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:**

**j) lead to a long-term decrease in the size of a population;**

**Note: A “population of a species” is defined under the EPBC Act as an occurrence of the species in a particular area. Occurrences include but are not limited to:**

- **A geographically distinct regional population, or collection of local populations; or**
- **A population, or collection of local populations, that occurs within a particular bioregion.**

*Swainsona recta* was recorded during field surveys conducted during September and October 2011, although they were not recorded during surveys conducted in October and November 2008, January 2009, or March and April 2011. All individuals recorded were recorded within WBBRGYB (wooded areas) under the external overhead line, although there is also the potential for this species to inhabit the pasture areas of this community and also areas of RSSGRBLLB in other parts of the study area and project site.

Thirty six individuals were recorded across five locations within or near the proposed 45 m powerline easement. It is possible that more individuals are present in this area but may not have been detected as not all recorded individuals were in flower and detection of non-flowering individuals is often difficult. The numbers of individuals are outlined below according to the five locations where the species was recorded:

- 24 individuals on the lower slope east of the current access track
- Seven individuals near an existing powerpole and within the proposed easement east of the current access track
- Two individuals in a small area on the western west side of road, small area
- Two individuals in a small area on the western west side of road, small area
- One individual on the western west side of road, small area

The proposal could impact on *Swainsona recta*, leading to a decrease in the size of the population by directly removing individuals of the species. However, where necessary, poles will be aligned to ensure no impacts, thereby avoiding the loss of all recorded individuals of this species. In areas between poles, removal of trees is the only anticipated impact. Given that most of the individuals identified were in the current easement, the majority of tree clearance has already been undertaken in those areas and, therefore, any future disturbance due to the need to remove trees is likely to be minimal.

Realignment of the powerline corridor further east or west was considered although this was likely to result in greater impacts on potential habitat for this species as additional clearance areas would be needed to provide access for construction and maintenance. In the current location, the external overhead line runs along an existing easement and access road and, therefore, impacts to native vegetation have been minimised. Furthermore, provided stringent mitigation measures are implemented during construction, it is unlikely that the proposal would have a detrimental impact on the population with many of the recorded individuals present in a current powerline easement. These

include:

- Fencing around the individuals incorporating a 5 m buffer from the outer most plants when erecting the fencing;
- Implementation of sediment and erosion control measures; and
- Ongoing weed management.

The proposal could also impact on *Swainsona recta*, leading to a decrease in the size of the population by reducing the amount of potential habitat available to the species, degrading *Swainsona recta* habitat (eg. through fragmentation or weed invasion), or changing the fire or grazing regime of the area.

Potential habitat for *Swainsona recta* within the study area exists in areas of WBBRGYB, and RSSCRLLB, and WBBRGYB (wooded areas and pasture). The proposal will permanently remove 69.68 ha and temporarily remove 31.16 ha of potential habitat within the study area.

However, the amount of clearance of potential habitat is minimal with respect to the amount of potential habitat present for this species within the project site. Only 6.37 % of the habitat within the project site will be removed in a linear and dispersed manner, rather than one consolidated block and no individuals will be directly impacted. While a greater proportion of potential habitat within the study area will be removed (25.49 %), the majority of habitat in the study area will remain. Areas of temporary vegetation removal will regenerate. The species is pollinated by insects (it is also self-compatible), and these insects and their movements would not be impacted by the proposal. Mitigation measures to minimise erosion and control soil movement and weed spread will be implemented during construction works to limit potential impacts from the proposal on potential habitat.

**k) reduce the area of occupancy of the species;**

Under the proposal, a small amount of potential habitat for *Swainsona recta* is proposed to be removed (69.68 ha permanently removed and 31.16 ha temporarily removed). No individuals of *Swainsona recta* recorded under the overhead powerlines will be impacted. Furthermore, vegetation removal is to occur in linear fingers within clusters rather than one consolidated stand in the study area, and thus, would not significantly reduce the known area of occupancy for the species. Therefore, the proposal is not expected to reduce the area of occupancy of the species.

**l) fragment an existing population into two or more populations;**

The existing population recorded under the powerlines, or any existing populations that may be present in the study area and project site, are unlikely to be fragmented by the proposal. Processes such as pollination (the species is pollinated by insects and is also self-compatible) would not be compromised given that access roads would be only 12 m wide. Poles to be placed within the habitat where *Swainsona recta* was recorded will be aligned to ensure no impacts, thereby avoiding the loss of all recorded individuals of this species. The poles would not fragment the existing population. As such, the proposal is not expected to fragment any existing population into two or more populations.

**m) adversely affect habitat critical to the survival of a species;**

**Note: Habitat critical to the survival of a species refers to areas that are necessary:**

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

The proposal will impact potential habitat of *Swainsona recta*, however, no known individuals will be impacted. 69.68 ha of potential habitat for the species will be permanently removed and 31.16 ha temporarily removed and it is possible that *Swainsona recta* not identified in the survey, occur in this area. However, it is not known whether the habitat represents critical habitat for the species.

Despite this, the proposal would not adversely affect habitat. The habitat that will be removed represents 25.49 % of habitat in the study area and 6.37 % of habitat in the project site. This amount is considered to be minimal, and the proposal would leave ample habitat for the species and for the long-term maintenance of the species. The proposal would not impact on the likely pollinators of the species, and with access roads only 6 m wide, would not prevent pollinators from accessing any individuals of *Swainsona recta* present.

The habitat proposed to be removed does not constitute habitat identified in a recovery plan for the species, habitat critical for that species, or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act.

**n) disrupt the breeding cycle of a population;**

No recorded individuals of *Swainsona recta* will be impacted given that poles will be aligned to avoid any losses of individuals and the current access track will not be widened. Mitigation measures such as fencing around the individuals (incorporating a 5 m buffer from the outer most plants when erecting the fencing), the implementation of sediment and erosion control measures, and ongoing weed management will be conducted to protect the habitat in the area where individuals were recorded.

The action will remove only 100.84 ha of potential habitat for the species (69.68 ha permanently removed and 31.16 ha temporarily removed), representing 25.49 % of potential habitat in the study area and 6.37% of potential habitat in the project site. This amount is considered to be minimal with respected the amount present within the project site. The proposal would leave ample potential habitat for individuals of the species to complete their life cycles

Given that no individuals of the species would be impacted, mitigation measures will be implemented, and processes such as pollination will not be impacted (the species is pollinated by insects, and is also self pollinating, and these insects and their movements would not be impacted by the proposal.), it is unlikely that the proposal would disrupt the life / breeding cycle of the population.

**o) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;**

The action will permanently remove 69.68 ha and temporarily remove 31.16 ha of potential habitat for *Swainsona recta*. It will also remove small amounts of known habitat for the erection of poles supporting an overhead powerline where individuals of *Swainsona recta* were recorded. However, the removal of potential and known habitat will occur in linear fingers within clusters rather than one consolidated stand and in small discrete sections. Only a small amount of potential habitat would be impacted (25.49 % of the potential habitat in the study area). The removal of a relatively small amount of potential habitat within the study area is unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline. It is also unlikely to isolate or modify potential habitat for the species (eg. through changed disturbance regimes) to the extent that the species is likely to decline. Potential impacts from the proposal on potential habitat e.g. soil movement or weed spread will be managed.

- 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;

**Note: An invasive species is an introduced species, including an introduced (translocated) native species, which out-competes native species for space and resources or which is a predator of native species. Introducing an invasive species into an area may result in that species becoming established. An invasive species may harm listed threatened species or ecological communities by direct competition, modification of habitat or predation.**

Some of the threats to *Swainsona recta* include weed invasion, and competition with native grass species and *Callitris endlicheri* (Black Cypress Pine) (OEH 2011b). The proposal is unlikely to result in invasive weed species; however, control measures to avoid the spread of weeds will be implemented from pre-construction works, throughout construction and operation until decommissioning, thereby reducing potential impacts of the proposal to potential habitat for this species. It is also unlikely to increase the density of native grass species or *Callitris endlicheri*. While grazing will be removed during construction, it will be resumed following the construction phase.

- q) introduce disease that may cause the species to decline, or

No diseases are known to threaten *Swainsona recta*. The action is not expected to introduce any disease to the study area.

- r) interfere with the recovery of the species.

No individuals of *Swainsona recta*, recorded during field survey, will be impacted, and mitigation measures will be implemented to protect the species' habitat. Thus, the proposal is unlikely to interfere with the recovery of the species. In addition, ample potential habitat would remain available for the species. The action would only remove 25.49 % of the potential habitat mapped within the study area for the species. The proposal will not increase the occurrence of weeds, increase the intensity of grazing in the study area, or alter the current fire regime which would interfere with the recovery of *Swainsona recta*.

***Thesium australe* (Austral Toadflax)**

*Thesium australe* is listed as a vulnerable species under the EPBC Act. A description for the species is provided in Part 3A assessment for the species in Appendix H.

**An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:**

- a) **lead to a long-term decrease in the size of an important population of a species;**

**Note: An 'important population' 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;**

While there is potential for the species to occur in the study area and project site, *Thesium australe* was not recorded during the field surveys. There are no records for the species in the locality; the species was predicted to occur by the Protected Matters search tool (DSEWPAC 2011a), which includes a large area of predicted occurrence. Given that no individuals of *Thesium australe* were recorded in the study area or locality, it is unlikely that an important population occurs at the study area. Thus, the action is not expected to lead to a long-term decrease in the size of an important population of the species.

- b) **reduce the area of occupancy of an important population;**

As detailed in part a), no individuals of *Thesium australe* were recorded during the field surveys, and it is unlikely that an important population occurs at the study area. As such, the proposal will not reduce the area of occupancy of an important population.

- c) **fragment an existing important population into two or more populations;**

As detailed in part a), no individuals of *Thesium australe* were recorded during the field surveys, and it is unlikely that an important population occurs at the study area. As such, the proposal will not fragment an existing important population into two or more populations.

- d) **adversely affect habitat critical to the survival of a species;**

**Note: Habitat critical to the survival of a species refers to areas that are necessary:**

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

Given that no individuals of *Thesium australe* were detected within the study area or project site during the field surveys, the study area is unlikely to represent habitat critical to the survival of the species, and thus, the proposal is unlikely to adversely affect habitat critical to the survival of the species. It is possible that field surveys did not detect the species; however, the action will remove only 103.08 ha of potential habitat for the species (71.52 ha permanently removed and 31.56 ha temporarily removed),

representing 6.73 % of potential habitat in the study area and 2.63 % of potential habitat in the project site. This amount is considered to be minimal, and the proposal would leave ample potential habitat for the species and for the long-term maintenance of the species.

The potential habitat proposed to be removed does not constitute habitat identified in a recovery plan for the species, habitat critical for that species, or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act.

**e) disrupt the breeding cycle of an important population;**

As detailed in part a), no individuals of *Thesium australe* were recorded during the field surveys, and it is unlikely that an important population occurs at the study area. As such, the proposal will not disrupt the breeding / life cycle of an important population.

**f) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The action will permanently remove 71.52 ha and temporarily remove 31.56 ha of potential habitat for *Thesium australe*. However, removal of potential habitat will occur in linear fingers within clusters rather than one consolidated stand. No individuals of *Thesium australe* were recorded within the study area and only a small amount of potential habitat would be impacted (6.73 % of the potential habitat in the study area). The removal of a relatively small amount of potential habitat within the study area is unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline. It is also unlikely to isolate or modify potential habitat for the species (eg. through intensified grazing, listed as a threat to the species; OEH 2011b) to the extent that the species is likely to decline. Grazing pressure and management varies across the landscape, and the proposal is unlikely to exacerbate over-grazing at the site. It may, in fact, contribute to a more sustainable grazing regime through the mitigation and offset measures proposed in some parts of the site. Potential impacts from the proposal on potential habitat e.g. soil movement or weed spread will be managed.

**g) result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

**Note: An invasive species is an introduced species, including an introduced (translocated) native species, which out-competes native species for space and resources or which is a predator of native species. Introducing an invasive species into an area may result in that species becoming established. An invasive species may harm listed threatened species or ecological communities by direct competition, modification of habitat or predation.**

One of the key threats to *Thesium australe* is loss or degradation of habitat by weed invasion (OEH 2011b). The proposal is unlikely to result in invasive weed species; however, control measures to avoid the spread of weeds will be implemented from pre-construction works, throughout construction and operation until decommissioning, thereby reducing potential impacts of the proposal to potential habitat for this species. These are detailed in **Table 17**.

**h) introduce disease that may cause the species to decline, or**

No diseases are known that threaten *Thesium australe*. The action is not expected to introduce any disease to the study area.

**i) interfere substantially with the recovery of the species.**

No individuals of *Thesium australe* were detected within the study area or project site during the field surveys which may be impacted by the proposal. Thus, the proposal is unlikely to interfere with the recovery of the species. However, should a population of the species be present, ample potential habitat would remain available for the species. The action would only remove 6.73 % of the potential habitat mapped within the study area for the species. The proposal would not increase the occurrence of weeds or increase the intensity of grazing in the study area which would interfere with the recovery of *Thesium australe*.

## THREATENED FAUNA

### *Anthochaera phrygia* (Regent Honeyeater)

Regent Honeyeater is listed as an endangered and migratory species under the EPBC Act, and is included in the Japan-Australia Migratory Bird Agreement (JAMBA). A description for the species is provided in Part 3A assessment for the species in Appendix H.

**An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:**

- a) **lead to a long-term decrease in the size of a population;**

**Note: A “population of a species” is defined under the EPBC Act as an occurrence of the species in a particular area. Occurrences include but are not limited to:**

- **A geographically distinct regional population, or collection of local populations; or**
- **A population, or collection of local populations, that occurs within a particular bioregion.**

The proposal has the potential to impact on the Regent Honeyeater through the removal of potential habitat used by the species and through accidental strike of individuals with the turbines during operation of the wind farm. However, impacts from the proposal are unlikely to lead to a long-term decrease in the size of a Regent Honeyeater population as the wind farm is not situated at key breeding sites.

The impact on this species is difficult to predict in the absence past studies, However, Honeyeaters are thought to fly at or just above canopy height whilst foraging and move from ridge to ridge at a height between 5 m and 50 m above the canopy (pers comm. David Geering, OEH). Therefore, there is a risk that these species may also be struck by wind turbines when moving between foraging areas, particularly in areas where White Box are present and when there is an abundant flowering event.

The likelihood that honeyeaters would actively avoid the wind farm is also unknown. In the absence of sufficient studies or information, the likelihood of the Regent Honeyeater being struck cannot be accurately predicted.

The proposal will remove only a small amount of potential foraging and breeding habitat for the species (4.96 % and 1.14 % in the study area and project site, respectively), with tree clearance avoided where possible. However, these resources will remain in the study area and could be used by the species. The study area lies approximately 40 km to the west of the Capertee Valley (one of the main breeding areas for the species), and approximately 55 km to the south west of the Mudgee – Wollar region (a less used breeding area), which are preferred breeding areas for this species. Thus, large concentrations of a breeding population of the species are unlikely to be present in the study area or project site which could be impacted by the proposal, leading to any long-term decreases in the size of a Regent Honeyeater population.

Individuals may be killed or injured through strikes with turbines. Honeyeaters are thought to fly at or just above canopy height whilst foraging and move from ridge to ridge at a height between 5 m and 50 m above the canopy (pers comm. David Geering, OEH). Therefore, there is a risk that these species may also be struck by wind turbines when moving between foraging areas, particularly in areas where

White Box are present and when there is an abundant flowering event.

The likelihood that honeyeaters would actively avoid the wind farm is also unknown. In the absence of sufficient studies or information, the likelihood of the Regent Honeyeater being struck cannot be accurately predicted. A commitment to monitoring strike across CRWF has been made. This will include the preparation of a bird and bat monitoring program prior to operation of the wind farm that, in consultation with OEH and SEWPAC, will identify the frequency of monitoring and reporting, the thresholds at which impacts are considered unacceptable and the adaptive management approaches which are acceptable.

**b) reduce the area of occupancy of the species;**

The Regent Honeyeater is likely to currently occupy the study area and project site given previous records of the species in the locality, the proximity to known breeding sites, and the presence of potential foraging habitat in the study area and project site. Under the proposal, potential habitat for Regent Honeyeater will be removed (11.19 ha permanently and 3.15 ha temporarily removed). However, only a small proportion will be removed, and vegetation removal will occur in linear fingers within clusters rather than one consolidated stand in the study area. The Regent Honeyeater is a highly mobile species and will be able to access the large areas of remaining resources in the study area and project site. Thus, the removal of a small amount of habitat is unlikely to reduce the area of occupancy for the species. Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of individuals.

**c) fragment an existing population into two or more populations;**

It is unlikely that the proposal would fragment an existing Regent Honeyeater population into two or more populations from construction activities given the narrow linear nature of the proposal, sited on mostly cleared areas, and the highly mobile nature of the Regent Honeyeater, which can move large distances in the 100s of km (the species is capable of dispersing more than 530 km; Scientific Committee Final Determinations 2011).

During the operational phase of the wind farm, there is a risk that Regent Honeyeaters will accidentally collide with the moving turbines. Honeyeaters are thought to fly at or just above canopy height whilst foraging and move from ridge to ridge at a height between 5 m and 50 m above the canopy (pers comm. David Geering, OEH). Therefore, there is a risk that these species may also be struck by wind turbines when moving between foraging areas, particularly in areas where White Box are present and when there is an abundant flowering event.

The likelihood that honeyeaters would actively avoid the wind farm is also unknown. In the absence of sufficient studies or information, the likelihood of the Regent Honeyeater being struck cannot be accurately predicted. A commitment to monitoring strike across CRWF has been made. This will include the preparation of a bird and bat monitoring program prior to operation of the wind farm that, in consultation with OEH and SEWPAC, will identify the frequency of monitoring and reporting, the thresholds at which impacts are considered unacceptable and the adaptive management approaches which are acceptable.

**d) adversely affect habitat critical to the survival of a species;**

**Note: Habitat critical to the survival of a species refers to areas that are necessary:**

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

The action will remove potential habitat for Regent Honeyeater. However, this potential habitat is unlikely to constitute habitat critical to the survival of a species, as it represents habitat likely to be used only periodically. Known breeding locations are necessary for maintaining sustainable populations. It is unlikely that the proposed vegetation clearance would impact on this species such that resources would become limited within the study area (i.e. the proposal is unlikely to substantially reduce the amount of potential habitat for this species present within the project site). The action will remove only 14.33 ha of potential habitat for the species (11.19 ha permanently removed and 3.15 ha temporarily removed), representing 4.96 % of potential habitat in the study area and 1.14 % of potential habitat in the project site. This amount is considered to be minimal, and the proposal would leave ample potential habitat for the long-term maintenance of the species.

The potential habitat proposed to be removed does not constitute habitat identified in a recovery plan for the species, habitat critical for that species, or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act.

**e) disrupt the breeding cycle of a population;**

It is unlikely that any preferred breeding habitat will be impacted by the proposal, as although the species is known to breed in surrounding fragmented woodlands and may breed in mistletoe, the main breeding areas and the study lies approximately 40 km to the west of the Capertee Valley (one of the main breeding areas for the species), and approximately 55 km to the south west of the Mudgee – Wollar region (a less used breeding area). The study area does not support large amounts of Box-Gum Woodland or riparian gallery forest preferred by the species for breeding. Only a small amount of potential habitat will be impacted, with the majority of potential resources retained in the study area and project site. As such, the breeding cycle of a population is unlikely to be impacted.

**f) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;**

The action will permanently remove 11.19 ha and temporarily remove 3.15 ha of potential habitat for Regent Honeyeater. However, removal of potential habitat will occur in linear fingers within clusters rather than one consolidated stand. Only a small amount of potential habitat would be impacted (4.96 % of the potential habitat in the study area). The removal of a relatively small amount of potential habitat within the study area is unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline.

The proposal is also unlikely to isolate or modify potential habitat for the species (eg. through changed disturbance regimes) to the extent that the species is likely to decline. Potential impacts from the proposal on potential foraging habitat e.g. soil movement or weed spread will be managed.

During the operational phase of the wind farm, there is a risk that Regent Honeyeaters will accidentally collide with the moving turbines. Honeyeaters are thought to fly at or just above canopy height whilst

foraging and move from ridge to ridge at a height between 5 m and 50 m above the canopy (pers comm. David Geering, OEH). Therefore, there is a risk that these species may also be struck by wind turbines when moving between foraging areas, particularly in areas where White Box are present and when there is an abundant flowering event.

The likelihood that honeyeaters would actively avoid the wind farm is also unknown. In the absence of sufficient studies or information, the likelihood of the Regent Honeyeater being struck cannot be accurately predicted. A commitment to monitoring strike across CRWF has been made. This will include the preparation of a bird and bat monitoring program prior to operation of the wind farm that, in consultation with OEH and SEWPAC, will identify the frequency of monitoring and reporting, the thresholds at which impacts are considered unacceptable and the adaptive management approaches which are acceptable.

**result in invasive species that are harmful to a endangered species becoming established in the endangered species' habitat;**

**Note: An invasive species is an introduced species, including an introduced (translocated) native species, which out-competes native species for space and resources or which is a predator of native species. Introducing an invasive species into an area may result in that species becoming established. An invasive species may harm listed threatened species or ecological communities by direct competition, modification of habitat or predation.**

Feral animals can have a detrimental impact on Regent Honeyeater through grazing which prevent native vegetation from regenerating. The proposal is unlikely to contribute to increasing feral animal activity across the project site and instead may assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites.

**g) introduce disease that may cause the species to decline, or**

No diseases are known to threaten Regent Honeyeater. The action is not expected to introduce any disease to the study area.

**h) interfere substantially with the recovery of the species.**

Given the proposal will not impact on core breeding habitat of the Regent Honeyeater, the proposal is unlikely to interfere with the recovery of the species. Ample potential habitat will remain available for the species, despite the removal of 14.33 ha of the potential foraging habitat mapped within the study area for the species. The proposal will not increase the intensity of grazing in the study area, or increase the activities of feral animals which would interfere with the recovery of the Regent Honeyeater.

***Dasyurus maculatus maculatus* (SE mainland population) (Spotted-tailed Quoll)**

The Spotted-tailed Quoll is listed as an endangered species under the EPBC Act. A description for the species is provided in Part 3A assessment for the species in Appendix H.

**An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:**

**a) lead to a long-term decrease in the size of a population;**

**Note: A “population of a species” is defined under the EPBC Act as an occurrence of the species in a particular area. Occurrences include but are not limited to:**

- **A geographically distinct regional population, or collection of local populations; or**
- **A population, or collection of local populations, that occurs within a particular bioregion.**

The proposal has the potential to impact on the Spotted-tailed Quoll through the removal of potential foraging and breeding habitat used by the species.

However, the degree to which the species will be impacted is not considered significant, and the proposal is unlikely to lead to a long-term decrease in the size of a Spotted-tailed Quoll population. This is because the proposal will remove only a small amount of potential foraging and breeding habitat for the species (4.33 % and 0.86 % in the study area and project site, respectively), with tree clearance, including hollow-bearing trees, avoided where possible by siting turbines in previously cleared areas. Vegetation removal will occur in linear fingers within clusters rather than one consolidated stand. Habitat elements such as logs will be retained and installed as fauna habitat following construction. The majority of foraging and breeding resources will remain in the study area, and the main habitat corridor through the project site along the eastern slopes of Crudine Ridge will be largely retained.

The proposal would be unlikely to impact on the species during the operation of the wind farm and thus will be unlikely to lead to a long-term decrease in the size of a Spotted-tailed Quoll population.

**b) reduce the area of occupancy of the species;**

The range of the Spotted-tailed Quoll has contracted considerably since European settlement. It is now found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Queensland (OEH 2011b). In NSW, the species occurs on both sides of the Great Dividing Range, although it is more common on the eastern side, with the northern section representing a stronghold for the species.

The species is not at the limit of its distribution at Crudine Ridge, with records for the species occurring further west of the site and the predicted distribution extending to Bourke (NPWS 1999). However, records on the western side of the range are scattered. The species is likely to be close to the limit of its range at the study area.

The Spotted-tailed Quoll has the potential to currently occupy the study area and project site given previous records of the species in the locality, and the presence of potential foraging and breeding habitat in the study area and project site. Under the proposal, potential foraging and breeding habitat for the Spotted-tailed Quoll will be removed (7.98 ha permanently and 1.65 ha temporarily removed). However, only a small proportion will be removed, and vegetation removal will occur in linear fingers

within clusters rather than one consolidated stand in the study area. The Spotted-tailed Quoll is a highly mobile species and will be able to access foraging and breeding resources in the study area and project site. Thus, the removal of potential foraging and breeding habitat is not considered likely to significantly reduce the area of occupancy for the species. Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals.

**c) fragment an existing population into two or more populations;**

It is unlikely that the proposal would fragment an existing Spotted-tailed Quoll population into two or more populations from construction activities given the narrow linear nature of the proposal, sited on mostly cleared areas, and the highly mobile nature of the Spotted-tailed Quoll, which can move several kilometres in one night (NPWS 1999). The species would be able to cross access tracks constructed in the study area.

**d) adversely affect habitat critical to the survival of a species;**

**Note: Habitat critical to the survival of a species refers to areas that are necessary:**

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

The action will remove a small amount of potential foraging and breeding habitat for the Spotted-tailed Quoll. However, this potential foraging and breeding habitat does not constitute habitat critical to the survival of the species. The Spotted-tailed Quoll forages over a wide area of up to 750 ha for females and 3,500 ha for males (OEH 2011b). The proposal would leave ample potential habitat (foraging, breeding, movement habitat) for the long-term genetic maintenance of the species, with the main habitat corridor through the project site along the eastern slopes of Crudine Ridge largely retained. Further, preferred habitat for the species includes large, forested areas with hollow logs and rocky outcrops, particularly areas with thick understorey or dense vegetation along drainage lines. The habitat at Crudine Ridge is considered to be marginal for the species given the drainage lines are largely cleared of vegetation and the understorey is relatively sparse.

The potential habitat proposed to be removed does not constitute habitat identified in a recovery plan for the species, habitat critical for that species, or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act.

**e) disrupt the breeding cycle of a population;**

Spotted-tailed Quolls breed from April to July each year, with dens in hollow logs, tree hollows, rock outcrops or caves. The low-lying rock outcrops within the study area do not provide suitable habitat for dens, and there are no caves present within the study area. The only suitable habitat for Spotted-tailed Quoll dens within the study area are in fallen hollow logs or tree hollows.

Given the marginal nature of the potential habitat within the study area, it is unlikely that the study area would be preferred breeding habitat for the Spotted-tailed Quoll. However, hollow-bearing trees will be retained where possible, and logs will be or relocated to continue to function as fauna habitat following construction. Any disturbance to hollow-bearing trees or logs will require a pre-clearance survey to be undertaken in accordance with a tree clearing protocol. An ecologist will be present on site during

clearing to capture and re-release fauna (where appropriate). The project is not expected to disrupt the breeding cycle of any population.

**f) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;**

The action will permanently remove 7.98 ha and temporarily remove 1.65 ha of potential marginal foraging and breeding habitat for the Spotted-tailed Quoll. However, removal of potential marginal foraging and breeding habitat will occur in linear fingers within clusters rather than one consolidated stand, with tree clearance occurring in previously cleared areas, and hollow-bearing trees retained where possible. Only a small amount of potential foraging and breeding habitat would be impacted (4.33 % of the potential habitat in the study area). The removal of a relatively small amount of potential habitat within the study area is unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline. It is also unlikely to isolate or modify potential habitat for the species (eg. through changed disturbance regimes) to the extent that the species is likely to decline. Potential impacts from the proposal on potential foraging habitat e.g. soil movement or weed spread will be managed. Habitat elements such as logs will be relocated to continue to function as fauna habitat following construction works.

**g) result in invasive species that are harmful to a endangered species becoming established in the endangered species' habitat;**

**Note: An invasive species is an introduced species, including an introduced (translocated) native species, which out-competes native species for space and resources or which is a predator of native species. Introducing an invasive species into an area may result in that species becoming established. An invasive species may harm listed threatened species or ecological communities by direct competition, modification of habitat or predation.**

Feral animals such as feral cats and the European Red Fox can have a detrimental impact on Spotted-tailed Quoll through competition for resources. However, the proposal is unlikely to contribute to increasing feral animal activity across the project site and instead may assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites. Mitigation measures should consider the accidental poisoning of Spotted-tailed Quoll when planning baiting programs. It is best to avoid placement of baits within the best areas of Quoll habitat within the project site.

**h) introduce disease that may cause the species to decline, or**

Epidemic diseases, such as parasitic protozoans, are known to be passed from Cats to the Quolls (NPWS 1999). The action is not expected to increase cat numbers within the study area or project site, and is not expected to introduce any disease to the study area.

**i) interfere substantially with the recovery of the species.**

Given that the proposal will only remove a small amount of potential foraging and breeding habitat (4.33 % of the potential habitat in the study area), with trees including hollow-bearing trees retained where possible, and the removal of potential habitat will occur in linear fingers within clusters rather than one consolidated stand, the proposal is unlikely to interfere with the recovery of the Spotted-tailed Quoll. Habitat will remain in the study area and project site for the species, which will not be isolated from other areas of habitat for this highly mobile species. Potential impacts from the proposal on potential foraging habitat e.g. soil movement or weed spread will be managed. Habitat elements such as logs will be

relocated to continue to function as fauna habitat following construction works. The proposal will not increase the activities of feral animals which would interfere with the recovery of the Spotted-tailed Quoll.

***Lathamus discolor* (Swift Parrot)**

Swift Parrot is listed as an endangered species under the EPBC Act, as well as a marine species due to its migratory path over Bass Strait. A description for the species is provided in Part 3A assessment for the species in Appendix H.

**An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:**

**a) lead to a long-term decrease in the size of a population;**

**Note: A “population of a species” is defined under the EPBC Act as an occurrence of the species in a particular area. Occurrences include but are not limited to:**

- **A geographically distinct regional population, or collection of local populations; or**
- **A population, or collection of local populations, that occurs within a particular bioregion.**

The proposal has the potential to impact on the Swift Parrot through the removal of potential habitat used by the species and through accidental strike of individuals with the turbines during operation of the wind farm.

However, the degree to which the species will be impacted is not considered significant, and the proposal is unlikely to lead to a long-term decrease in the size of a Swift Parrot population. This is because the proposal will remove only a small amount of potential foraging habitat for the species (4.96 % and 1.14 % in the study area and project site, respectively), with tree clearance avoided where possible. Foraging resources will remain in the study area which could be used by the species. No breeding habitat will be impacted as the Swift Parrot breeds in Tasmania.

Individuals may be killed or injured through strikes with turbines during the operation of the wind farm. However, bird strike will be monitored during the operation of the wind farm and an adaptive management approach implemented whereby additional measures are investigated should significant bird strike at certain turbines be recorded to prevent any long-term decreases in the size of a Swift Parrot population. In addition, a study of the cumulative impacts of collision with turbines on the overall population of Swift Parrot, predicted by the modelling for all current and presently proposed wind farms within the species' range, are very small. Results for the range of avoidance rates modelled equate to slightly more or less than one parrot killed due to wind turbine collisions every ten years (Smales 2005). Swift Parrots are likely to be able to detect wind turbines, unlike wire fencing which they often collide with, as they are solid, opaque structures.

**b) reduce the area of occupancy of the species;**

In NSW, the Swift Parrot mostly occurs on the coast and south west slopes, but its range extends from Victoria and the eastern parts of South Australia to south-east Queensland (OEH 2011b). The Swift Parrot is likely to currently occupy the study area and project site given previous records of the species in the locality, and the presence of potential foraging habitat in the study area and project site. Under the proposal, potential foraging habitat for Swift Parrot will be removed (11.19 ha permanently and 3.15 ha temporarily removed). However, only a small proportion will be removed, and vegetation removal will occur in linear fingers within clusters rather than one consolidated stand in the study area. The Swift Parrot is a highly mobile species and will be able to access foraging resources in the study area and

project site. Thus, the removal of potential foraging habitat is not considered likely to significantly reduce the area of occupancy for the species. Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals.

**c) fragment an existing population into two or more populations;**

It is unlikely that the proposal would fragment an existing Swift Parrot population into two or more populations from construction activities given the narrow linear nature of the proposal, sited on mostly cleared areas, and the highly mobile nature of the Swift Parrot, which can move large distances in the 100s of km.

During the operational phase of the wind farm, there is a risk that Swift Parrots will accidentally collide with the moving turbines. However, bird strike will be monitored during the operation of the wind farm and an adaptive management approach implemented whereby additional measures are investigated should significant bird strike at certain turbines be recorded, preventing a Swift Parrot population being fragmented into two or more populations.

**d) adversely affect habitat critical to the survival of a species;**

**Note: Habitat critical to the survival of a species refers to areas that are necessary:**

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

The action will remove potential habitat for the Swift Parrot. However, this potential habitat does not constitute habitat critical to the survival of a species, as it represents habitat used only periodically for foraging, and does not represent breeding habitat for the species (breeding habitat is necessary for maintaining sustainable populations and the genetic diversity of the species). Regarding potential foraging habitat to be removed, it is unlikely that the proposed vegetation clearance would impact on this species such that foraging resources would become limited within the study area i.e. the proposal is unlikely to substantially reduce the amount of potential foraging habitat for this species present within the project site. Swift Parrots are also transitory and move to areas supporting foraging resources. The action will remove only 14.33 ha of potential habitat for the species (11.19 ha permanently removed and 3.15 ha temporarily removed), representing 4.96 % of potential habitat in the study area and 1.14 % of potential habitat in the project site. This amount is considered to be minimal, and the proposal would leave ample potential habitat for the long-term maintenance of the species.

The potential habitat proposed to be removed does not constitute habitat identified in a recovery plan for the species, habitat critical for that species, or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act.

**e) disrupt the breeding cycle of a population;**

No Swift Parrot breeding habitat will be impacted by the proposal, as Swift Parrots breed between September and January each year in Tasmania, utilising tree hollows in *Eucalyptus globulus* (Tasmanian Blue Gum). Only a small amount of potential foraging habitat will be impacted, with the majority of potential foraging resources retained in the study area and project site. As such, the breeding cycle of a population is unlikely to be impacted.

**f) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;**

The action will permanently remove 11.19 ha and temporarily remove 3.15 ha of potential foraging habitat for the Swift Parrot. However, removal of potential foraging habitat will occur in linear fingers within clusters rather than one consolidated stand. Only a small amount of potential foraging habitat would be impacted (4.96 % of the potential habitat in the study area). The removal of a relatively small amount of potential habitat within the study area is unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline.

The proposal is also unlikely to isolate or modify potential habitat for the species (eg. through changed disturbance regimes) to the extent that the species is likely to decline. Potential impacts from the proposal on potential foraging habitat e.g. soil movement or weed spread will be managed.

During the operational phase of the wind farm, there is a risk that the Swift Parrot will accidentally collide with the moving turbines, and thus, the proposal could isolate or modify habitat, or decrease the quality of habitat to the extent that the species could decline. However, the incidence of collisions with turbines has been modelled for Swift Parrot (Smales 2005). Results for the range of avoidance rates modelled equated to slightly more or less than one parrot killed due to wind turbine collisions every 10 years. Swift Parrots are likely to be able to detect wind turbines, unlike wire fencing which they often collide with, as they are solid, opaque structures.

**g) result in invasive species that are harmful to a endangered species becoming established in the endangered species' habitat;**

**Note: An invasive species is an introduced species, including an introduced (translocated) native species, which out-competes native species for space and resources or which is a predator of native species. Introducing an invasive species into an area may result in that species becoming established. An invasive species may harm listed threatened species or ecological communities by direct competition, modification of habitat or predation.**

Grazing by feral animals may prevent the recruitment of eucalyptus species used by Swift Parrots while on the mainland. The proposal is unlikely to contribute to any increasing feral animal activity across the project site and instead may assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites.

**h) introduce disease that may cause the species to decline, or**

No diseases are known to threaten Swift Parrot. The action is not expected to introduce any disease to the study area.

**i) interfere substantially with the recovery of the species.**

Given the proposal will not impact on the breeding habitat of the Swift Parrot, the proposal is unlikely to interfere with the recovery of the species. Ample potential foraging habitat will remain available for the species, despite the permanent removal of 11.19 ha of the potential foraging habitat mapped within the study area for the species. The proposal will not increase the intensity of grazing in the study area which would interfere with the recovery of the Swift Parrot.

***Chalinolobus dwyeri* (Large-eared Pied Bat)**

Large-eared Pied Bat is listed as a vulnerable species under the EPBC Act. A description for the species is provided in Part 3A assessment for the species in Appendix H.

**An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:**

- a) **lead to a long-term decrease in the size of an important population of a species;**

**Note: An 'important population' 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;**

The Large-eared Pied Bat was detected with a high level of certainty in anabat analyses (a probable detection, where detections have a low probability of confusion with species of similar calls) from a single call recorded during field survey. The species was recorded in the project site, just outside of the study area, in the Sallys Flat Cluster within RSSGRBLLB. The species is also known in nearby conservation reserves in the Mid-Western Regional and Bathurst Regional LGAs: Munghorn Gap Nature Reserve, Goulburn River National Park, and Wollemi National Park, and crown land near Ulan (DSEWPAC 2011b).

It is possible that the population in the area represents an important population of the species based on the species being close to the limit of its range at Crudine Ridge. The species has not been recorded too much further to the west of the Central West CMA (OEH 2011b). It would not represent an important population based on it being a key source population for breeding or dispersal; the largest concentration of populations for breeding appears to be in the sandstone escarpments of the Sydney basin and northwest slopes of NSW (DSEWPAC 2011b).

However, should an important population be present at Crudine Ridge, the proposal is unlikely to lead to a long-term decrease in the size of an important population. This is because during construction of the turbines and associated infrastructure, the proposal will avoid tree clearance wherever possible and will remove only a small amount of foraging habitat relative to the amount of foraging habitat in the study area (4.96 % of habitat in the study area (288.65 ha) and 1.14 % of the project site (1261.66 ha) will be removed). Vegetation clearance will be linear in nature and, therefore, will not result in large consolidated patches of vegetation clearance (the removal of any areas of potential habitat may result in the reduction of a territorial range but is unlikely to affect the entire territory). The proposal will not significantly fragment the habitat of the species, which is highly mobile. Further, the proposal is unlikely to impact Large-eared Pied Bat during the operation of the wind farm. Large-eared Pied Bat probably forages for small, flying insects below the forest canopy (OEH 2011b). Churchill (2008) has also observed the species flying at the mid-canopy level approximately 6-10 m above the ground. These foraging heights would be unlikely to bring the Large-eared Pied Bat in proximity to the turbines which could result in accidental strike and possible mortality through barotrauma.

- b) **reduce the area of occupancy of an important population;**

As outlined above, it is possible that a Large-eared Pied Bat population in the area represents an important population of the species based on the species being close to the limit of its range at Crudine

Ridge. However, the proposal is unlikely to reduce the area of occupancy of Large-eared Pied Bat. Under the proposal, foraging habitat for the species will be removed (7.98 ha permanently and 1.65 ha temporarily removed). This represents a small proportion relative to what will be retained in the study area and project site (4.33 % in the study area and 0.86 % in the project site), and vegetation removal will occur in linear fingers within clusters rather than one consolidated stand in the study area. The Large-eared Pied Bat is a mobile species and will be able to access remaining foraging resources in the study area and project site. Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals.

**c) fragment an existing important population into two or more populations;**

As outlined above, it is possible that a Large-eared Pied Bat population in the area represents an important population of the species based on the species being close to the limit of its range at Crudine Ridge. However, the proposal is unlikely to fragment an existing important population into two or more populations. This is because construction activities will result in the removal of foraging habitat in linear fingers within clusters rather than one consolidated stand in the study area. The Large-eared Pied Bat is a mobile species and will be able to access remaining foraging resources in the study area and project site following works.

During the operational phase of the wind farm, there is a risk that Large-eared Pied Bats will accidentally collide with the moving turbines or be affected by barotrauma. However, the foraging heights of Large-eared Pied Bats are low to the ground and below the canopy, which make them unlikely to come into contact with turbines. Bat strike will also be monitored during the operation of the wind farm and an adaptive management approach implemented whereby additional measures are investigated should significant bat strike at certain turbines be recorded, preventing a Large-eared Pied Bat population being fragmented into two or more populations.

**d) adversely affect habitat critical to the survival of a species;**

**Note: Habitat critical to the survival of a species refers to areas that are necessary:**

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

The action will remove habitat for the Large-eared Pied Bat. However, this habitat does not constitute habitat critical to the survival of a species, as it represents habitat used only periodically for foraging, and does not represent breeding habitat for the species (breeding habitat is necessary for maintaining sustainable populations and the genetic diversity of the species). Some potential roosting habitat, the disused mud nests of Fairy Martins and possibly hollow-bearing trees, may be impacted, but the species roosts and breeds primarily in caves, crevices in cliffs, and old mine workings (DSEWPAC 2011b), and hollow-bearing trees will remain in the study area and project site.

Regarding foraging habitat to be removed, it is unlikely that the proposed vegetation clearance would impact on this species such that foraging resources would become limited within the study area i.e. the proposal is unlikely to substantially reduce the amount of foraging habitat for this species present within the project site. The action will remove only 9.63 ha of foraging habitat for the species (7.98 ha permanently removed and 1.65 ha temporarily removed), representing 4.33 % of foraging habitat in the

study area and 0.86 % of foraging habitat in the project site. This amount is considered to be minimal, and the proposal would leave ample foraging habitat for the long-term maintenance of the species.

The habitat proposed to be removed does not constitute habitat identified in a recovery plan for the species, habitat critical for that species, or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act.

**e) disrupt the breeding cycle of an important population;**

As outlined in part a), it is possible that a Large-eared Pied Bat population in the area represents an important population of the species based on the species being close to the limit of its range at Crudine Ridge. However, no Large-eared Pied Bat breeding habitat will be impacted by the proposal, as Large-eared Pied Bat breed primarily in caves, crevices in cliffs, and disused mines (DSEWPAC 2011b). Only a small amount of foraging habitat will be impacted, with the majority of foraging resources retained in the study area and project site. As such, the breeding cycle of any important population is unlikely to be impacted.

**f) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;**

The action will permanently remove 7.98 ha and temporarily remove 1.65 ha of foraging habitat for the Large-eared Pied Bat. However, removal of foraging habitat will occur in linear fingers within clusters rather than one consolidated stand. Only a small amount of foraging habitat would be impacted (4.33 % and 0.86 % of the habitat in the study area and project site, respectively). The removal of a relatively small amount of habitat within the study area is unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline.

The proposal is also unlikely to isolate or modify habitat for the species (eg. through changed disturbance regimes) to the extent that the species is likely to decline. Potential impacts from the proposal on foraging habitat e.g. soil movement or weed spread will be managed.

During the operational phase of the wind farm, there is a risk that the Large-eared Pied Bat will accidentally collide with the moving turbines or be affected by barotrauma, and thus, the proposal could isolate or modify habitat, or decrease the quality of habitat to the extent that the species could decline. However, the Large-eared Pied Bat forages low to the ground and below the canopy which make them unlikely to come into contact with turbines.

**g) result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

**Note: An invasive species is an introduced species, including an introduced (translocated) native species, which out-competes native species for space and resources or which is a predator of native species. Introducing an invasive species into an area may result in that species becoming established. An invasive species may harm listed threatened species or ecological communities by direct competition, modification of habitat or predation.**

No invasive species that are harmful to the Large-eared Pied Bat have been identified. Introduced predators and weeds are not identified as a threat to Large-eared Pied Bat in the Action Plan for Australian Bats (Duncan *et al.* 1999). Even so, the proposal is unlikely to contribute to any increased feral animal activity or weed invasion across the project site and instead may assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites.

Mitigation measures should consider the poisoning of Large-eared Pied Bat from pesticides/herbicides. It is unlikely that any pesticides used in feral animal management will impact on the species given insect control is unlikely to be required. The application of herbicides should be restricted when alternative methods are available.

**h) introduce disease that may cause the species to decline, or**

The Action Plan for Australian Bats (Duncan *et al.* 1999) does not identify any diseases that threaten Large-eared Pied Bat. The action is not expected to introduce any disease to the study area.

**i) interfere substantially with the recovery of the species.**

Given the proposal will not impact on the breeding habitat of the Large-eared Pied Bat, the proposal is unlikely to interfere with the recovery of the species. Ample foraging habitat will remain available for the species, despite the permanent removal of 7.98 ha of the foraging habitat mapped within the study area for the species. The application of herbicides will not be used where alternative methods are available.

***Nyctophilus corbeni* (Greater (eastern) Long-eared Bat)**

The Greater Long-eared Bat is listed as a vulnerable species under the EPBC Act. A description for the species is provided in Part 3A assessment for the species in Appendix H.

**An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:**

- a) **lead to a long-term decrease in the size of an important population of a species;**

**Note: An 'important population' 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;**

The Greater Long-eared Bat was not detected with certainty during field survey and there are no previous records for the Greater Long-eared Bat in the locality. However, the anabat analyses identified the calls of *Nyctophilus* species, which could belong to any of three *Nyctophilus* species (namely *N. geoffroyi*, *N. gouldi* or *N. corbeni*), whose calls are difficult to tell apart. The lack of previous records in the locality may reflect the limited survey effort undertaken prior to this survey rather than the absence of the species in the locality. Thus, the species may be present in the study area.

Should the species be present in the study area, it is possible that the population in the area represents an important population of the species based on the species being close to the limit of its range at Crudine Ridge. The species' distribution coincides approximately with the Murray Darling Basin (OEH 2011b). It would not represent an important population based on it being a key source population for breeding or dispersal; the Pilliga scrub region is a stronghold for the species, with the species more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland (OEH 2011b).

However, should an important population be present at Crudine Ridge, the proposal is unlikely to lead to a long-term decrease in the size of an important population. This is because during construction of the turbines and associated infrastructure, the proposal will avoid tree clearance wherever possible and will remove only a small amount of potential foraging and breeding habitat relative to the amount of potential foraging and breeding habitat in the study area (4.33 % of habitat in the study area (222.17 ha) and 0.86 % of the project site (1121.32 ha) will be removed). Vegetation clearance will be linear in nature and, therefore, will not result in large consolidated patches of vegetation clearance (the removal of any areas of potential habitat may result in the reduction of a territorial range but is unlikely to affect the entire territory). The proposal will not significantly reduce the area of woodland remnants remaining in the project site to a size that could not be used by the species; the Greater Long-eared Bat requires large, intact areas of habitat to persist in an area (Turbill *et al.* 2008). Further, the proposal will not significantly fragment the habitat of the species, which is highly mobile.

During the operation of the wind farm, the proposal is unlikely to impact on a population of Greater Long-eared Bat. The Greater Long-eared Bat is a slow flying agile bat, which uses the understorey to hunt non-flying prey, especially caterpillars and beetles, even hunting on the ground (OEH 2011b). The foraging height of the species would be unlikely to bring it in proximity to the turbines which could result in accidental strike and possible mortality through barotrauma. Foraging activities are also concentrated

around patches of trees in the landscape (DSEWPAC 2011b).

**b) reduce the area of occupancy of an important population;**

As outlined above, should the Greater Long-eared Bat be present in the study area, it is possible that a population in the area represents an important population of the species based on the species being close to the limit of its range at Crudine Ridge. However, the proposal is unlikely to reduce the area of occupancy of Greater Long-eared Bat. Under the proposal, potential foraging and breeding habitat for the species will be removed (7.98 ha permanently and 1.65 ha temporarily removed). This represents a small proportion relative to what will be retained in the study area and project site (4.33 % in the study area and 0.86 % in the project site), and vegetation removal will occur in linear fingers within clusters rather than one consolidated stand in the study area. The Greater Long-eared Bat is a mobile species and will be able to access remaining foraging resources in the study area and project site. Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals.

**c) fragment an existing important population into two or more populations;**

As outlined above, should the Greater Long-eared Bat be present in the study area, it is possible that a population in the area represents an important population of the species based on the species being close to the limit of its range at Crudine Ridge. However, the proposal is unlikely to fragment an existing important population into two or more populations. This is because construction activities will result in the removal of potential foraging and breeding habitat in linear fingers within clusters rather than one consolidated stand in the study area. The Greater Long-eared Bat is a mobile species and will be able to access remaining foraging resources in the study area and project site following works.

During the operational phase of the wind farm, there is a risk that Greater Long-eared Bat will accidentally collide with the moving turbines or be affected by barotrauma. However, the Greater Long-eared Bat is a slow flying agile bat, which uses the understorey to hunt non-flying prey, especially caterpillars and beetles, even hunting on the ground (OEH 2011b). The foraging height of the species would be unlikely to bring it in proximity to the turbines which could result in accidental strike and possible mortality through barotrauma. Bat strike will also be monitored during the operation of the wind farm and an adaptive management approach implemented whereby additional measures are investigated should significant bat strike at certain turbines be recorded, preventing a Greater Long-eared Bat population being fragmented into two or more populations.

**d) adversely affect habitat critical to the survival of a species;**

**Note: Habitat critical to the survival of a species refers to areas that are necessary:**

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

The action will remove potential foraging and breeding habitat for the Greater Long-eared Bat. However, this potential habitat does not constitute habitat critical to the survival of a species. The species has a broad distribution across the Murray-Darling Basin, and the stronghold for the species is the Pilliga scrub. The species is more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland (OEH 2011b).

As a worst case scenario, the project will remove 4.33 % and 0.86 % of the potential foraging and breeding habitat mapped within the study area and project site. Given the distribution and habitat preference of the Greater Long-eared Bat, and that extensive areas of habitat will remain in the study area and project site for the long-term maintenance of the species, it is unlikely that the habitat proposed for clearance would limit the availability of resources for the species at Crudine Ridge and hence habitat critical to the survival of the species.

The potential habitat proposed to be removed does not constitute habitat identified in a recovery plan for the species, habitat critical for that species, or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act.

**e) disrupt the breeding cycle of an important population;**

As outlined above, should the Greater Long-eared Bat be present in the study area, it is possible that a population in the area represents an important population of the species based on the species being close to the limit of its range at Crudine Ridge. However, the proposal is unlikely to disrupt the breeding cycle of an important population. While potential breeding habitat, hollow-bearing trees, will be removed under the proposal, trees including hollow-bearing trees will be avoided where possible. Where the removal of hollow-bearing trees is required, a pre-clearance protocol will be developed and implemented to determine if roosts are present in tree hollows of any trees proposed for clearing. An ecologist will be present during clearing to capture and re-release individuals (where appropriate). Only a small amount of potential foraging and breeding habitat will be impacted, with the majority of potential foraging and breeding / roosting resources retained in the study area and project site. As such, the breeding cycle of any important population is unlikely to be impacted.

**f) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The action will permanently remove 7.98 ha and temporarily remove 1.65 ha of potential foraging, breeding and roosting habitat for the Greater Long-eared Bat. However, removal of potential habitat will occur in linear fingers within clusters rather than one consolidated stand. Only a small amount of potential habitat would be impacted (4.33 % and 0.86 % of the habitat in the study area and project site, respectively). The removal of a relatively small amount of habitat within the study area is unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline, particularly given the broad range of the species. The proposal will not significantly reduce the area of woodland remnants remaining in the project site to a size that could not be used by the species; the Greater Long-eared Bat requires large, intact areas of habitat to persist in an area (Turbill *et al.* 2008).

The proposal is also unlikely to isolate or modify habitat for the species (eg. through changed disturbance regimes) to the extent that the species is likely to decline. Potential impacts from the proposal on potential foraging habitat e.g. soil movement or weed spread will be managed.

During the operational phase of the wind farm, there is a risk that Greater Long-eared Bats will accidentally collide with the moving turbines or be affected by barotrauma, and thus, the proposal could isolate or modify habitat, or decrease the quality of habitat to the extent that the species could decline. However, the Greater Long-eared Bat is a slow flying agile bat which mostly forages in the understorey. The foraging height of the species would be unlikely to bring it in proximity to the turbines.

**g) result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**

**Note: An invasive species is an introduced species, including an introduced (translocated) native species, which out-competes native species for space and resources or which is a predator of native species. Introducing an invasive species into an area may result in that species becoming established. An invasive species may harm listed threatened species or ecological communities by direct competition, modification of habitat or predation.**

No invasive species that are harmful to the Greater Long-eared Bat have been identified. Introduced predators and weeds are not identified as a threat to Greater Long-eared Bat in the Action Plan for Australian Bats (Duncan *et al.* 1999), although introduced predators have been documented as a threat to the related Lesser Long-eared Bat (*Nyctophilus geoffroyi*; DSEWPAC 2011b). Even so, the proposal is unlikely to contribute to any increased feral animal activity or weed invasion across the project site and instead may assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites.

Mitigation measures should consider the poisoning of Greater Long-eared Bat from pesticides/herbicides. It is unlikely that any pesticides used in feral animal management will impact on the species given insect control is unlikely to be required. The application of herbicides should be restricted when alternative methods are available.

**h) introduce disease that may cause the species to decline, or**

The Action Plan for Australian Bats (Duncan *et al.* 1999) does not identify any diseases that threaten Greater Long-eared Bat. The action is not expected to introduce any disease to the study area.

**i) interfere substantially with the recovery of the species.**

Given the removal of potential habitat under the proposal will be minimal, with potential foraging and breeding/roosting habitat remaining in the study area and project site, the proposal is unlikely to interfere with the recovery of the species.

***Polytelis swainsonii* (Superb Parrot)**

The Superb Parrot is listed as a vulnerable species under the EPBC Act. A description for the species is provided in Part 3A assessment for the species in Appendix H.

**An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:**

- a) **lead to a long-term decrease in the size of an important population of a species;**

**Note: An 'important population' 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;**

While there is potential for the species to occur in the study area and project site, Superb Parrot was not recorded during the field surveys. There are no records for the species in the locality; the species was predicted to occur by the Protected Matters search tool (DSEWPAC 2011a), which includes a large area of predicted occurrence. Given that no individuals of Superb Parrot were recorded in the study area or locality, it is unlikely that an important population occurs at the study area. Thus, the action is not expected to lead to a long-term decrease in the size of an important population of the species.

- b) **reduce the area of occupancy of an important population;**

As detailed in part a), no Superb Parrot individuals were recorded during the field surveys, and it is unlikely that an important population occurs at the study area. As such, the proposal will not reduce the area of occupancy of an important population.

- c) **fragment an existing important population into two or more populations;**

As detailed in part a), no Superb Parrot individuals were recorded during the field surveys, and it is unlikely that an important population occurs at the study area. As such, the proposal will not fragment an existing important population into two or more populations.

- d) **adversely affect habitat critical to the survival of a species;**

**Note: Habitat critical to the survival of a species refers to areas that are necessary:**

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

Given that no Superb Parrot individuals were detected within the study area or project site during the field surveys, the study area is unlikely to represent habitat critical to the survival of the species, and thus, the proposal is unlikely to adversely affect habitat critical to the survival of the species. Further, the proposal will not impact on Superb Parrot breeding habitat, which is located in the South-western Slopes and the Riverina area (OEH 2011b). The action will remove only 9.63 ha of potential foraging

habitat for the species (7.98 ha permanently removed and 1.65 ha temporarily removed), representing 4.33 % of potential habitat in the study area and 0.86 % of potential habitat in the project site. This amount is considered to be minimal, and the proposal would leave ample potential foraging habitat for the species and for the long-term maintenance of the species.

The potential habitat proposed to be removed does not constitute habitat identified in a recovery plan for the species, habitat critical for that species, or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act.

**e) disrupt the breeding cycle of an important population;**

As detailed in part a), no Superb Parrot individuals were recorded during the field surveys, and it is unlikely that an important population occurs at the study area. As such, the proposal will not disrupt the breeding cycle of an important population. Further, the proposal is unlikely to disrupt the breeding cycle of the species in general. No breeding habitat will be impacted by the proposal given that the Superb Parrot breeds mainly in the South-western Slopes, with the other major breeding area located in the Riverina area (OEH 2011b). The National Recovery Plan for the Superb Parrot (Baker-Gabb 2011) shows the project site to be outside of the species' breeding areas. The project site also does not lie within 10 km of breeding areas, where the species forages during the breeding season (DSEWPAC 2011b).

**f) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The action will permanently remove 7.98 ha and temporarily remove 1.65 ha of potential habitat for the Superb Parrot. However, removal of potential habitat will occur in linear fingers within clusters rather than one consolidated stand. The Superb Parrot was not recorded within the study area and only a small amount of potential foraging habitat would be impacted (4.33 % and 0.86 % of the potential habitat in the study area and project site, respectively). The removal of a relatively small amount of potential habitat within the study area is unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline.

The proposal is also unlikely to isolate or modify potential habitat for the species (eg. through intensified grazing, which would reduce the regeneration of food trees for the species) to the extent that the species is likely to decline. Grazing pressure and management varies across the landscape, and the proposal is unlikely to exacerbate over-grazing at the site. It may, in fact, contribute to a more sustainable grazing regime through the mitigation and offset measures proposed in some parts of the site. Potential impacts from the proposal on potential habitat e.g. soil movement or weed spread will be managed.

During the operational phase of the wind farm, there is a risk that Superb Parrots will accidentally collide with the moving turbines, and thus, the proposal could isolate or modify habitat, or decrease the quality of habitat to the extent that the species could decline. However, Superb Parrots generally move along wooded corridors when making local foraging movements, rarely crossing large areas of open ground (Baker-Gabb 2011). Superb Parrots moving about a location in the course of routine foraging most likely do so within or just above the height of the trees in which they feed. The proposal would not impact the main wooded areas along the Namoi and Macquarie Rivers that the species is likely to use during migration from breeding to non-breeding sites (Baker-Gabb 2011).

**g) result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**

**Note: An invasive species is an introduced species, including an introduced (translocated) native species, which out-competes native species for space and resources or which is a predator of native species. Introducing an invasive species into an area may result in that species becoming established. An invasive species may harm listed threatened species or ecological communities by direct competition, modification of habitat or predation.**

The loss of hollows to feral bees and native and exotic hollow-nesting birds is listed as one of the key threats to the Superb Parrot (DSWEPAC 2011b). However, the proposal will not impact on nesting habitat. Feral animals can have a detrimental impact on Superb Parrot habitat. In the case of grasslands and grassy woodlands, grazing by feral animals such as the European Rabbit and Goat can result in loss of species diversity and tussock structure which in turn impacts the presence of insects as a food source for Superb Parrot. It is also unlikely to contribute to increasing feral animal activity across the project site and instead is likely to assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites.

**h) introduce disease that may cause the species to decline, or**

The Superb Parrot is threatened by Beak and Feather Disease, which is caused by the Beak and Feather Disease circovirus (DSEWPAC 2011b). Given the disease is transmitted from common parrot species to the Superb Parrot (DSEWPAC 2011b), the action is not expected to contribute to the introduction of the disease to the study area.

**i) interfere substantially with the recovery of the species.**

Given the proposal will not impact on the breeding habitat of the Superb Parrot or on foraging habitat within 10 km of Superb Parrot breeding habitat or wooded corridors used by the species during migration between breeding and non-breeding areas, the proposal is unlikely to interfere with the recovery of the species. Ample potential foraging habitat will remain available for the species in the study area and project site, despite the removal of 1.65 ha of the potential foraging habitat mapped within the study area for the species. The proposal will not introduce disease to the study area, or use insecticides to control insect pests on crops and that are harmful to the species which would interfere with the recovery of the Superb Parrot.

***Pteropus poliocephalus* (Grey-headed Flying-fox)**

The Grey-headed Flying-fox is listed as a vulnerable species under the EPBC Act. A description for the species is provided in Part 3A assessment for the species in Appendix H.

**An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:**

- a) **lead to a long-term decrease in the size of an important population of a species;**

**Note: An 'important population' 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;**

The Grey-headed Flying-fox was not detected during the field surveys, although it has been previously recorded in the locality to the south of the study area near Crudine on Turondale Road approximately 2.5 km south of the intersection with Hill End Road (BRC 2011).

Given the distribution of the species which is concentrated mostly on the eastern side of the Great Dividing Range (DSEWPAC 2011b), and the location of Crudine Ridge within the species' distribution, it is possible that an important population of Grey-headed Flying-fox occurs at the study area.

However, should an important population be present at Crudine Ridge, the proposal is unlikely to lead to a long-term decrease in the size of an important population. This is because during construction of the turbines and associated infrastructure, the proposal will avoid tree clearance wherever possible and will remove only a small amount of potential foraging habitat relative to the amount of potential foraging habitat in the study area (4.96 % of habitat in the study area (288.65 ha) and 1.14 % of the project site (1,261.66 ha) will be removed). Vegetation clearance will be linear in nature and, therefore, will not result in large consolidated patches of vegetation clearance. Further, the proposal will not significantly fragment the habitat of the species, which is highly mobile. No roosting or breeding habitat will be impacted, with the nearest camp located in near Wellington, approximately 80 km to the north west of the study area (DECCW 2008).

During the operation of the wind farm, the species could collide with turbines or be electrocuted on powerlines. However, given the distance from the nearest camp and the distance generally travelled during foraging excursions, only low numbers of individuals would likely be present in the study areas. Powerlines are already present in the locality and proposed powerlines would increase the amount of powerlines by approximately 15 km. Should collisions or electrocution occur resulting in the death of individuals, it would be unlikely to lead to a long-term decrease in the size of an important population.

- b) **reduce the area of occupancy of an important population;**

As outlined above, it is possible that an important population of the species is present in the study area based on the species being close to the limit of its range at Crudine Ridge. However, the proposal is unlikely to reduce the area of occupancy of Grey-headed Flying-fox. Under the proposal, only potential foraging habitat for the species will be removed (11.19 ha permanently and 3.15 ha temporarily removed). This represents a small proportion relative to what will be retained in the study area and project site 4.96 % in the study area and 1.14 % in the project site, and vegetation removal will occur in

linear fingers within clusters rather than one consolidated stand in the study area. The Grey-headed Flying-fox is a mobile species and will be able to access remaining foraging resources in the study area and project site. Also, given habitat is widely spread across the project site, it is unlikely that the proposed wind farm would lead to the displacement of any individuals.

**c) fragment an existing important population into two or more populations;**

As outlined above, it is possible that an important population of the species is present in the study area based on the species being close to the limit of its range at Crudine Ridge. However, the proposal is unlikely to fragment an existing important population into two or more populations. This is because construction activities will result in the removal of potential foraging habitat in linear fingers within clusters rather than one consolidated stand in the study area. The Grey-headed Flying-fox is a mobile species and will be able to access remaining foraging resources in the study area and project site following works.

During the operational phase of the wind farm, there is a risk that Grey-headed Flying-fox will accidentally collide with the moving turbines or be electrocuted on powerlines causing a barrier to movement and fragmenting an existing population into two or more populations. However, bat strike and electrocution will be monitored during the operation of the wind farm and an adaptive management approach implemented whereby additional measures are investigated should significant bat strike at certain turbines or electrocution be recorded, preventing a Grey-headed Flying-fox population being fragmented into two or more populations.

**d) adversely affect habitat critical to the survival of a species;**

**Note: Habitat critical to the survival of a species refers to areas that are necessary:**

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

No roosting/breeding habitat (camps) will be impacted by the proposal. As such, the proposal will not adversely impact habitat critical to the survival of the species. The action will remove only 103.19 ha of potential foraging habitat for the species (11.19 ha permanently removed and 3.15 ha temporarily removed), representing 4.96 % of potential habitat in the study area and 1.14 % of potential habitat in the project site. This amount is considered to be minimal, and the proposal would leave ample potential foraging habitat for the species and for the long-term maintenance of the species.

The potential habitat proposed to be removed does not constitute habitat identified in a recovery plan for the species, habitat critical for that species, or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act.

**e) disrupt the breeding cycle of an important population;**

As outlined above, it is possible that an important population of the species is present in the study area based on the species being close to the limit of its range at Crudine Ridge. However, the proposal is unlikely to disrupt the breeding cycle of an important population. No roosting or breeding habitat will be impacted by the proposal given that no camps are present in the study area, with the nearest camp located near Wellington, approximately 80 km to the north west of the study area (DECCW 2008).

**f) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The action will permanently remove 11.19 ha and temporarily remove 3.15 ha of potential foraging habitat for the Grey-headed Flying-fox. However, removal of potential habitat will occur in linear fingers within clusters rather than one consolidated stand. Only a small amount of potential foraging habitat will be impacted (4.96 % and 1.14 % of the potential habitat in the study area and project site, respectively). The removal of a relatively small amount of potential habitat within the study area is unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline.

The proposal is also unlikely to isolate or modify potential habitat for the species (eg. through intensified grazing, which would reduce the regeneration of food trees for the species) to the extent that the species is likely to decline. Grazing pressure and management varies across the landscape, and the proposal is unlikely to exacerbate over-grazing at the site. It may, in fact, contribute to a more sustainable grazing regime through the mitigation and offset measures proposed in some parts of the site. Potential impacts from the proposal on potential habitat e.g. soil movement or weed spread will be managed.

During the operational phase of the wind farm, there is a risk that Grey-headed Flying-foxes will accidentally collide with the moving turbines or be electrocuted on powerlines, and thus, the proposal could isolate or modify habitat, or decrease the quality of habitat to the extent that the species could decline. However, bat strike and the incidence of electrocution will be monitored during the operation of the wind farm and an adaptive management approach implemented whereby additional measures are investigated should significant bat strike at certain turbines or electrocution be recorded, preventing a the isolation of habitat. Powerlines are already present in the locality and proposed powerlines would increase the amount of powerlines by approximately 15 km.

**g) result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**

**Note: An invasive species is an introduced species, including an introduced (translocated) native species, which out-competes native species for space and resources or which is a predator of native species. Introducing an invasive species into an area may result in that species becoming established. An invasive species may harm listed threatened species or ecological communities by direct competition, modification of habitat or predation.**

No invasive species that are harmful to the Grey-headed Flying-fox have been identified. Introduced predators and weeds are not identified as a threat to Grey-headed Flying-fox in the Action Plan for Australian Bats (Duncan *et al.* 1999). Even so, the proposal is unlikely to contribute to any increased feral animal activity or weed invasion across the project site and instead may assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites.

**h) introduce disease that may cause the species to decline, or**

The Action Plan for Australian Bats (Duncan *et al.* 1999) identifies Australian bat Lyssavirus, Bat Paramyxovirus and Menangle Pig virus as diseases that may affect Grey-headed Flying-fox. The action is not expected to introduce any disease to the study area.

**i) interfere substantially with the recovery of the species.**

Given the proposal will not impact on the breeding or roosting habitat of the Grey-headed Flying-fox, the

proposal is unlikely to interfere with the recovery of the species. Ample potential foraging habitat will remain available for the species in the study area and project site, despite the permanent removal of 11.19 ha of the potential foraging habitat mapped within the study area for the species. The proposal will not introduce disease to the study area, which would interfere with the recovery of the Grey-headed Flying-fox.

## MIGRATORY SPECIES

### *Anthochaera phrygia* (Regent Honeyeater)

Regent Honeyeater is listed as an endangered and migratory species under the EPBC Act, and is included in the Japan-Australia Migratory Bird Agreement (JAMBA). A description for the species is provided in Part 3A assessment for the species in Appendix H.

**An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will meet any of the following criteria:**

- a) 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;**

**Note: An “area of important habitat for a migratory species” is defined as:**

- **Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or**
- **Habitat that is of critical importance to the species at particular life-cycle stages; and/or**
- **Habitat utilised by a migratory species which is at the limit of the species’ range; and/or**
- **Habitat within an area where the species is declining.**

The action will permanently remove 11.19 ha and temporarily remove 3.15 ha of potential foraging habitat for Regent Honeyeater.

However, this area to be removed will not substantially destroy or modify foraging habitat for the species given it represents 4.96 % of potential habitat in the study area and 1.14 % of potential habitat in the project site. Areas of potential habitat will remain in the study area and project site. The proposal is also unlikely to isolate or modify potential habitat for the species (eg. through changed disturbance regimes) to the extent that the species is likely to decline. Potential impacts from the proposal on potential foraging habitat e.g. soil movement or weed spread will be managed. Other disturbance regimes, such as grazing by livestock and feral animals and fire, will not increase as a result of the proposal.

In terms of breeding habitat, the proposal will not substantially impact any breeding habitat for the species as the study area does not support large amounts of Box-Gum Woodland or riparian gallery forest preferred by the species for breeding, and is not known breeding habitat. Thus, areas of critical habitat of importance to Regent Honeyeater will not be affected.

- b) result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species;**

It is unlikely that the proposed works would result in the introduction of invasive species that are considered likely to impact on Regent Honeyeater. The species suffers from competition from larger aggressive honeyeaters, particularly *Manorina melanocephala* (Noisy Miner), *Philemon corniculatus* (Noisy Friarbird) and *Anthochaera carunculata* (Red Wattlebirds). However, the proposal would be unlikely to lead to an increase in the incidence of these species in the project site.

Feral animals can have a detrimental impact on Regent Honeyeater through grazing which prevent native vegetation from regenerating. The proposal is unlikely to contribute to increasing feral animal activity across the project site and instead may assist with the management of these species through the proposed mitigation measures to be implemented within the study area and on the proposed offset sites.

- c) seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.**

**Note: An “ecological significant proportion” of the population varies with the species and each circumstance will need to be evaluated. Some factors include the species’ population status, genetic distinctiveness and species specific behavioural patterns. eg. site fidelity.**

**A “population of a migratory species” is the entire population or any geographically separate part of the population, a significant proportion of whose members cyclically and predictably cross one or more nationally jurisdictional boundaries including Australia.**

It is unlikely that the study area would support an ecological significant proportion of Regent Honeyeater given the species has only been recorded six times in the locality, the species is unlikely to breed in the study area as it does not support large amounts of Box-Gum Woodland or riparian gallery forest preferred by the species, and the study area is not a known breeding area. The closest known key breeding area in NSW is located approximately 40 km to the west of the site in the Capertee Valley, with a less used breeding area located approximately 55 km to the south west in the Mudgee – Wollar region (OEH 2011b). The site could be used as a foraging resource for these populations during the non-breeding season, although there are few records within the locality.

While foraging habitat would be removed, the amount removed would be minimal and represents a small proportion of the foraging habitat in the project site and the locality. Regent Honeyeaters would be able to continue using resources remaining within and outside of the project site.

The proposal may affect the lifecycle of the Regent Honeyeater through accidental strike with the turbines during operation of the wind farm. However, the Regent Honeyeater is a passerine species that forages mainly in the crowns of flowering trees (DSEWPAC 2011b). Thus while within the study area, they are unlikely to collide with turbines given the species. Preliminary evidence suggests that when dispersing from the Capertee Valley following breeding, Regent Honeyeaters use narrow corridors of forest that extend from the valley floor to the talus slopes on the border of Wollemi National Park, with no evidence of dispersal through the large areas of dry woodland on the sandstone plateau of the park (DSEWPAC 2011b). Thus, the risk of collision with the turbines may be low to moderate at the study area which supports mostly dry open woodland with some forest. It has also only been recorded a few times in the locality, and so the number of individuals in the study area is likely to be low. If struck, the proposal would be unlikely to seriously disrupt the lifecycle of an ecologically significant portion of the Regent Honeyeater population.

***Ardea alba* (Great Egret)**

The Great Egret is listed as a migratory species under the EPBC Act, and is included in the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA).

It has been reported in a wide range of wetland habitats, for example inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial habitats. The species may retreat to permanent wetlands or coastal areas when other wetlands are dry (DSEWPAC 2011b).

The Great Egret has a diverse diet that includes fish, insects, crustaceans, molluscs, frogs, lizards, snakes and small birds and mammals. It exhibits a diverse array of complex foraging behaviours. In simple terms, it mostly forages by wading through shallow to moderately deep water, by standing in water and capturing prey that wanders nearby, or by walking over shore or dry ground. It typically secures its prey by abruptly 'stabbing', or by probing or pecking, with the bill. Prey is taken from water and vegetation but not from sediments (DSEWPAC 2011b).

The Great Egret roosts in large flocks that may consist of hundreds of birds. The species usually nest in colonies and rarely in solitary pairs, which are located in wooded and shrubby swamps including mangrove forests (the main habitat of the species in the Top End), *Melaleuca* swamps (on the eastern coast of Australia and south-western Western Australia) and mixed eucalypt/acacia/lignum swamps. Colonies may be mono-specific or commonly mixed with other egrets, herons, ibises, spoonbills and/or cormorants. Breeding colonies in south-eastern Australia typically comprise up to several hundred pairs, but colonies in the Channel Country of Queensland and at the Top End of the Northern Territory may comprise several thousand pairs (DSEWPAC 2011b).

The Great Egret is dispersive and, in parts of its range, migratory. In Australia, multi-directional post-breeding movements of up to 280 km have been recorded in south-western Western Australia, and similar patterns of movement have been recorded in eastern Australia. The species undertakes some regular seasonal movements, mostly to and from breeding colonies, and towards the coast in the dry season. There is circumstantial evidence of long-distance migration, with regional differences in reporting rates suggesting that individuals migrate north to winter in tropical northern Australia, consistent with changes in the availability of suitable wetland habitat. Regular migration to locations outside of Australia is suspected but not confirmed (DSEWPAC 2011b).

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will meet any of the following criteria:

- a) **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;**

**Note: An “area of important habitat for a migratory species” is defined as:**

- **Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or**
- **Habitat that is of critical importance to the species at particular life-cycle stages; and/or**
- **Habitat utilised by a migratory species which is at the limit of the species’ range; and/or**
- **Habitat within an area where the species is declining.**

The study area provides marginal habitat for this species which is likely only to be used following heavy rainfall. No wetlands are present within the study area, and thus no roosting habitat is present. Further, no habitat typically used for breeding by the species (mangrove forests, *Melaleuca* swamps, mixed eucalypt/acacia/lignum swamps) is present within the study area. Therefore, it is unlikely that the study area would support an area of important habitat for this species.

The impacts in terms of disturbance to potential habitat for the Great Egret within the project site are likely to be negligible given the impacts from the proposal would occur primarily on the ridge tops. Potential impacts from the proposal on potential foraging habitat e.g. soil movement or weed spread will be managed. Other disturbance regimes, such as grazing by livestock and feral animals and fire, will not increase as a result of the proposal. Further, the Great Egret forages widely, with the species capable of making large regional movements. The species is likely to be present infrequently while migrating or foraging. Only the minimal amount of clearing will be required, which represents a small amount comparative to the amount of habitat present within the project site. Therefore, the proposed loss of potential habitat is not likely to substantially modify, destroy, or isolate an area of important habitat for the species.

- b) **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 proposal would not result in the establishment of an invasive species that is harmful to Great Egret.

- c) **seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.**

**Note: An “ecological significant proportion” of the population varies with the species and each circumstance will need to be evaluated. Some factors include the species’ population status, genetic distinctiveness and species specific behavioural patterns. Eg. site fidelity.**

**A “population of a migratory species” is the entire population or any geographically separate part of the population, a significant proportion of whose members cyclically and predictably cross one or more nationally jurisdictional boundaries including Australia.**

The proposal is unlikely to seriously disrupt the lifecycle of an ecologically significant proportion of the population of Great Egret as the study area supports only marginal foraging habitat for this species which is only likely to be used opportunistically following heavy rainfall events. The study area does not support any roosting or breeding habitat. The majority of potential foraging habitat would be retained in the project site which could be used by the species following construction works.

***Ardea ibis* (Cattle Egret)**

The Cattle Egret is listed as a migratory species under the EPBC Act, and is included in the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA).

It occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. It has occasionally been seen in arid and semi-arid regions however this is extremely rare. High numbers have been observed in moist, low-lying poorly drained pastures with an abundance of high grass; it avoids low grass pastures. It is commonly associated with the habitats of farm animals, particularly cattle, but also pigs, sheep, horses and deer (DSEWPAC 2011b).

The Cattle Egret has a diverse diet, which includes fish, macroinvertebrates, frogs, lizards, snakes and small birds and mammals. The species often forages away from water on low lying grasslands, improved pastures and croplands. It is commonly found in cattle fields and other farm areas that contain livestock. The Cattle Egret has also been observed foraging in rubbish tips. It is becoming more frequent in drier regions; consuming the ticks of livestock in the absence of other food sources. This inland spread is believed to be due to the construction of artificial waterways (DSEWPAC 2011b).

The Cattle Egret roosts in trees, or amongst ground vegetation in or near lakes and swamps. It has also been recorded roosting near human settlement and industrial areas in Murwillumbah, NSW. It breeds in colonies in wooded swamps such as mangrove forests (e.g. the lower Adelaide River, Northern Territory), *Melaleuca* swamps (e.g. Shortland, NSW) and the eucalypt/lignum swamps of the Murray-Darling Basin. They may also breed in artificial situations or close to urban areas. Generally the nesting trees are inundated except where breeding on small islands. Nests are sited usually in middle to upper branches (DSEWPAC 2011b).

In Australia, the Cattle Egret is a partial migrant; some of the population migrates to New Zealand, while the remainder migrates locally. The birds migrate from breeding colonies in south-east Queensland and north-east NSW to spend winter in either south-east Australia or New Zealand. In north and west Australia the movement is not as well known as that of the east and south (DSEWPAC 2011b).

**An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will meet any of the following criteria:**

- a) **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;**

**Note: An “area of important habitat for a migratory species” is defined as:**

- **Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or**
- **Habitat that is of critical importance to the species at particular life-cycle stages; and/or**
- **Habitat utilised by a migratory species which is at the limit of the species’ range; and/or**
- **Habitat within an area where the species is declining.**

The study area provides marginal foraging habitat for this species which is likely only to be present and used by the species following heavy rainfall. No wetlands are present within the study area, and thus

no roosting habitat is present (the species roosts in trees near lakes and swamps; DSEWPAC 2011b). Further, no habitat typically used for breeding by the species (mangrove forests, *Melaleuca* swamps, eucalypt/lignum swamps) is present within the study area. Therefore, it is unlikely that the study area would support an area of important habitat for this species.

The impacts in terms of disturbance to potential foraging habitat for the Cattle Egret within the project site are likely to be negligible given the impacts from the proposal would occur primarily on the ridge tops. Potential impacts from the proposal on potential foraging habitat e.g. soil movement or weed spread will be managed. Other disturbance regimes, such as grazing by livestock and feral animals and fire, will not increase as a result of the proposal. Further, the Cattle Egret forages widely, with the species capable of making large regional movements (DSEWPAC 2011b). The species is likely to be present infrequently while migrating or foraging. Only the minimal amount of clearing will be required, which represents a small amount comparative to the amount of habitat present within the project site. Therefore, the proposed loss of potential habitat is not likely to substantially modify, destroy, or isolate an area of important habitat for the species.

**b) 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 proposal would not result in the establishment of an invasive species that is harmful to Cattle Egret.

**c) seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.**

**Note: An “ecological significant proportion” of the population varies with the species and each circumstance will need to be evaluated. Some factors include the species’ population status, genetic distinctiveness and species specific behavioural patterns. Eg. site fidelity.**

**A “population of a migratory species” is the entire population or any geographically separate part of the population, a significant proportion of whose members cyclically and predictably cross one or more nationally jurisdictional boundaries including Australia.**

The proposal is unlikely to seriously disrupt the lifecycle of an ecologically significant proportion of the population of Cattle Egret as the study area supports only potential foraging habitat for this species which is only likely to be used opportunistically following heavy rainfall events. The study area does not support any roosting or breeding habitat. The majority of potential foraging habitat would be retained in the project site which could be used by the species following construction works.

***Hirundapus caudactus* (White-throated Needletail)**

The White-throated Needletail is listed as a migratory species under the EPBC Act, and is included in the Japan-Australia Migratory Bird Agreement (JAMBA), the China-Australia Migratory Bird Agreement (CAMBA), and the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA) (DSEWPAC 2011b).

In Australia, the White-throated Needletail is almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. Because they are aerial, it has been stated that conventional habitat descriptions are inapplicable, but there are, nevertheless, certain preferences exhibited by the species. Although they occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland. They also commonly occur over heathland, but less often over treeless areas, such as grassland or swamps. When flying above farmland, they are more often recorded above partly cleared pasture, plantations or remnant vegetation at the edge of paddocks. In coastal areas, they are sometimes seen flying over sandy beaches or mudflats, and often around coastal cliffs and other areas with prominent updraughts, such as ridges and sand-dunes (DSEWPAC 2011b).

During the non-breeding season in Australia, the White-throated Needletail has been recorded eating a wide variety of insects, including beetles, cicadas, flying ants, bees, wasps, flies, termites, moths, locusts and grasshoppers. The White-throated Needletail almost always forage aerially, at heights up to 'cloud level' though usually much lower (DSEWPAC 2011b).

The species has been recorded roosting in trees in forests and woodlands, both among dense foliage in the canopy or in hollows. It has been suggested that they also sometimes roost aerially (DSEWPAC 2011b).

The species breeds in wooded lowlands and sparsely vegetated hills, as well as mountains covered with coniferous forests in Asia, from central and south-eastern Siberia and Mongolia, east to the Maritime Territories of Russia, Sakhalin and the Kuril Islands and south to northern Japan and north-eastern China (DSEWPAC 2011b).

**An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will meet any of the following criteria:**

- a) 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;**

**Note: An “area of important habitat for a migratory species” is defined as:**

- **Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or**
- **Habitat that is of critical importance to the species at particular life-cycle stages; and/or**
- **Habitat utilised by a migratory species which is at the limit of the species’ range; and/or**
- **Habitat within an area where the species is declining.**

The proposal involves the permanent removal of up to approximately 71.64 ha of potential foraging and

roosting habitat for this species. Further, approximately 31.58 ha of potential foraging and roosting habitat will be temporarily cleared within the project site. This includes areas of woodland, grassland and areas cleared

However, the majority of clearance impacts will occur in previously cleared open grassy areas which provide limited habitat for this species and the majority of vegetation within the project site will be retained. The proposal will not substantially increase fragmentation in the area which would isolate areas of important habitat for the species, particularly given White-throated Needletails forage aerially over both wooded and open areas. The amount of vegetation that would be directly impacted comprises only a small portion of vegetation throughout the study area (6.67 %) and an even smaller portion of vegetation within the project site (2.62 %). The proposal is also unlikely to isolate or modify potential habitat for the species (eg. through changed disturbance regimes) to the extent that the species is likely to decline. Potential impacts from the proposal on potential roosting habitat e.g. soil movement or weed spread will be managed. Other disturbance regimes, such as grazing by livestock and feral animals and fire, will not increase as a result of the proposal.

In terms of breeding habitat, the proposal will not substantially impact any breeding habitat for the species as it breeds in Asia. Thus, areas of critical habitat of importance to the White-throated Needletail will not be affected.

**b) 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 proposal would not result in the establishment of an invasive species that is harmful to White-throated Needletails.

**c) seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.**

**Note: An “ecological significant proportion” of the population varies with the species and each circumstance will need to be evaluated. Some factors include the species’ population status, genetic distinctiveness and species specific behavioural patterns. Eg. site fidelity.**

**A “population of a migratory species” is the entire population or any geographically separate part of the population, a significant proportion of whose members cyclically and predictably cross one or more nationally jurisdictional boundaries including Australia.**

It is unlikely that the study area would support an ecological significant proportion of White-throated Needletail given the species has only been recorded three times in the locality at one location (south east of the study area at “Wiruna” property on Old Ilford Road, near Razorback; Birds Australia 2011a), and the species disperses widely when in Australia, with individuals not maintaining home ranges and territories (DSEWPAC 2011b). Thus, the proposal would not seriously disrupt the lifecycle of an ecological significant proportion of the species.

While vegetation representing potential foraging and roosting habitat will be removed, the amount removed would be minimal and represents a small proportion of the vegetation in the project site and the locality. Further, while the species exhibits preferences for vegetation associations, it is aerial when in Australia, and thus, vegetation removal will not significantly affect the species. White-throated Needletails would be able to continue using resources remaining within and outside of the project site.

The proposal may affect the lifecycle of the White-throated Needletail through accidental strike with the

turbines during operation of the wind farm. However, given the species forages at high altitudes (at “cloud level”, over 1000 m above the ground; DSEWPAC 2011b), it is unlikely that the species will accidentally collide with turbines.

***Merops ornatus* (Rainbow Bee-eater)**

The Rainbow Bee-eater is listed as a migratory species under the EPBC Act, and is included in the Japan-Australia Migratory Bird Agreement (JAMBA) (DSEWPAC 2011b).

In Australia, the Rainbow Bee-eater mainly occurs in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation. It usually occurs in open, cleared or lightly-timbered areas that are often, but not always, located in proximity to permanent water. It also occurs in inland and coastal sand dune systems, and in mangroves in northern Australia, and has been recorded in various other habitat types including heathland, sedgeland, vine forest and vine thicket, and on beaches (DSEWPAC 2011b).

The Rainbow Bee-eater mainly feeds on insects, and will occasionally take other animal items including earthworms, spiders and tadpoles. The insect component of the diet mainly consists of bees and wasps, but also includes various other insects such as beetles, moths, butterflies, damselflies, dragonflies, flies, ants and bugs. The Rainbow Bee-eater captures most of its prey in flight, although it also takes food items from the ground and from foliage, and has occasionally been seen to snatch items from below the surface of rivers and dams (DSEWPAC 2011b).

The Rainbow Bee-eater breeds in socially monogamous pairs that are sometimes assisted by a varying number of auxiliary birds or 'helpers' that are usually male. The nests are typically concentrated together in loose colonies, although in some instances pairs will nest solitarily. The nest is located in an enlarged chamber at the end of long burrow or tunnel that is excavated, by both sexes, in flat or sloping ground, in the banks of rivers, creeks or dams, in roadside cuttings, in the walls of gravel pits or quarries, in mounds of gravel, or in cliff-faces. Nesting areas are often re-used, and banding studies indicate that at least some migrant birds return to the same nesting area each year. However, pairs usually excavate a new nesting burrow for each breeding season (DSEWPAC 2011b).

The movement patterns of the Rainbow Bee-eater are complex, and are not fully understood. Populations that breed in southern Australia are migratory. However, populations that breed in northern Australia are considered to be resident, and in many northern localities the Rainbow Bee-eater is present throughout the year. Regarding populations that breed in southern Australia, these move north to northern Australia, Papua New Guinea and eastern Indonesia after breeding and remain there for the duration of the Australian winter. Populations of the Rainbow Bee-eater gather together and assemble into flocks before migration. The migrating flocks, which can consist of tens to hundreds or thousands of birds, often fly high above the ground when on passage (DSEWPAC 2011b).

**An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will meet any of the following criteria:**

- a) **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;**

**Note: An “area of important habitat for a migratory species” is defined as:**

- **Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or**
- **Habitat that is of critical importance to the species at particular life-cycle stages; and/or**

- **Habitat utilised by a migratory species which is at the limit of the species' range; and/or**
- **Habitat within an area where the species is declining.**

The proposal involves the permanent removal of up to approximately 71.64 ha of potential foraging and breeding habitat for this species. Further, approximately 31.58 ha of potential foraging and breeding habitat will be temporarily cleared within the project site. This includes areas of woodland, grassland and areas cleared.

However, the proposal will not substantially increase fragmentation in the area which would isolate areas of important habitat for the species, particularly given Rainbow Bee-eaters can make large regional movements across the continent and beyond. The amount of vegetation that would be directly impacted comprises only a small portion of vegetation throughout the study area (6.67 %) and an even smaller portion of vegetation within the project site (2.62 %). Areas of potential habitat will remain in the study area and project site. The proposal is also unlikely to isolate or modify potential habitat for the species (eg. through changed disturbance regimes) to the extent that the species is likely to decline. Potential impacts from the proposal on potential habitat e.g. soil movement or weed spread will be managed. Other disturbance regimes, such as grazing by livestock and feral animals and fire, will not increase as a result of the proposal.

**b) 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 proposal would not result in the establishment of an invasive species that is harmful to Rainbow Bee-eater. The species is threatened by Cane Toads, and could be impacted by predators such as foxes, but the proposal would not introduce Cane Toads or increase the numbers of foxes to the project site.

**c) seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.**

**Note: An “ecological significant proportion” of the population varies with the species and each circumstance will need to be evaluated. Some factors include the species’ population status, genetic distinctiveness and species specific behavioural patterns. Eg. site fidelity.**

**A “population of a migratory species” is the entire population or any geographically separate part of the population, a significant proportion of whose members cyclically and predictably cross one or more nationally jurisdictional boundaries including Australia.**

The proposal would impact on potential foraging and breeding habitat for the Rainbow Bee-eater. However, the amount of foraging and breeding habitat that would be impacted represents a small portion of vegetation throughout the study area (6.67 %) and an even smaller portion of vegetation within the project site (2.62 %). Rainbow Bee-eaters would be able to continue using resources remaining within and outside of the project site.

The proposal may affect the lifecycle of the Rainbow Bee-eater through accidental strike with the turbines during operation of the wind farm. Strike could impact individuals from a resident population during their breeding period or individuals migrating from more southern areas to the north. A resident population is likely to be present given that Rainbow Bee-eater has been recorded on 7 occasions in two locations in the locality: six times in the Lower Pyramul area to west of the study area, and once to

the south of the study area in the Sofala area (on Sofala Road, approximately 3 km south from the intersection with Hill End Road; Birds Australia 2011a). Rainbow Bee-eater was also recorded twice within the project site during the surveys. However, Rainbow Bee-eaters usually forages from open perches, from which it may scan for prey. While it captures most of its prey in flight, sometimes employing foraging strategies such as aerial sweeping, it also takes food items from the ground and from foliage, as well as below the surface of rivers and dams, suggesting it generally flies at a moderate height, below the height of the turbines. During migration from southern to northern Australia, migrating flocks, which can consist of tens to hundreds or thousands of birds, often fly high above the ground when on passage (DSEWPAC 2011b). Thus, the species would be unlikely to collide with turbines during migration.

Given the availability of remaining habitat in the project site, the foraging behaviour, and high altitudes that Rainbow Bee-eaters will fly during migration, the proposed works are unlikely to seriously disrupt the lifecycle of a Rainbow Bee-eater population.

***Myiagra cyanoleuca* (Satin Flycatcher)**

The Satin Flycatcher is listed as a migratory species under the EPBC Act, and is included under the Bonn Convention (DSEWPAC 2011b).

Satin Flycatchers are mainly recorded in eucalypt forests, especially wet sclerophyll forest, often dominated by eucalypts such as *Eucalypt fastigata* (Brown Barrel), *E. dalrympleana* (Mountain Gum), Mountain Grey Gum, Narrow-leaved Peppermint, Messmate or Manna Gum, or occasionally Mountain Ash. Such forests usually have a tall shrubby understorey of tall acacias, for example *Acacia melanoxylon* (Blackwood). In higher altitude *E. stellulata* (Black Sallee) woodlands, they are often associated with tea-trees and tree-ferns. They sometimes also occur in dry sclerophyll forests and woodlands, usually dominated by eucalypts such as *E. blakelyi* (Blakely's Red Gum), *E. sideroxylon* (Mugga Ironbark), Yellow Box, *E. albens* (White Box), Manna Gum or stringybarks, including *E. macrorhyncha* (Red Stringybark) and Broad-leaved Stringybark, usually with open understorey. The species has also been recorded in other vegetation communities (DSEWPAC 2011b).

Satin Flycatchers are mainly insectivorous, preying on arthropods, mostly insects, although very occasionally they will also eat seeds. They are arboreal foragers, feeding high in the canopy and sub-canopy of trees, usually sallying for prey in the air or picking prey from foliage and branches of trees, flitting from one perch to another, constantly wagging their tail (DSEWPAC 2011b).

There is no information about roosting behaviour of the Satin Flycatcher, though they are known to nest in a fork of outer branches of trees, such as paperbarks, eucalypts, and banksias (DSEWPAC 2011b). Satin Flycatchers nest in simple pairs, in loose colonies or at least nests are clustered (DSEWPAC 2011b).

Satin Flycatchers are migratory, moving north in autumn to spend winter in northern Australia and New Guinea. They return south in spring to spend summer in south-eastern Australia. They are inconspicuous when on passage, possibly because movements are made singly or in pairs or small loose groups through the tree-tops and possibly at night. Their migration route appears to follow the Great Divide with some following the coast in NSW (DSEWPAC 2011b).

**An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will meet any of the following criteria:**

- a) 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;**

**Note: An “area of important habitat for a migratory species” is defined as:**

- **Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or**
- **Habitat that is of critical importance to the species at particular life-cycle stages; and/or**
- **Habitat utilised by a migratory species which is at the limit of the species’ range; and/or**
- **Habitat within an area where the species is declining.**

The proposal involves the permanent removal of up to approximately 7.98 ha of potential foraging and

breeding habitat for this species. Further, approximately 1.65 ha of potential foraging and breeding habitat will be temporarily cleared within the project site.

However, the proposal will not substantially increase fragmentation in the area which would isolate areas of important habitat for the species, particularly given clearing will occur in linear fingers rather than in one consolidated stand, across which the Satin Flycatcher could move. While Satin Flycatcher is known to use the vegetation communities present in the study area and project site (DSEWPAC 2011b), with the area predicted to support breeding habitat (DSEWPAC 2011a) and the locality supporting a high density of birds (1.25 birds/ha near Bathurst, NSW; DSEWPAC 2011b), the amount of vegetation that would be directly impacted comprises only a small portion of vegetation throughout the study area (4.33 %) and an even smaller portion of vegetation within the project site (0.86 %). Areas of potential habitat will remain in the study area and project site.

The proposal is also unlikely to isolate or modify potential habitat for the species (eg. through changed disturbance regimes) to the extent that the species is likely to decline. Potential impacts from the proposal on potential habitat e.g. soil movement or weed spread will be managed. Other disturbance regimes, such as grazing by livestock and feral animals and fire, will not increase as a result of the proposal.

**b) 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 proposal would not result in the establishment of an invasive species that is harmful to Satin Flycatcher.

**c) seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.**

**Note: An “ecological significant proportion” of the population varies with the species and each circumstance will need to be evaluated. Some factors include the species’ population status, genetic distinctiveness and species specific behavioural patterns. Eg. site fidelity.**

**A “population of a migratory species” is the entire population or any geographically separate part of the population, a significant proportion of whose members cyclically and predictably cross one or more nationally jurisdictional boundaries including Australia.**

It is possible that an ecologically significant proportion of a population of Satin Flycatcher occurs in the study area given a high density of the species (1.25 birds/ha) has been recorded near Bathurst (DSEWPAC 2011b) and the Protected Matters search tool predicted the area to be a breeding area (DSEWPAC 2011a). However, no Satin Flycatchers have been previously recorded in the locality and were not recorded during field survey.

The proposal would impact on potential foraging and breeding habitat for the Satin Flycatcher in the study area. However, the amount of foraging and breeding habitat that would be impacted represents a small portion of vegetation throughout the study area (4.33 %) and an even smaller portion of vegetation within the project site (0.86 %). Satin Flycatcher would be able to continue using resources remaining within and outside of the project site.

The proposal may affect the lifecycle of the Satin Flycatcher through accidental strike with the turbines during operation of the wind farm, should it be present. Strike could impact individuals from a resident population during their breeding period or individuals migrating from more southern areas to the north.

However, Satin Flycatchers are arboreal foragers, feeding high in the canopy and sub-canopy of trees. During migration from southern to northern Australia, Satin Flycatchers are likely to move through the tree-tops (DSEWPAC 2011b). Thus, the species would be unlikely to collide with turbines during migration.

Given the availability of remaining habitat in the project site, the foraging behaviour, and their movement through tree tops during migration, the proposed works are unlikely to seriously disrupt the lifecycle of a Satin Flycatcher population.

***Aprasia parapulchella* (Pink-tailed Worm Lizard)**

The Pink-tailed Worm Lizard is listed as a vulnerable species under the EPBC Act. A description for the species is provided in Part 3A assessment for the species in Appendix H.

**An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:**

- a) **lead to a long-term decrease in the size of an important population of a species;**

**Note: An 'important population' 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;**

While there is potential for the species to occur in the study area and project site, the Pink-tailed Worm Lizard was not recorded during the field surveys. This was despite targeted survey for the species at ten sites within suitable habitat in the project site in November 2008 (eight sites within the Sallys Flat Cluster and two sites within the Pyramul Cluster), where 500 rocks per site were rolled at seven sites, and 1000 rocks per site were rolled at three sites. The species has been recorded in the locality, but approximately 11 km away at Sofala and off Box Ridge Road (BRC 2011). Given that no individuals of Pink-tailed Worm Lizard were recorded in the study area or locality, it is unlikely that an important population occurs at the study area. Thus, the action is not expected to lead to a long-term decrease in the size of an important population of the species.

- b) **reduce the area of occupancy of an important population;**

As detailed in part a), no individuals of Pink-tailed Worm Lizard were recorded during the field surveys, and it is unlikely that an important population occurs at the study area. As such, the proposal will not reduce the area of occupancy of an important population.

- c) **fragment an existing important population into two or more populations;**

As detailed in part a), no individuals of Pink-tailed Worm Lizard were recorded during the field surveys, and it is unlikely that an important population occurs at the study area. As such, the proposal will not fragment an existing important population into two or more populations.

- d) **adversely affect habitat critical to the survival of a species;**

**Note: Habitat critical to the survival of a species refers to areas that are necessary:**

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

Given that no individuals of Pink-tailed Worm Lizard were detected within the study area or project site during the field surveys, the study area is unlikely to represent habitat critical to the survival of the

species, and thus, the proposal is unlikely to adversely affect habitat critical to the survival of the species. It is possible that field surveys did not detect the species; however, the action will remove only 102.71 ha of potential habitat for the species (71.15 ha permanently removed and 31.56 ha temporarily removed), representing 6.95 % of potential habitat in the study area and 2.69 % of potential habitat in the project site. This amount is considered to be minimal, and the proposal would leave ample potential habitat for the species and for the long-term maintenance of the species. Further, all large rocks (15 cm diameter – 70 cm diameter) removed from within the proposed development areas will be relocated to adjacent areas to supplement habitat.

The potential habitat proposed to be removed does not constitute habitat identified in a recovery plan for the species, habitat critical for that species, or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act.

**e) disrupt the breeding cycle of an important population;**

As detailed in part a), no individuals of Pink-tailed Worm Lizard were recorded during the field surveys, and it is unlikely that an important population occurs at the study area. As such, the proposal will not disrupt the breeding / life cycle of an important population.

**f) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The action will permanently remove 71.15 ha and temporarily remove 31.56 ha of potential habitat for Pink-tailed Worm Lizard. However, removal of potential habitat will occur in linear fingers within clusters rather than one consolidated stand. No individuals of Pink-tailed Worm Lizard were recorded within the study area and only a small amount of potential habitat would be impacted (6.95 % of the potential habitat in the study area). The removal of a relatively small amount of potential habitat within the study area is unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline. It is also unlikely to isolate potential habitat for the species to the extent that the species is likely to decline. Potential impacts from the proposal on potential habitat e.g. soil movement or weed spread will be managed.

Further, all large rocks (15 cm diameter – 70 cm diameter) removed from within the proposed development areas will be relocated to adjacent areas to supplement habitat.

**g) result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

**Note: An invasive species is an introduced species, including an introduced (translocated) native species, which out-competes native species for space and resources or which is a predator of native species. Introducing an invasive species into an area may result in that species becoming established. An invasive species may harm listed threatened species or ecological communities by direct competition, modification of habitat or predation.**

One of the key threats to Pink-tailed Worm Lizard is habitat degradation by weeds species. The proposal is unlikely to result in invasive weed species; however, control measures to avoid the spread of weeds will be implemented from pre-construction works, throughout construction and operation until decommissioning, thereby reducing potential impacts of the proposal to potential habitat for this species. These are detailed in **Table 17**.

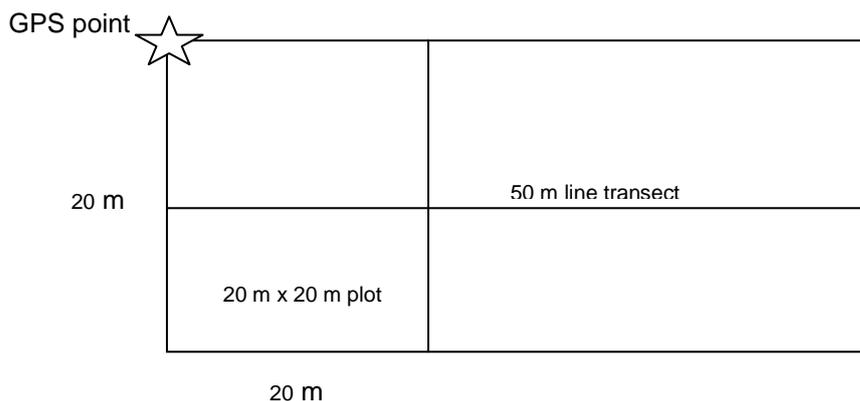
**h) introduce disease that may cause the species to decline, or**

No diseases are known that threaten Pink-tailed Worm Lizard. The action is not expected to introduce any disease to the study area.

**i) interfere substantially with the recovery of the species.**

No individuals of Pink-tailed Worm Lizard were detected within the study area or project site during the field surveys which may be impacted by the proposal. Thus, the proposal is unlikely to interfere with the recovery of the species. However, should a population of the species be present, ample potential habitat would remain available for the species. The action would only remove 6.95 % of the potential habitat mapped within the study area for the species. The proposal will not increase the occurrence of weeds which would interfere with the recovery of Pink-tailed Worm Lizard. All large rocks (15 cm diameter – 70 cm diameter) removed from within the proposed development areas will be relocated to adjacent areas to supplement habitat.

# Appendix K: Biobanking Plot Methodology



**Table 37: Methods for Biobanking Plot Survey**

Characteristic	Method
Indigenous Plant Species Richness	<ul style="list-style-type: none"> <li>20 m x 20 m quadrat within each vegetation type in the same location as the general flora surveys quadrats.</li> <li>Quadrat was traversed and the number of indigenous vascular plant species counted.</li> </ul>
Percentage Foliage Cover	<p><b>Native Over-storey Cover</b></p> <ul style="list-style-type: none"> <li>Assessed at 10 points at 5 m intervals along a 50 m transect adjacent to the vegetation quadrat.</li> <li>Native over-storey is the tallest woody stratum present (including emergents) above 1 m and includes all species native to New South Wales (i.e. native species not local to the area can contribute to over-storey structure).</li> <li>Over-storey cover is estimated as percent foliage cover, which is equivalent to the amount of shadow that would be cast on the ground if there were a light source directly overhead.</li> <li>Results were summed and then divided by the number of points measured along the transect.</li> </ul> <p><b>Native Mid-storey Cover</b></p> <ul style="list-style-type: none"> <li>Assessed at 10 points at 5 m intervals along a 50 m transect adjacent to the vegetation quadrat</li> </ul>

Characteristic	Method
	<ul style="list-style-type: none"> <li>• Native mid-storey contains all vegetation between the over-storey stratum and a height of 1 m (typically tall shrubs, under-storey trees and tree regeneration) and includes all species native to New South Wales (i.e. native species not local to the area can contribute to mid-storey structure).</li> <li>• Percentage foliage cover of the mid-storey was estimated.</li> <li>• Results were summed and then divided by the number of points measured along the transect.</li> </ul> <p><b>Native Ground Cover (grasses)</b></p> <ul style="list-style-type: none"> <li>• Native ground cover contains all native vegetation below 1 m in height and includes all species native to New South Wales.</li> <li>• Native ground cover (grasses) refers to native grasses (i.e. plants belonging to the family Poaceae).</li> <li>• Estimates of the percentage foliage cover were taken at 1 m intervals along 50 m transect.</li> <li>• Only those species directly underneath the tape measure were counted.</li> <li>• The total of 'hits' was divided by the number of points measured along the transect (i.e. 50).</li> </ul> <p><b>Native Ground Cover (shrubs)</b></p> <ul style="list-style-type: none"> <li>• Native ground cover (shrubs) refers to native woody vegetation &lt;1 m. It is measured in the same way as for native ground cover (grasses)</li> </ul> <p><b>Native Ground Cover (other)</b></p> <ul style="list-style-type: none"> <li>• Native ground cover (other) refers to non-woody native vegetation (vascular plants only) &lt;1 m that is not grass (e.g. herbs, ferns).</li> <li>• It is measured in the same way as for native ground cover (grasses)</li> </ul>
Exotic Plant Cover	<p><b>Exotic Plant Cover</b></p> <ol style="list-style-type: none"> <li>1. Exotic plant cover was measured as total per cent foliage cover of all exotics in all strata.</li> <li>2. Exotic vascular plants (i.e. not native to Australia) within the each strata was estimated using the same methodologies used for the native over-storey, mid-storey and native groundcover (grasses) as outlined above.</li> </ol>
Number of Tree with Hollows	<ol style="list-style-type: none"> <li>3. All dead and alive hollow-bearing trees within the 20 m x 50 m plot were recorded where they met the following criteria:             <ol style="list-style-type: none"> <li>4. Hollow entrance visible;</li> <li>5. Hollow entrance ≥ 5cm across;</li> </ol> </li> </ol>

Characteristic	Method
	6. Hollow appears to have depth; 7. Hollow at least 1 m above the ground; and 8. The centre of the tree is within the plot (note that the hollow does not need to be within the plot).
Regeneration	9. Proportion of overstorey species present in the entire vegetation zone with a Diameter at Breast Height (DBH) $\leq$ 5 cm (i.e. regenerating). 10. Total proportion was calculated by dividing the number of regeneration trees by the total number of trees within the plot.
Total Length of Fallen Logs	<ul style="list-style-type: none"> <li>• Length of all logs within the 20 m x 50 m plot with a diameter <math>\geq</math> 10 cm and that were at least 0.5 m long were measured.</li> <li>• The lengths were then summed to obtain a total length of fallen logs within the plot.</li> <li>• For logs that were not wholly within the plot, only the part of the log that fell within the plot boundaries was measured.</li> </ul>

**Source and further details:** *Biobanking Operation Manual (DECC 2009)*

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