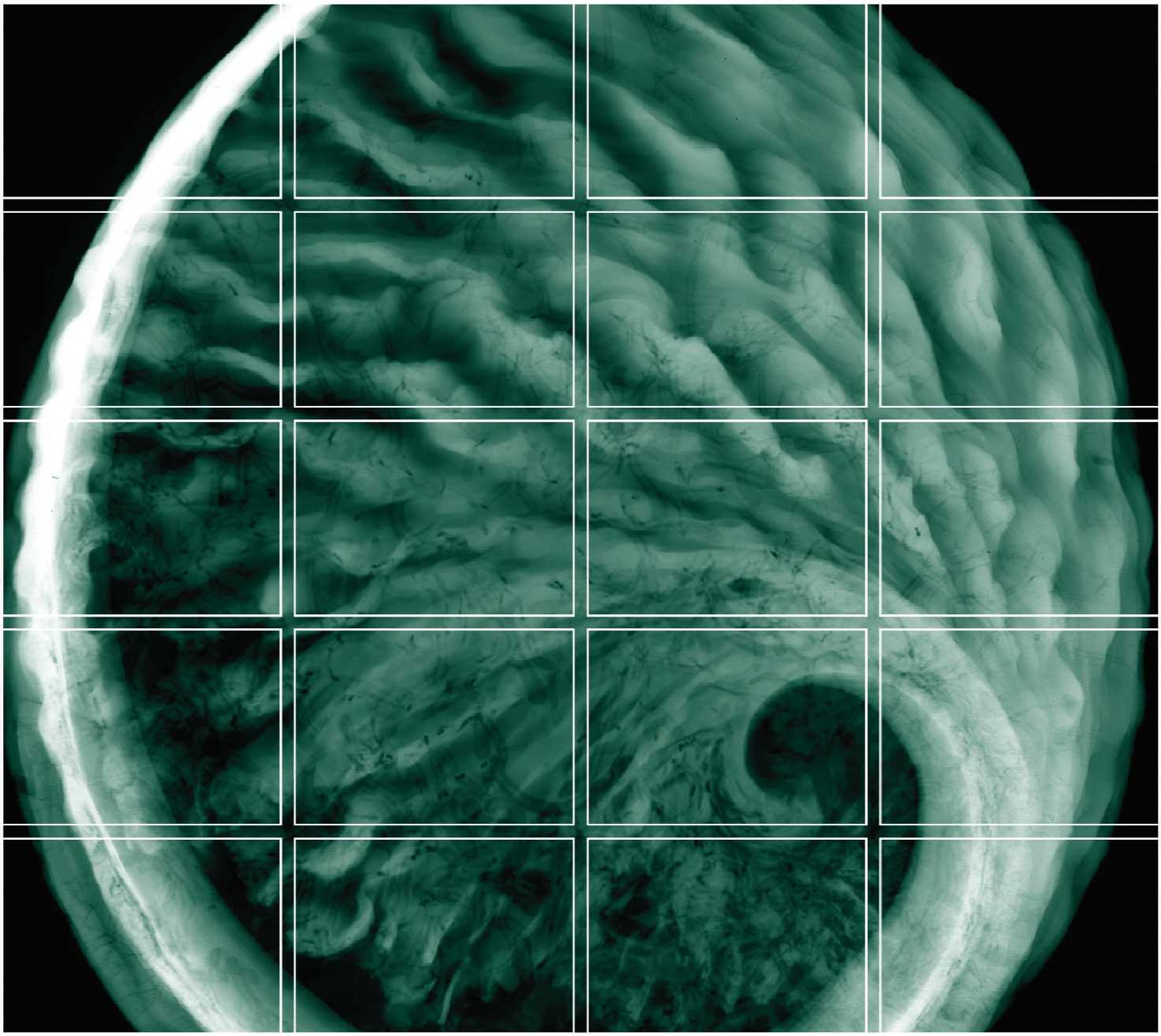


Paling Yards Wind Farm

Supplementary Ecology Report

Union Fenosa Wind Australia Pty Ltd

14 January 2014

0131035_Ecology_Rp01v02

www.erm.com

The world's leading sustainability consultancy

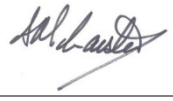
ERM

Paling Yards Wind Farm

Supplementary Ecology Report

Union Fenosa Wind Australia Pty Ltd

14 January 2014

Approved by:	*Adam Coburn*
Position:	Project Manager
Signed:	
Date:	*14 January 2014*
Approved by:	*Steve Laister*
Position:	Partner In Charge
Signed:	
Date:	*14 January 2014*

Environmental Resources Management Australia Pty Ltd Quality System

0131035_Ecology_Rp01v02

www.erm.com

FINAL REPORT

Union Fenosa Wind Australia Pty Ltd

Paling Yards Wind Farm
Supplementary Ecology Report

January 2014

Reference: 0131035_Ecology_Rp01v02

Environmental Resources Management Australia
Building C, 33 Saunders Street
Pyrmont, NSW 2009
Telephone +61 2 8584 8888
Facsimile +61 2 8584 8800
www.erm.com

CONTENTS

CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF PHOTOGRAPHS

1 INTRODUCTION

Environmental Resources Management Australia Pty Ltd (ERM) has been engaged by Union Fenosa Wind Australia Pty Ltd (Union Fenosa) to undertake a Supplementary Ecological Assessment for the proposed Paling Yards Wind Farm (the Project). The ecological assessment has been prepared in response to elements of the NSW Department of Planning and Infrastructure's (DoPI) adequacy review letter dated 9 May 2013 (the DoPI letter) regarding the Project. Specifically, this assessment addresses the biodiversity items from Attachment A of the Office of Environment and Heritage's (OEH) submission to the DoPI, as outlined in *Table 1.1*.

Table 1.1 Biodiversity Issues Identified in the DoPI Letter

Issue	Recommendation	Location in Report
Issue 1: Methodology	• provide justification for not utilising adequate survey techniques as outlined in the Threatened Species Survey and Assessment Guidelines (the Guidelines). In particular, provide a discussion relating to the consequences of inadequate surveying for bats; and • in the absence of surveys likely to detect a full range of fauna in the study site, the proponent should utilise whatever surveys are available to better inform which threatened species may occur within the project boundary.	Section 4.3
Issue 2: Avoidance	• include details of the site selection assessment with regard to ecological considerations; • ensure that all avoidance measures implemented in finalising the location and design of the facility are detailed within the EA; and • justify the level of avoidance implemented, based on further details regarding impacts to native vegetation throughout the site, including the northern transmission line.	Section 4.3 and 5.2

Issue 3: Assessment of Impacts	• provide (in table format) for all areas of remnant native vegetation, including areas of derived native grassland (DNG):
	  • the Biometric Vegetation Type;
	  • condition of the vegetation (in accordance with the BioBanking Assessment Methodology (BBAM)); and
	  • the impact area (in hectares) of all vegetation within the footprint of the development.
	• provide more detailed vegetation maps showing each vegetation type, by condition, within the activity area. Include information to allow third party verification of areas mapped as improved pasture. Ideally, the BBAM should be used to guide these assessments;
	• provide a map showing vegetation plot locations; and
	• undertake an assessment of all cleared areas to determine the extent and quantum of areas of DNG in the Study Area (including along the northern transmission line).
		Section 3.1 and Annexes A and C

Issue	Recommendation	Location in Report
Issue 4: Bird and Bat Impact	• undertake an impact assessment of the risk of bird and bat collision, the significance and potential mitigation of the impact, including: • an adequately detailed rationale to support conclusions on the likely significance of impacts; • consideration of site specific and landscape specific factors including (but not limited to) habitat, topographical features, movement corridors and weather in assessing impacts on birds and bats; and • genuine consideration of the potential for barrier effects and how this may effectively extend the footprint of the facility; and • consider options for mitigation of impacts of collision on bats and birds.	Chapter 4 and Annexes B and C
Issue 5: Mitigation	• profile the range of mitigation measures that would be genuinely considered for implementation at the site to mitigate any potential impacts, including level of success of these measures at other sites (where known).	Section 4.4
Issue 6: Offset Proposal	• determine if an offset is required, based on the results of additional field survey and analysis; and • prepare offset commitments prior to approval of the impact.	Section 5

1.1 DEFINITIONS

In this assessment, the following definitions apply:

- **Development Footprint:** the parts of the Study Area in which physical disturbance is proposed for development of the Project. This includes the location of infrastructure and any required easements including Wind Turbine Generators (WTGs) and associated crane pads, access tracks, a batching plant, substations, two options for the overhead power lines (including stanchions and their associated easements), underground electrical reticulation routes and wind monitoring masts. Areas that will be temporarily disturbed during construction are included in this area, ie the temporary concrete batching plant. The Development Footprint is based on CAD drawings provided by Union Fenosa on 14 May 2013.

- **Study Area:** the area which is the subject of this ecological assessment, which includes:

  - the area within 100 m of the Development Footprint; and

  - areas of potential habitat for threatened birds and bats within the Project Application Area.

- **Project Application Area (PAA):** the area in which Union Fenosa has applied to develop the Project. The PAA is bound by parcels of land associated with the Development Footprint.

1.2 LIMITATIONS

This ecological assessment is targeted towards responding to the biodiversity items raised in the DoPI letter within a tight timeframe and as such, the following limitations apply:

- the supplementary survey effort and season was restricted to a period of five days by two field ecologists (for a total of 10 days of field effort) in May 2013, thereby limiting opportunities to observe flora and fauna other than those that are present or visible during this season;

- supplementary surveys were not undertaken during the optimal survey season for the majority of native species (spring and summer);

- supplementary fauna survey techniques were targeted towards collecting data to support a collision risk assessment for threatened birds and bats;

- late autumn is not an optimal season for microbat surveys. It is anticipated that the abundance and diversity of the microbats will be lower than during spring and summer months. Two of the survey nights dropped below freezing and all dropped below 10 degrees centigrade. These temperatures are likely to restrict bat activity to the warmer periods of the night, typically in the early evening; and

- the supplementary bird survey will only capture bird species which are present and active during late autumn. On two of the colder days, bird activity was noticeably lower than other slightly warmer days, especially for the Wedge-tailed Eagle (*Aquila audax*).

2 METHODS

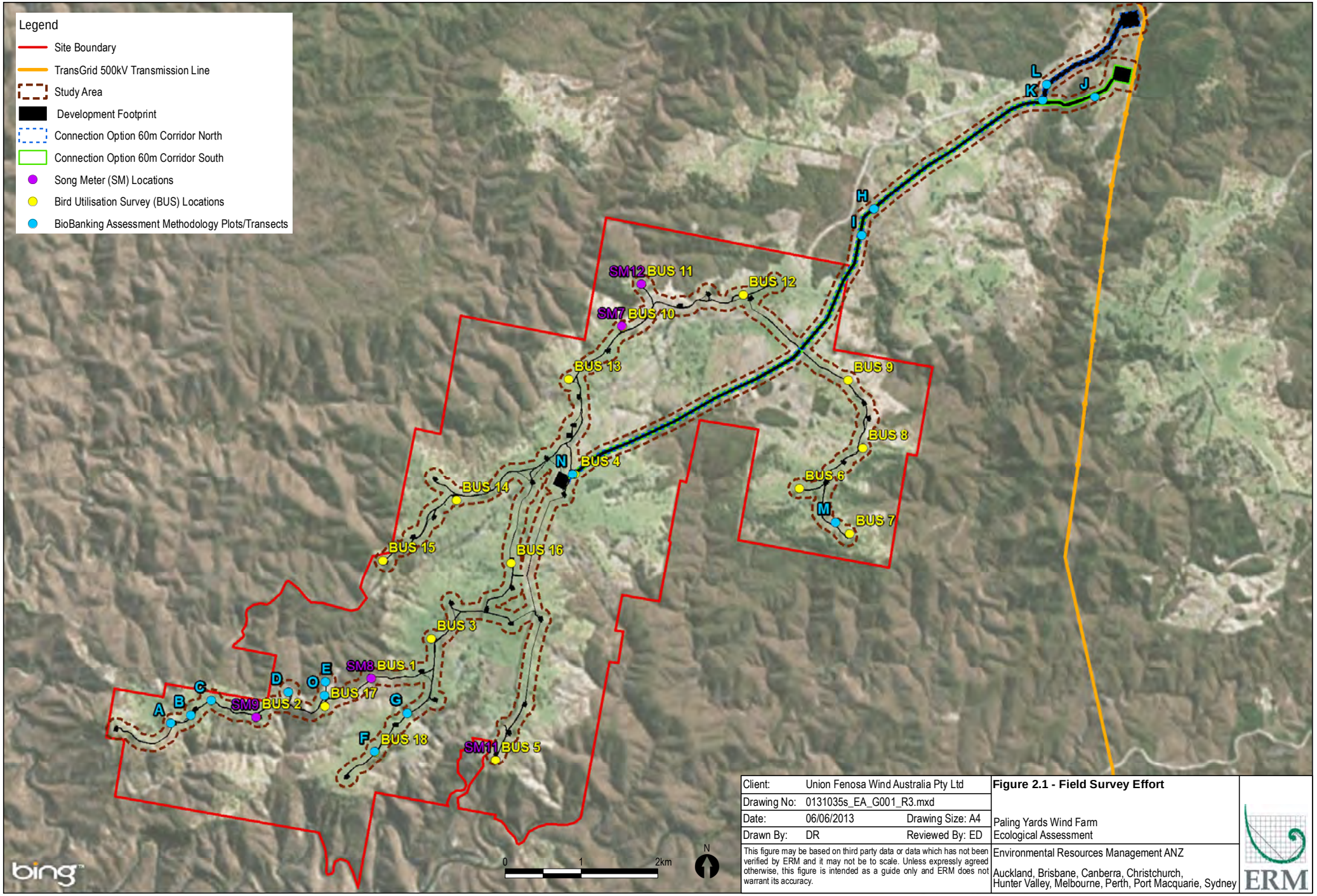
ERM undertook a five day site visit during 20 - 24 May 2013. This section describes the methods used during the site visit and subsequent data analysis and reporting.

2.1 VEGETATION MAPPING

ERM undertook a review of available mapping products for the Study Area at the commencement of the Project and during preparations for field investigations. This included:

- *Paling Yards Wind Farm: Environmental Assessment* (April 2013); and
- *Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands* (Tozer *et al.* 2010).

ERM undertook to map the vegetation of the Study Area according to the vegetation types defined in the NSW Biometric Vegetation Types (BVTs) Database. This was achieved with a combination of qualitative field observation and plot/transect data collection according to the BioBanking Assessment Methodology (BBAM) (DECC 2009). A total of 15 plot/transects were completed with at least one completed in each of the different vegetation types, including six completed in non-native pasture vegetation (refer *Figure 2.1*).



Client:	Union Fenosa Wind Australia Pty Ltd		**Figure 2.1 - Field Survey Effort**
Drawing No:	0131035s_EA_G001_R3.mxd		
Date:	06/06/2013	Drawing Size: A4	Paling Yards Wind Farm Ecological Assessment
Drawn By:	DR	Reviewed By: ED	Environmental Resources Management ANZ

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM

Vegetation Zones were created to represent the diversity of vegetation condition across the Study Area. This was achieved by assigning primary and secondary condition classes to each occurrence (or 'patch') of BVT observed in the Study Area. The primary condition class is a dichotomy prescribed in the BBAM which requires all native vegetation on a site to be classed as either:

- **Low Condition**: Native over-storey percent foliage cover less than 25% of the lower benchmark value AND less than 50% of groundcover vegetation is indigenous species; and

- **Moderate – Good Condition**: Native over-storey percent foliage cover greater than 25% of the lower benchmark value OR more than 50% of groundcover vegetation is indigenous species.

The condition class definitions provided above are for woody vegetation types. A secondary condition class was assigned based on field observation of the range of vegetation conditions across the Study Area. The nomenclatural rules used in this assessment for the assignment of the condition classes are described in *Table 2.1.* Note that references to 'benchmark' values are to the Biometric Vegetation Types Benchmarks Database which contains data on the floristic and structural characteristics of each BVT.

Table 2.1 Condition Class Definitions

Condition Class* (Primary_Secondary)	Definition
Mod-Good_Poor-Weedy	Native over-storey percent foliage cover between 25% of the lower benchmark value and within benchmark value Groundcover greater than 50% area covered by introduced species and
Mod-Good_Poor-Grassland	Over-storey percent foliage cover less than 25% of the lower benchmark value, however groundcover greater than 50% area covered by indigenous species
Mod-Good_Srubby	Over-storey percent foliage cover less than 25% of the lower benchmark value; and Although shrubby, mid-storey below benchmark value however groundcover greater than 100% of benchmark value appearing as a response to recent clearing
Mod-Good_Mod	Over-storey percent foliage cover greater than 50% of the lower benchmark value; and Mid-storey and groundcover affected by grazing or other agricultural impact however benchmark community structure and species composition partially represented

* Primary condition class definition is that for woody vegetation types in the BBAM (DECC 2009)

Where relevant the Vegetation Zones identified in the Study Area were equated to Threatened/Endangered Ecological Communities (TECs/EECs) listed under the EPBC Act and TSC Act respectively.

2.2 *FLORA*

A floristic inventory was collected through the identification of all flora species encountered in the BBAM plot/transects or incidentally in the field, either in-situ or by collecting a sample for later identification. A matrix was created detailing the relative cover value of each species in each plot. All samples were identified to species level where sufficient material of the individual was available. In some cases identification to genus or family level was the best possible result. Flora species nomenclature is consistent with the NSW Flora Online (PlantNet) (RBG&DT 2012).

2.3 *HABITAT*

The Study Area was initially assessed through interpretation of satellite imagery. Areas supporting native vegetation and potential fauna habitat were located and then surveyed by vehicle and on foot. Fauna habitat types were also quantified using biometric plots, which were undertaken in each BVT found within the Development Footprint.

2.4 *FAUNA*

2.4.1 *Microbats*

Bat surveys were undertaken to provide information on the status and use of the Study Area by bats, with emphasis on threatened bat species. Surveys were undertaken using static Songmeter bat detectors to sample the echolocation calls of free-flying bats in the Study Area. Songmeter surveys were conducted at five locations in the Study Area using SM2+ Bat units from 20 – 24 May 2013.

Harp trapping was not conducted for several reasons, relating to the season during which the field surveys were conducted. Due to the cold temperatures forecast and late autumn survey period, it was expected that low abundances of bats would occur at the Study Site, especially in open areas, where the wind turbines are proposed to be located. It was anticipated that the trapping rate would be very low and any captured bats would be subjected to an elevated chance of mortality due to the cold. Temperatures dropped below freezing on two of the survey nights, with the minimum temperature at Taralga, minus five degrees centigrade. This rationale was discussed with David Geering (OEH Dubbo, 16/05/13).

The survey locations were selected to represent the variety of habitats that occur within the Study Area. These comprised open cleared grazing paddocks with scattered trees and areas of woodland around the periphery of the Development Footprint. All of the Songmeter units were placed within close proximity to proposed wind turbines, with several overlooking steep slopes in order to detect high flying species. Songmeter units were programmed to commence operation approximately 30 minutes before dusk, and to cease approximately 30 minutes after dawn. The location of survey points are shown in *Figure 2.1.* Total survey effort equated to 18 Songmeter nights in total, refer to *Table 2.2.*

As discussed in *Section 1.2,* there were timing restrictions for the field work, and the late autumn survey is not optimal for microbats. Therefore, it is anticipated that the abundance and diversity of the microbats will be lower than during spring and summer months. One of the survey nights dropped below freezing and all dropped below 10 degrees centigrade. These temperatures are likely to restrict bat activity to the warmer periods of the night, typically early evening.

Table 2.2 Songmeter Effort and Habitat Type.

Unit No	Date Deployed	Date Collected	Habitat Type
SM 8	20/05/2013	24/05/2013	Boundary of woodland and pasture areas, no understory
SM 9	21/05/2013	24/05/2013	Scattered trees over pasture
SM 11	20/05/2013	24/05/2013	Scattered trees over pasture, overlooking wooded valley
SM 7	21/05/2013	24/05/2013	Open pasture overlooking wooded valley
SM 12	21/05/2013	24/05/2013	Scattered Trees over pasture, close to open woodland

SM - refers to the Songmeter Units used for the bat call recordings

Analysis

Analysis of bat calls was undertaken by Narawan Williams (Consultant Ecologist, Clarence Town, NSW). All of the data was analysed with a species list provided for each of the sites sampled. Species were attributed with Definite, Probable or Possible, depending on the level of confidence in the identification. When a threatened species was detected, the number of calls were documented to provide a relative estimate of activity within the Study Area.

2.4.2 Birds

The techniques used to survey birds focused on assessing bird utilisation of the development area, especially for birds flying at Rotor Swept Area (RSA) height. Bird Utilisation Surveys (BUS) were undertaken to assess species prone to rotor strike. All birds observed incidentally throughout the field surveys were also identified and it was noted if they were flying within the RSA height range, which was identified as being between 25 and 200 metres. The following sections describe the methods of the BUS surveys undertaken.

Bird Utilisation Survey

The methods adopted for the BUS were consistent with the requirements for a "Level One" bird risk assessment (AusWEA 2005). This approach has been endorsed in the AusWEA latest (2007) Best Practice Guidelines.

The BUS surveys were undertaken on 20 and 21 May 2013 and involved a fixed survey point bird count. Eighteen survey points were established at WTG locations and were distributed spatially across the Development Footprint. The location of each survey point is shown in *Figure 2.1.*

The BUS method involved two observers stationed at a fixed survey point for 15 minutes, recording the abundance of all large bird species observed within 800 m and all small birds within 100 m. For each observation distance from the centre point and flight height were also documented. Flight heights were classified using graded height intervals and later compared against rotor swept area (RSA) height for the proposed turbines, and classified as: below RSA height (less than 30 m), at RSA height (30 to 175 m), or above RSA height (above 175 m). When a bird was recorded flying through the range of different height categories which included RSA, a conservative approach was taken and the bird was listed as being within RSA. The RSA specified above takes a conservative approach, allowing for a range of different tower heights and blade lengths to be used. The actual RSA is likely to be smaller than listed above with a maximum range from 30 to 175 m above ground.

Incidental observations of waterbirds and raptors were made while moving about the Study Area. Emphasis was placed on observing birds that were moving at and above RSA height. As discussed in *Section 1.2,* there were timing restrictions for the field survey; therefore, the BUS surveys represent a snapshot of activity during late autumn, rather than an assessment of seasonal variation of bird utilisation of the Development Footprint.

2.5 *OFFSETS*

A BioBanking Assessment was undertaken to provide an indication of the area of land that would be required to offset the Project, along with an indication of the vegetation types that can be used for the offset. The assessment was undertaken by accredited BioBanking assessor Evelyn Craigie (Accreditation Number 0089). It was largely undertaken in accordance with the BBAM and Credit Calculator Operational Manual (DECC 2009), however, a simplified approach was adopted, with one 1000 ha assessment circle and one 100 ha assessment circle used. This did not cover the entire Project area, however, it covered an area that was representative of native vegetation cover across the Development Footprint. This approach has been used in previous indicative Biobanking assessments for wind farm projects. It was considered appropriate for this Project as a formal Biobanking Statement is not being sought at this stage.

Vegetation zones were assigned based on the vegetation mapping results provided in *Section 3.1*. The area of each vegetation zone is based on the area of the vegetation type in the permanent Development Footprint and the southern sub-option for the transmission line.

The BioBanking Credit Calculator Version 2.0 was used to calculate the credits required and the BioBanking Credit Converter was used to convert the credit requirements into an equivalent amount of hectares required for the offset.

3 RESULTS

3.1 WEATHER CONDITIONS

The weather conditions during the field investigations were cool with the temperature range between 1 - 15ºC during daylight hours (see *Table 3.1*). The details provided in *Table 3.1* were obtained from the nearest weather observation station at Taralga, approximately 25 km SSE of the Study Area.

Table 3.1 Taralga Daily Weather Observations May 2013

Date	Min Temp (°C)	Max Temp (°C)	Rain (mm)	Temp (°C)	Relative Humidity (%)	Cloud Cover (8th)	Wind Direction	Wind Speed (km/h)
20	-0.5	10.8	0	7	79	4	W	26
21	2.3	14.9	0	9.5	75	4	W	30
22	-5	10.5	0.2	3.5	76	6	WSW	7
23	3.5	11	16	8	100	8	SE	7
24	6	11	2.3	7.5	93	8	NW	13

Source: Bureau of Meteorology (2013)

3.2 VEGETATION MAPPING

Vegetation mapping of the Study Area was undertaken as discussed in the following sections.

3.2.1 Biometric Vegetation Types

Four BVTs were identified in the Study Area, as shown in *Table* 3.2. It is inherently difficult to identify vegetation types where there has been modification due to agriculture as the tree densities may have been reduced and grass species composition may have been altered from the pre-European condition for pasture improvement. In these cases the best suited vegetation type is selected based on available site observations such as remnant tree species type present.

Table 3.2 Biometric Vegetation Types in the Study Area

BVT Code	Biometric Vegetation Type
LA103	Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands
LA124	Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands
LA182	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion
LA186	River Oak forest and woodland of the NSW South Western Slopes and South Eastern Highlands Bioregions

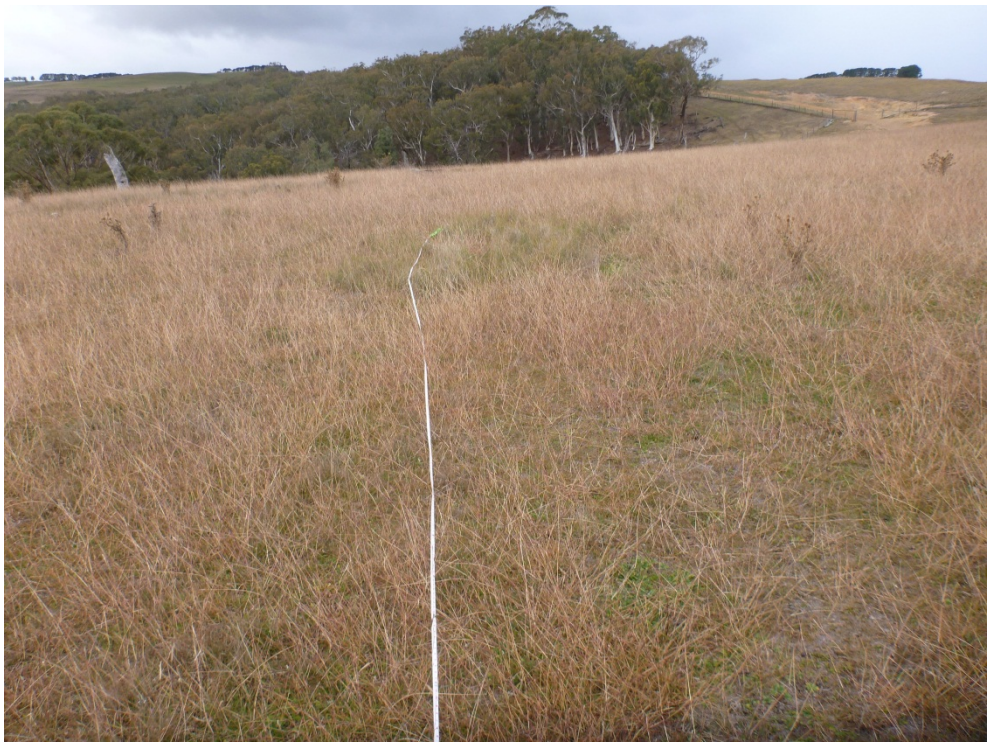
Condition classes were applied to each of the BVTs mapped in the Study Area to create Vegetation Zones (as described in *Section 2.1*). The vegetation zones present in the Study Area and their area in the Development Footprint are shown in *Table 3.3* and *Figure 3.1.*

A brief description of each BVT in the Study Area is provided below. Refer *to Annex A* for a full species list for each Vegetation Zone.

LA103: Apple Box - Yellow Box Dry Grassy Woodland of the South Eastern Highlands

This BVT exists in small patches of the Study Area and consists of native grasses occurring in pasture. There are no shrubs and scattered Apple Box (*Eucalyptus bridgesiana*), Yellow Box (*E. melliodora*) and Manna Gum (*E. viminalis*) trees occur throughout the pasture, however, none occur in the patches of native grass. The native grass patches in the west of the Study Area are dominated by Red Grass (*Bothriochloa macra*) and the patch in the centre part of the Study Area is dominated by Weeping Grass (*Microlaena stipoides*). The patches are subject to ongoing stock grazing. *Photograph 3.1* shows a typical example of this BVT in the Study Area.

Photograph 3.1 LA103: Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands



LA124: Broad-Leaved Peppermint - Brittle Gum - Red Stringybark Dry Open Forest On The South Eastern Highlands

This BVT is a woodland dominated by Broad-leaved Peppermint (*Eucalyptus dives*) and Red Stringybark (*E. macrorhyncha*) with occasional Bundy (*E. goniocalyx*) and Black Sally (*E. stellulata*). There are very few shrubs and the ground layer is sparse with abundant leaf litter. Grass species characteristic of this BVT are Small-flowered Wallaby-grass (*Rytidosperma setaceum*) and Snowgrass (*Poa sieberiana*). *Photograph 3.2* shows a typical example of this BVT in the Study Area.

This BVT occurs mostly around the fringes of the Study Area however some patches occur in the Study Area. Qualitative observation in the field indicates the BVT is widespread in the PAA. It occurs in the Study Area in two modified forms:

- one that has been cleared recently and allowed to regenerate with a thinned tree canopy layer and more densely distributed Cassinia shrubs and grasses; and

- another that has been cleared except for some scattered trees that have been retained amongst the native grasses used as pasture.

Photograph 3.2 LA124: Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands

LA182: Red Stringybark - Scribbly Gum - Red Box - Long-Leaved Box Shrub - Tussock Grass Open Forest The NSW South Western Slopes Bioregion

This BVT is a woodland that is dominated by Inland Scribbly Gum (*Eucalyptus rossii*) and Red Stringybark. There are very few shrubs, one species occurring is Hoary Guinea Flower (*Hibbertia obtusifolia*) and the ground layer is sparse with abundant leaf litter. *Photograph 3.3* shows a typical example of this BVT in the Study Area.

This BVT occurs on crests and slopes in the south west of the Study Area. Qualitative observation in the field indicates the BVT is widespread in the PAA. It occurs in the Study Area in an additional modified form where the vegetation has been recently cleared and allowed to regenerate with a thinned tree canopy layer and more densely distributed shrubs such as Hoary Guinea Flower, Heath Wattle (*Acacia brownii*), Ploughshare Wattle (*A. gunnii*), Daphne Heath (*Brachyloma daphnoides*) and Purple Wiregrass (*Aristida ramosa*).

Photograph 3.3 LA182: Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion

LA186: River Oak Forest and Woodland of The NSW South Western Slopes And South Eastern Highlands Bioregions

This BVT is a woodland along some ephemeral drainage lines dominated by Blakely's Red Gum (*Eucalyptus blakelyi*) and Manna Gum (*E. viminalis*). There are also Willow trees (*Salix spp.*) present along these drainage lines. There are very few native species in the mid and ground layer with a major abundance of Blackberry (*Rubus fruticosus agg. spp.*) shrubs.

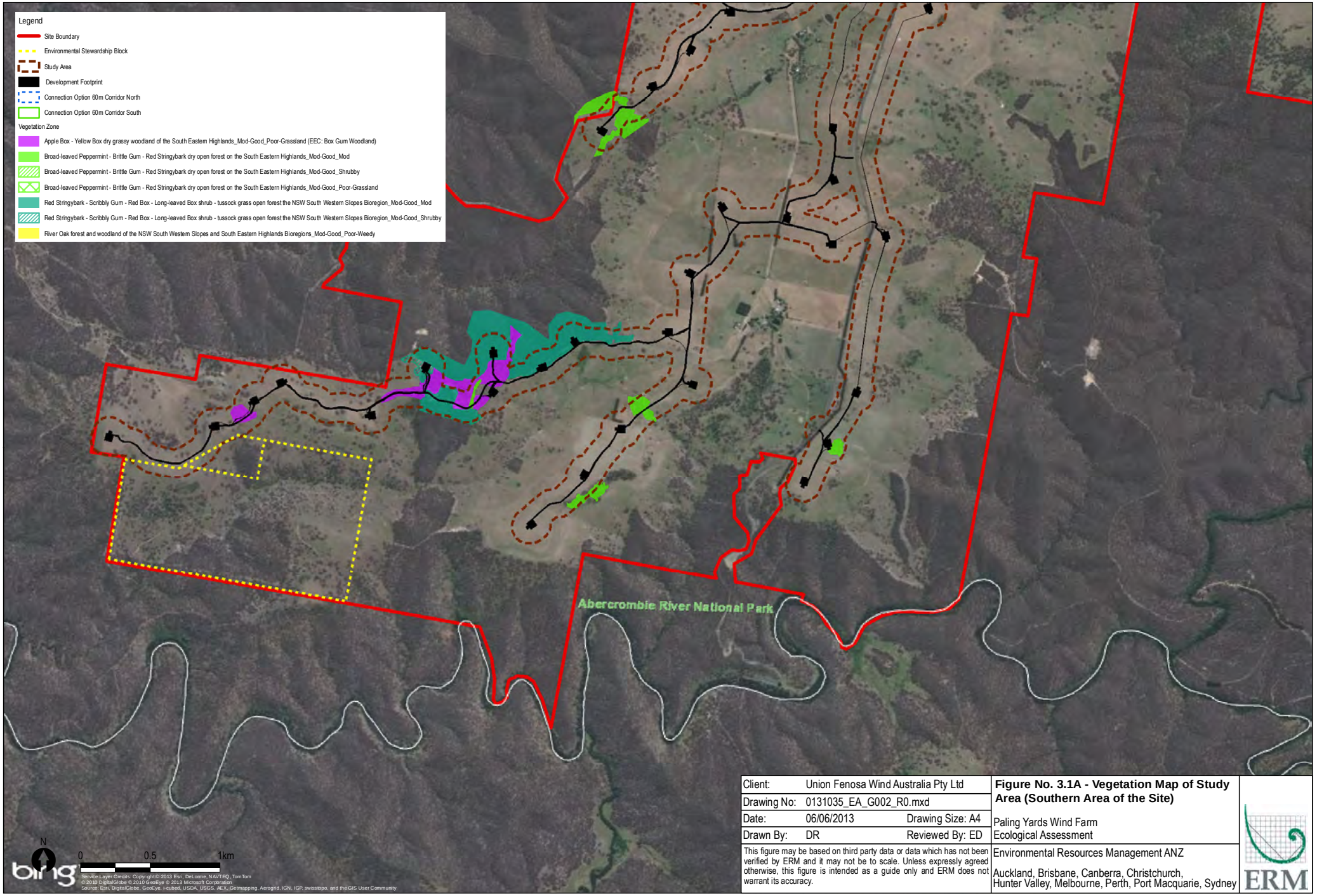
This BVT occurs along an ephemeral drainage line in the north of the Study Area. No River Oaks were observed but the BVT was selected to best describe the vegetation present on these drainage lines due to the presence of the other tree species matching the description. *Photograph 3.4* shows a typical example of this BVT in the Study Area.

Photograph 3.4 LA186: River Oak forest and woodland of the NSW South Western Slopes and South Eastern Highlands Bioregions

Table 3.3 Area of Each Vegetation Zone in the Study Area and Development Footprint

BVT Code	Vegetation Zone	Area in Development Footprint (ha)	Equivalent EEC Type
LA103_MG_PG	Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands_Mod-Good_Poor-Grassland	2.9	Box Gum Woodland occurring as Derived Native Grassland (TSC Act)
LA124_MG_M	Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands_Mod-Good_Mod	6.9	-
LA124_MG_PG	Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands_Mod-Good_Poor-Grassland	0.0	-
LA124_MG_Shrubby	Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands_Mod-Good_Shrubby	2.3	-
LA182_MG_M	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion_Mod-Good_Mod	1.4	-
LA182_MG_Shrubby	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion_Mod-Good_Shrubby	0.2	-
LA186_MG_PW	River Oak forest and woodland of the NSW South Western Slopes and South Eastern Highlands Bioregions_Mod-Good_Poor-Weedy	0.3	-
Total		**14.0**	-

1. The BVT Code is provided here with a suffix which is an abbreviation of the condition class
2. Sections of the development footprint include areas of existing cleared farm track, covering approximately 0.4 ha.



Client:	Union Fenosa Wind Australia Pty Ltd	
Drawing No:	0131035_EA_G002_R0.mxd	
Date:	06/06/2013	Drawing Size: A4
Drawn By:	DR	Reviewed By: ED

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

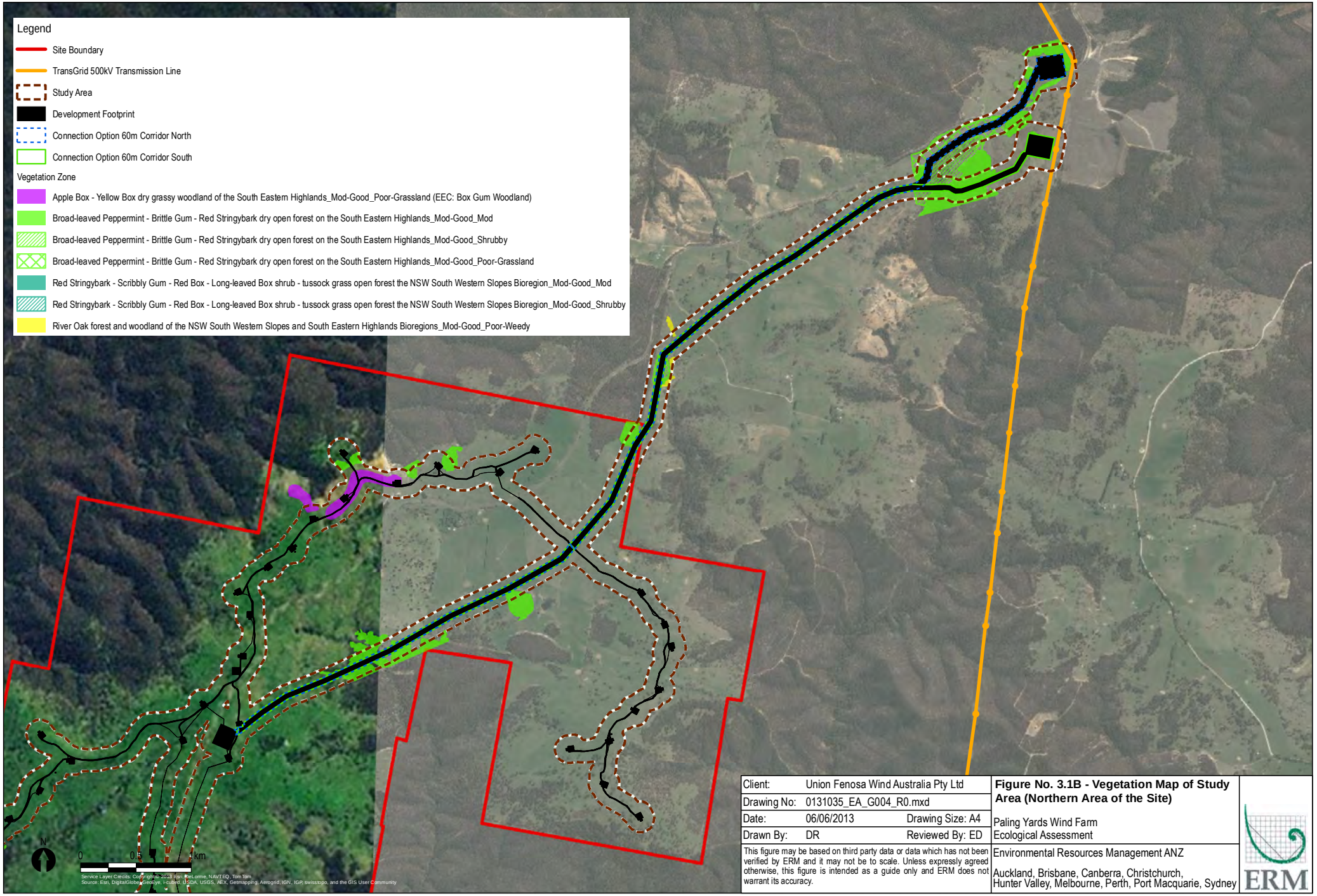
Figure No. 3.1A - Vegetation Map of Study Area (Southern Area of the Site)

Paling Yards Wind Farm
Ecological Assessment

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch,
Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM



Client:	Union Fenosa Wind Australia Pty Ltd	
Drawing No:	0131035_EA_G004_R0.mxd	
Date:	06/06/2013	Drawing Size: A4
Drawn By:	DR	Reviewed By: ED

Figure No. 3.1B - Vegetation Map of Study Area (Northern Area of the Site)

Paling Yards Wind Farm
Ecological Assessment

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch,
Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM

3.2.2 *Threatened and Endangered Ecological Communities*

The relationship of each of the Vegetation Zones to both EPBC Act-listed TECs and TSC Act-listed EECs is provided in *Table 3.3*. The only Vegetation Zone that constitutes an EEC is *LA103: Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands_ Mod-Good_Poor-Grassland,* as discussed below.

White Box Yellow Box Blakley's Red Gum Woodland (Box Gum Woodland)

This Vegetation Zone: *LA103: Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands_ Mod-Good_Poor-Grassland* constitutes the TSC Act-listed EEC: White Box Yellow Box Blakely's Red Gum Woodland (Box Gum Woodland) as the patches are areas of native grassland surrounded by scattered Apple Box and Yellow Box trees (see *Figure 3.1*). It is presumed that these areas are highly modified from their pre-European condition and in the past the structure of the vegetation would have comprised more trees with a herb-rich grassy layer. The areas occurring onsite now are derived from what is assumed to be their previous condition. Patches of the EEC occur along undulating slopes of the Study Area in discrete patches and are currently used as grazing lands.

The Vegetation Zone does not constitute the EPBC-Act listed condition of Box Gum Woodland as the patches have no mature trees (including no regeneration) and very low herb species richness.

3.2.3 *Exotic Vegetation Communities*

Exotic pasture comprises areas of grassland with greater than 75% exotic species and all or most of the indigenous vegetation has been removed (Benson 1996). Areas of exotic pasture are widespread across the Study Area (refer *Figure 3.1*). These areas have undergone pasture improvement and are dominated by exotic pasture species. They are predominantly used for cattle and sheep grazing. Common species in areas of exotic pasture include Cocksfoot (*Dactylis glomerata*), Brome species (*Bromus sp.*), legumes (*Medicago spp.*), Sheep Sorrel (*Acetosella vulgaris*), Barley Grasses (*Hordeum sp.*) and Rye Grass (*Lolium sp.*). Weed species such as Thistles (Variegated Thistle: *Silybum marianum*; Spear Thistle: *Cirsium vulgare* and St Barnaby's Thistle: *Centaurea solstitialis*) are prevalent in areas of exotic pasture. Where native species persist in areas of exotic pasture, they comprise scattered Speargrasses (*Austrostipa spp.*) and Wallaby Grasses (*Rytidosperma spp.*). Exotic pasture covers 759.0 ha of the Study Area.

3.3 *FLORA*

Field investigations identified 83 flora taxa in the Study Area, 55 (66.3%) of which were indigenous and 28 (33.7%) are introduced. A full list of flora species recorded in the Study Area is provided in *Annex A*.

3.3.1 Threatened Flora

Field investigations did not identify any threatened flora species nor any optimal or sub optimal habitat for any threatened flora species.

3.3.2 Introduced Flora

The *Noxious Weeds Act 1993* designates some introduced flora as 'declared noxious weeds'. This declaration designates actions required by the landholder in managing these weeds. Field investigations identified 28 introduced flora in the Study Area of which four are listed as Declared Noxious Weeds under the *Noxious Weeds Act 1993* in the Oberon LGA. These are shown in *Table 3.4.*

Table 3.4 Declared Noxious Weeds of the Study Area

Scientific Name	Common Name	Declaration Class and LGA	Location
Lycium ferocissimum	African Boxthorn	4 (Oberon)	In east of Study Area south of WTG 60
Nassella trichotoma	Serrated Tussock	4 (Oberon)	Widespread in Study Area
Rosa rubiginosa	Sweet Briar	4 (Oberon)	Widespread in Study Area
Rubus fruticosus sp. agg.	Blackberry complex	4 (Oberon)	Widespread in Study Area especially in north on undulating slopes and in ephemeral drainage lines

Class four weeds are plants that pose a potentially serious threat to primary production, the environment or human health, are widely distributed in an area to which the order applies and are likely to spread in the area or to another area. The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction (DPI 2013). Four class four weeds were identified in the Study Area all of which are widespread and common across the Study Area (refer *Table 3.4*).

3.4 HABITAT

The majority of the Development Footprint consists of improved pasture with scattered Eucalypt trees and small patches of derived native grassland around the periphery. This area provides suitable habitat for disturbance tolerant bird and bat species with abundant birds including the Australian Raven (*Corvus coronoides*), Australian Magpie (*Cracticus tibicen*) and Sulphur-crested Cockatoo (*Cacatua galerita*). The pasture areas do not represent significant habitat for fauna, although two threatened species were recorded, the Flame Robin (*Petroica phoenicea*)_and the Scarlet Robin (*Petroica boodang*). Specific hollow-bearing tree surveys were not undertaken, although it was noted that there were few tree hollows which existed within the Development Footprint.

The Development Footprint is surrounded by forest which is likely to provide higher habitat value for both birds and bats, including the potential for threatened woodland birds to occur. Impacts to the forested areas as a result of the Project have largely been avoided through the design process, with one turbine removed and three turbines resited in order to reduce clearance (Anderson, 2012). Three turbines are within areas which will require some clearance of forested areas.

3.5 FAUNA

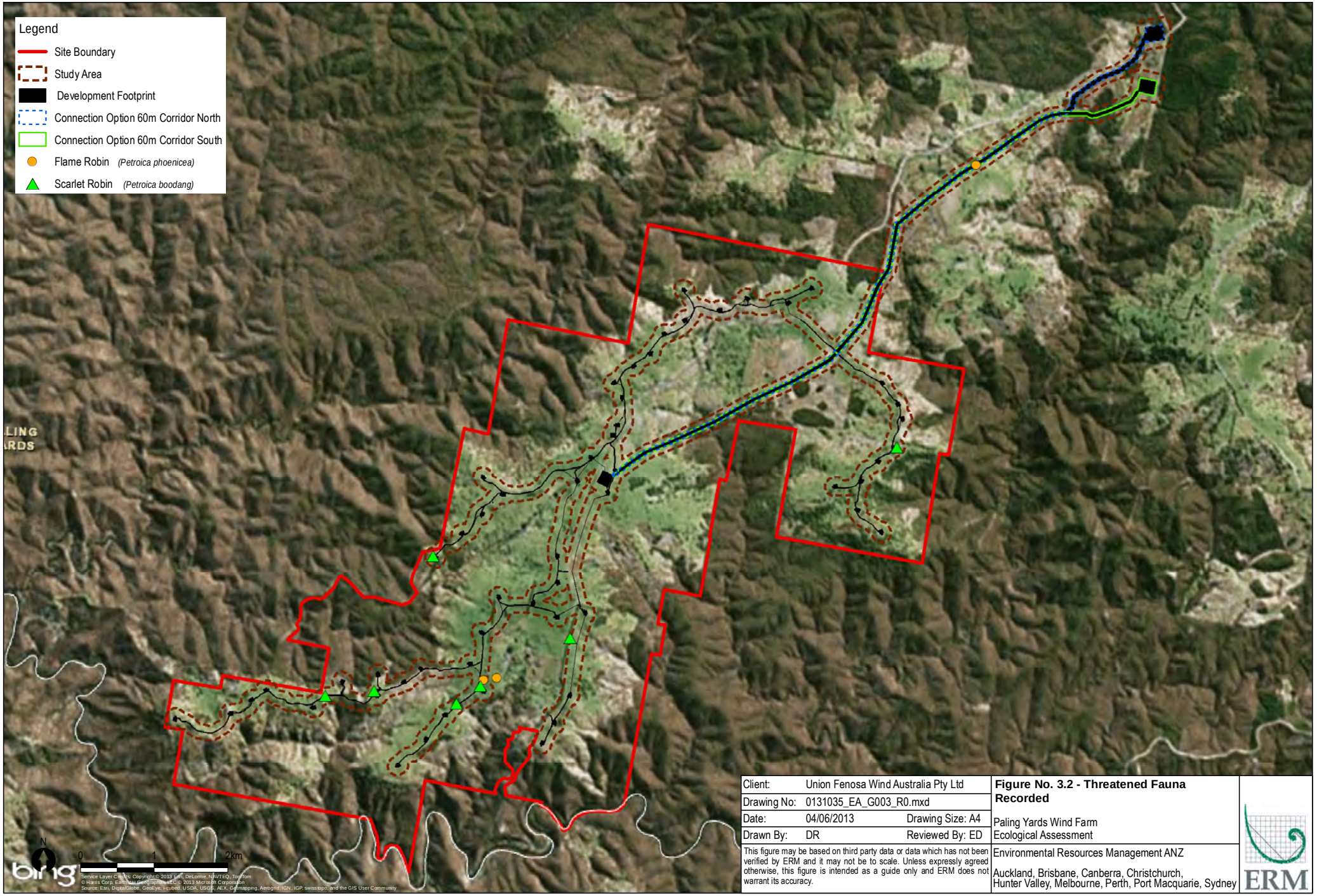
The majority of species were recorded incidentally with a total of five native mammals and two exotic mammals observed (refer to *Table 3.5*). Forty bird species were recorded; including two species listed as Vulnerable under the TSC Act, the Flame Robin and the Scarlet Robin (refer to *Figure 3.2*). Nine Flame Robins were observed in three groups and 19 Scarlet Robins in seven groups. Both of these species were observed throughout the Study Area, typically within areas of improved pasture and perching on fences. There did not appear to be a preference for habitat adjacent to woodlands or scattered trees, with many of the Robins observed foraging freely in open areas.

Table 3.5 Fauna Recorded during the Field Surveys

Common Name	Scientific Name	EPBC	TSC Act
MAMMALS			
Eastern Grey Kangaroo	*Macropus giganteus*	-	-
Eastern Wallaroo	*Macropus robustus*	-	-
Red Necked Wallaby	*Macropus rufogriseus*	-	-
European Rabbit*	*Oryctolagus cuniculus**	-	-
Common Wombat	*Vombatus ursinus*	-	-
European Red Fox*	*Vulpes vulpes**	-	-
Swamp Wallaby	*Wallabia bicolor*	-	-
BIRDS			
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	-	-
Grey Teal	*Anas gracilis*	-	-
Pacific Black Duck	*Anas superciliosa*	-	-

Common Name	Scientific Name	EPBC	TSC Act
Australasian Pipit	*Anthus novaeseelandiae*	-	-
Wedge-tailed Eagle	*Aquila audax*	-	-
Hardhead	*Aythya australis*	-	-
Sulphur-crested Cockatoo	*Cacatua galerita*	-	-
Muscovy Duck*	*Cairina moschate**	-	-
Australian Wood Duck	*Chenonetta jubata*	-	-
White-winged Chough	*Corcorax melanorhamphos*	-	-
White-throated Treecreeper	*Cormobates leucophaea*	-	-
Australian Raven	*Corvus coronoides*	-	-
Pied Butcherbird	*Cracticus nigrogularis*	-	-
Australian Magpie	*Cracticus tibicen*	-	-
Black Swan	*Cygnus atratus*	-	-
Laughing Kookaburra	*Dacelo novaeguineae*	-	-
Emu	*Dromaius novaehollandiae*	-	-
White-faced Heron	*Egretta novaehollandiae*	-	-
Black-shouldered Kite	*Elanus axillaris*	-	-
Galah	*Eolophus roseicapillus*	-	-
Brown Falcon	*Falco berigora*	-	-
Nankeen Kestrel	*Falco cenchroides*	-	-
Eurasian Coot	*Fulica atra*	-	-
Magpie-lark	*Grallina cyanoleuca*	-	-
Welcome Swallow	*Hirundo neoxena*	-	-
Superb Fairy-wren	*Malurus cyaneus*	-	-
Noisy Miner	*Manorina melanocephala*	-	-
Little Pied Cormorant	*Microcarbo melanoleucos*	-	-
Jacky Winter	*Microeca fascinans*	-	-
Scarlet Robin	*Petroica boodang*		V
Flame Robin	*Petroica phoenicea*		V
Common Bronzewing	*Phaps chalcoptera*	-	-
Crimson Rosella	*Platycercus elegans*	-	-
Eastern Rosella	*Platycercus eximius*	-	-
Willie Wagtail	*Rhipidura leucophrys*	-	-
Pied Currawong	*Strepera graculina*	-	-
Common Starling*	*Sturnus vulgaris**	-	-
Australasian Grebe	*Tachybaptus novaehollandiae*	-	-
Banded Lapwing	*Vanellus tricolor*	-	-
Masked Lapwing	*Vanellus miles*	-	-

1. V – Listed Vulnerable under the TSC Act
2. * Denotes and exotic species



Client:	Union Fenosa Wind Australia Pty Ltd	
Drawing No:	0131035_EA_G003_R0.mxd	
Date:	04/06/2013	Drawing Size: A4
Drawn By:	DR	Reviewed By: ED

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

Figure No. 3.2 - Threatened Fauna Recorded

Paling Yards Wind Farm
Ecological Assessment

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM

3.5.1 Microbats

A total of 2,981 bat calls were analysed, which were recorded over 18 unit nights between 20 - 24 May 2013. Twelve microbat species were identified with varying levels of confidence (five definite, one probable, three possible and three that could be one of two species) (see *Table 3.6*). This included three threatened species, none of which were a definite identification (shown in bold in *Table 3.6*).

Table 3.6 Bat Species Recorded

Scientific Name	Common Name	Status TSC Act	Status EPBC Act	Confidence
Chalinolobus gouldi	Gould's Wattled Bat	-	-	Definite
Chalinolobus morio	Chocolate Wattled Bat	-	-	Definite
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	Probable / Possible
Scotorepens orion or ***Falsistrellus tasmaniensis***	Eastern Broad-nosed Bat or Eastern False Pipistrelle	-	-	Either
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	Possible
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat	V	-	Possible
Miniopterus schreibersii oceanensis or *Vespadelus darlingtoni*	Eastern Bent-wing Bat or Large Forest Bat	-	-	Either
Nyctophilus species (N. gouldi or *geoffroyi)*	Lesser Long-eared Bat or Gould's Long-eared Bat	-	-	Either
Scotorepens orion	Eastern Broad-nosed Bat	-	-	Possible
Tadarida australis	White-striped Freetail-bat	-	-	Definite
Vespadelus darlingtoni	Large Forest Bat	-	-	Definite
Vespadelus vulturnus or *V.regulus*	Little Forest Bat or Southern Forest Bat	-	-	Either

Definite – 100% confidence, Probable – over 60% confidence, Possible - between 20 and 60%.
EPBC Act and TSC Act Status; V – Vulnerable

Of the threatened species recorded, the Eastern False Pipistrelle was recorded by all five songmeters. There were 19 probable recordings, two possible recordings and 181 calls that may have been the Eastern False Pipistrelle or the Eastern Broad-nosed Bat.

The Greater Broad-nosed Bat was recorded four times with a confidence level of 'possible'. This species was recorded on SM7, which was located in open pasture overlooking a wooded valley.

The Eastern Bent-wing Bat was recorded by SM8 and SM11, which were located at the boundary of woodland and pasture and in scattered trees over pasture, overlooking a wooded valley. There was one possible recording of this species' call and three recordings that may have been this species or the Large Forest Bat.

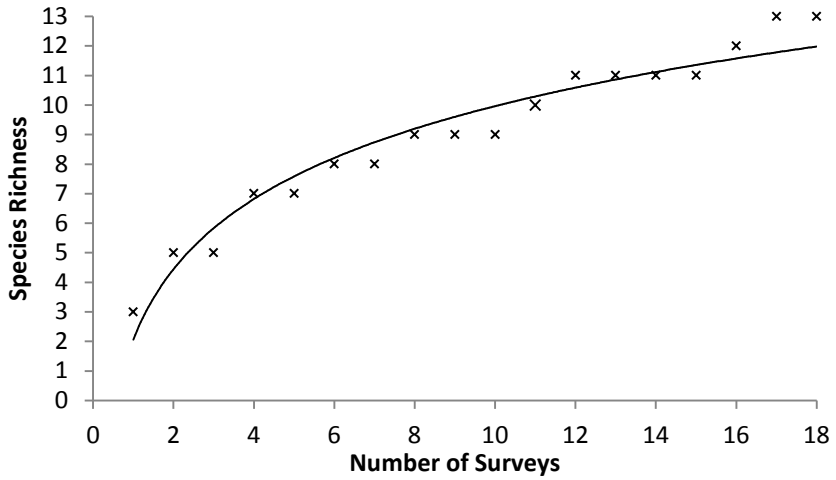
3.5.2 Bird Utilisation Surveys

This section details the results of the BUS undertaken on 20 and 21 May 2013. A total of 125 birds were recorded from 18 surveys. There were 13 different species identified, with the most abundant being the Australian Raven, Australia Magpie (*Cracticus tibicen*) and the Wedge-tailed Eagle. One threatened species was recorded: Scarlet Robin. This species is unlikely to fly at RSA height. No migratory species were recorded.

The majority of birds were observed flying short distances between trees and then perching. Often the peak activity was on arrival to site when birds were flushed from the immediate area into the surrounding trees. The majority of birds were observed individually or in small groups. On one occasion 27 Australian Ravens were disturbed, which may have been foraging on the ground, perhaps on a carcass, although this was not located.

The number of species recorded rose rapidly within the first five surveys conducted and then began to decline (Refer to *Figure 2.1*). After completion of the 18 surveys the number of new species declined, however had not reached asymptote.

Figure 3.3 Species Accumulation Curves for All Species Recorded



Species Recorded At RSA Height

Wedge-tailed Eagles were recorded flying at RSA height nine times during the BUS, which is 7% of the total number of birds recorded. No threatened species were observed flying at RSA height during the field surveys. The Wedge-tailed Eagles were observed soaring at range of heights from 10 m to over 250 m and were recorded across the Study Area. The species is not likely to be restricted to particular habitat types and were observed using ridges and hills within the Development Footprint to gain altitude, before moving away and exhibiting foraging behaviour over the surrounding forested areas.

Few birds were recorded flying at RSA outside of the BUS survey and were limited to Sulphur-crested Cockatoo, Australian Magpie and Australian Raven all of which were recorded infrequently flying close to the lower limit of RSA height at between 25 and 35 m. The majority of birds recorded incidentally and during the BUS were seen to hug the contours, rarely fly directly above ridge tops where the turbines are proposed. No species were observed exhibiting direct movement at height over the landscape as would be expected from migrating species.

4 IMPACT EVALUATION

This impact evaluation has been undertaken in response to the DoPI letter, and aims to directly address the issues raised by DoPI and OEH. This assessment does not aim to provide a review of all impacts to ecological values of the Study Area, as this has previously been addressed within the Project Environmental Assessment.

The impact evaluation has been undertaken in relation to the following:

- avoidance measures for native vegetation (Issue 2);
- native vegetation in the Study Area (Issue 3);
- bird and bat collision risk (Issue 4); and
- mitigation measures, updated to reflect the results of the field survey (Issue 5).

4.1 PROPOSED DEVELOPMENT

The Project comprises a number of components that would impact on ecological features, including permanent and temporary components. Those that have been included in this impact evaluation are listed in *Table 4.1* and further details are provided in the sections below.

Table 4.1 Project Components

Project Component	Number / Length	Maximum Dimensions
Permanent		
WTG	55	20 m x 20 m
Access tracks	-	6 m x 26.04 km
Substations	2	250 m x 210 m
Transmission lines (including power poles)	-	60 m x 9000 m*
Wind monitoring mast footings	3	6 m²
Crane pads	55	50 m x 50 m
Temporary		
Construction access tracks	-	10 m x 26.04 km
Batching plant	1	80 m x 80 m
Construction disturbance areas	-	2 m around the footprint of each WTG, crane pad, batching plant and monitoring tower
*This length includes both sub-options, of which only one will be selected.		

4.1.1 *Wind Turbine Generators*

A number of different WTG models are being considered for the Project. The dimensions associated with the largest model are considered in this assessment. The WTGs would have an overall height of up to 175 m when constructed. This envelope includes a tower of up to 107 m in height to the hub, coupled with a 67 m long blade (excluding hub) and an approximate two metre wide hub (i.e. a hub to rotor-tip radius of 68 m).

Reinforced concrete 'gravity foundations' of up to 20 x 20 m wide and between 1.5 to 3 m in depth, and/or reinforced concrete 'rock anchor foundations' of up to 12 x 12 m wide and reinforced concrete anchors of up to 20 m into the bedrock depending on the prevailing ground conditions.

4.1.2 *Crane Pads*

A temporary hardstand area of approximately 50 x 50 m would be required to enable the construction of each WTG. The hardstand area would be constructed of compacted soil and gravel to provide a stable platform for construction equipment and the crane. The hardstand area is only required for the construction phase and the gravel would be removed following construction. The compacted soil would remain to facilitate any major maintenance works required through the life of the Project. In areas where the crane pads occur in pasture, the pasture would be allowed to re-colonise the cleared area. In areas where the crane pads occur in native vegetation, the soil will be mechanically loosened to allow natural regeneration of the cleared area.

4.1.3 *Access Tracks*

A network of access tracks would lead from the proposed access points on the public roads to the WTGs and between each WTG. Existing farm tracks would be used as much as possible. During the construction phase of the project, the width of the access tracks would be approximately 8 – 10 m, in order to support the extra load of trucks carrying equipment and cranes for the erection of the towers. This width would be reduced during the operation phase of the project to approximately six metres.

4.1.4 *Overhead Transmission Line*

An overhead transmission line is proposed to connect to the Mt Piper to Bannaby 500 kV powerline. This comprises a corridor approximately 9 km in length and 60 m in width. Transmission line power poles will be spaced approximately 200 – 250 m apart. A permanent access track will not be constructed along the length of the transmission line as access will be gained informally across grassed paddocks using the closest route from existing tracks/roads nearby.

The 60 m easement associated with the transmission line would undergo limited clearing, i.e. only the vegetation within the power pole locations would be removed. There would be approximately 45 power poles along the centre of the easement, for which a permanent area of 1.5 m^2 would be cleared and a temporary area of 20 m^2 would be disturbed by heavy machinery. Outside the power pole locations, vegetation up to four metres in height would remain and vegetation up to 15 m in height at the edges of the easements would also remain.

4.1.5 Underground Cables

All cables would generally follow the same alignment as the access tracks, however, there are locations where the cable would diverge from the access tracks to reduce electrical losses and to overcome ground constraints. The underground cables are laid approximately one metre deep and would require a one metre wide cleared corridor during construction.

4.1.6 Substations

An on-site substation with a control room and facilities building would be located at the centre of the Project. A second substation would be located at the point where the overhead transmission line connects to the Mt Piper to Bannaby 500 kV powerline.

A construction envelope of approximately 250 m x 210 m would house the buildings surrounded by a fence and screening vegetation. This area includes the control room and facilities building that are approximately 400 m^2 each.

4.1.7 Wind Monitoring Masts

Up to three new permanent wind monitoring masts are proposed to provide ongoing wind data. They comprise a tall, thin tubular or lattice structure of up to 105 m with guy wires for support. Six footings of one square metre each are required.

4.1.8 Batching Plant

A batching plant with an area of approximately 80 m x 80 m is proposed near the centre of the Project. This area would incorporate loading bays, hoppers, silos, hardstand areas, water tanks and stockpile areas for the storage of the aggregates, sands and other raw materials.

4.2 *POTENTIAL IMPACTS*

Wind farm developments can result in a number of direct and indirect impacts to ecological features. The specific impacts that are considered in this assessment are:

- vegetation clearance;
- collision-related mortality;
- barotrauma; and
- avoidance of habitat (specific to birds and bats).

4.2.1 *Vegetation Clearance*

Vegetation clearance is required to install the various components of the wind farm. It includes the temporarily cleared areas during the construction phase, which are rehabilitated upon completion of the construction works, and the permanently cleared area. Vegetation clearance is a direct impact, which is quantified based upon the Development Footprint of the Project, involving all aspects of the Project components.

The potential impacts of vegetation clearance include reduction in the extent of native vegetation, loss of habitat, introduction of weeds and modification of surrounding areas of native vegetation.

The updated vegetation mapping indicates that the majority (86.6%) of the Development Footprint is proposed in areas of exotic pasture, thereby reducing the extent of native vegetation clearance (refer *Section 4.3* and *Section 4.5.1*).

4.2.2 *Collision-related Mortality*

Operational wind farms pose a collision risk to birds and bats where rotor strike can cause injury and/or death. Fatalities and injuries are usually caused by a collision with the moving blades (blade strike), or with turbine infrastructure, such as guy lines and powerlines. Lighting on wind farm turbines may also increase the likelihood of blade strike to insectivorous bat species by attracting insects to within the rotor swept area (RSA), thus causing bats to forage within this area and interact with the rotors.

The area of the Development Footprint where WTG are proposed is approximately 11 km by a maximum of 4.5 km. This area is dominated by improved pasture with some scattered trees on a plateau with gently rolling hills. The Development Footprint offers low habitat value for the majority of species, due to the highly cleared nature of the area. The landscape surrounding the Development Footprint is strongly contrasting with continuous forest and steeply incised valleys, although typically slightly lower in altitude than the Development Footprint. The Abercrombie River National Park adjoins the PAA to the north and west, with a small section also adjoining the south eastern corner of the PAA.

The forested areas will provide higher value habitat for the majority of fauna than the Development Footprint and will contain higher abundances and diversity of species. This may increase the collision risk within the Development Footprint, if birds and bats traverse the development area from forest to forest. Whilst this will occur to an extent, it is not considered likely that large numbers of volant species will cross the Study Area. This is due to the Development Footprint being higher than the majority of the surrounding area which would increase energy expenditure required for species flying over the plateau area. In addition, the open nature will also deter species which are vulnerable to predation in open areas. There were no potential movement corridors identified within the Development Footprint such as vegetated corridors or narrow cleared areas or saddles between forested areas. As such there are no recommendations to alter the placement of WTGs. The placement of the Development Footprint is not within any identified migratory corridor and it is not anticipated that the proposal will result in an elevated collision risk when compared to similar projects.

Impacts on Birds

The main potential impacts on bird species from an operational wind farm are:

- direct mortality associated with rotor collisions and collisions with other associated infrastructure including towers, guy wires and transmission lines; and

- indirect impacts relating to habitat loss through the effects of installation of wind farm facilities.

Rotor strike is reasonably well studied in Europe and the Americas where flocking seasonal migratory birds are common, whereas literature relating to rotor strike in Australia is relatively scarce.

Alienation of habitat is also a key consideration which is related to rotor strike, as it indicates a measure of "avoidance" of WTGs by birds and bats. In Australia, birds are generally considered to avoid flying through operational WTGs at a rate of 95% to 99% (Smales, 2005). This avoidance affect essentially leads to a loss of habitat within the footprint of the proposed development, but it also greatly reduces the number of birds interacting with WTGs once the wind farm is operational.

Collision risk depends on a wide range of factors as summarised below:

- high collision rates have been recorded at several large wind farms using older technology consisting of small, fast spinning models or using lattice masts where roosting can occur located in areas where large concentrations of birds are present (eg Altamont Pass in California, USA, Tarifa and Navarra in Spain (BL&A 2011)). High collision rates are particularly evident for large soaring raptors, near areas used by large numbers of roosting or foraging birds, migratory flyways or local fly paths or areas with high bird use. No large concentrations of birds were recorded in the Study Area and the area is not known to form part of any significant migratory routes for large numbers of birds. Wedge-tailed Eagles were frequently observed within the Study Area, soaring at RSA height and may be susceptible to rotor strike;

- large birds with poor manoeuvrability (such as larger waterbirds) are generally at greater risk of collision with wind turbines (BL&A 2011). Species that habitually fly at dawn, dusk or at night are also less likely to detect and avoid turbines. No large water birds were recorded during the field surveys. Although Wedge-tailed Eagles are large birds, they are manoeuvrable and are likely to avoid the turbines in most cases and this species is considered to be common within the Locality and the broader NSW region;

- bird collision risk may vary on a seasonal basis due to bird migration or breeding. No birds were recorded exhibiting direct movement at height and no birds listed as Migratory under the EPBC Act were recorded. The field surveys were conducted over five days in May 2013 and therefore only represent a snapshot of bird utilisation within the Development Footprint; and

- migratory birds that may visit the Study Area in some years based on spatial and temporal flowering patterns and other resource availability.

Studies on the interactions between wind farms, birds and bats have been undertaken across the world for decades. In the United States it is estimated that between 10,000 and 40,000 birds and bats are killed annually by collisions with wind farms (NWCC 2001).

In Australia studies tend to focus on the impacts to threatened species. A report produced for the Department of Environment and Heritage in 2005 carried out modelling to gauge the cumulative impacts of wind farm developments on the Swift Parrot (*Lathamus discolor*), across its range in south eastern Australia. The modelling used provides a measure of the potential risk at different rates at which birds might avoid collisions (Smales 2005). The report concluded that the number of Swift Parrots that the model predicts might be killed on average per annum at each wind farm, according to three avoidance rates, modelled a cumulative total of between 0.08 and 0.13 Swift Parrots per year predicted to be killed by collisions at all of the sites the population is likely to encounter within its natural range. This equates to slightly more or less than a single parrot killed every ten years (Smales 2005). Therefore, the cumulative impacts of collision with turbines on the overall population of Swift Parrots as predicted by the modelling for all current and presently proposed wind farms as of 2005 within the species' range are very small (Smales 2005).

In North America and Europe most bird collisions at wind farms are attributed to migrating birds. Many Northern hemisphere species are distinctly migratory, however most Australian species are nomadic, moving long distances in response to rainfall and drought at a continental scale. The data collected in this study indicates that the most abundant bird species flying at RSA height was the Wedge-tailed Eagle with 9 sightings at RSA height during the BUS. The other species observed at RSA, the Australian Raven and Australian Magpie, were recorded infrequently. Given the abundance and wide distribution of the species recorded flying at RSA height, population scale impacts are not considered likely within the Study Area. No threatened species were recorded flying at RSA height.

Impacts on Bats

Limited data is available on wind farm impacts on bats in Australia. The only mortality rate data in the public domain in Australia is that from Woolnorth wind farm of 1.86 bats per turbine per year, published by Hydro-Tasmania. This rate range is comparable to that recorded for most North American and European wind farms (BL&A 2011).

Several hypotheses have been suggested in an attempt to determine how and why bats are killed by wind turbines (BL&A 2011). These include:

- sensory failure where bats are unable to visually or acoustically detect moving turbine blades (non-echo locating bats are less able to avoid collision);
- roost attraction where bats may mistake turbines for a roost;
- acoustic attraction where bats are attracted to sounds generated by turbines;

- insect concentration such that bats are attracted to lit areas such as wind farms because of higher insect activity;

- food resources, in that wind farms tend to be built in areas where insects are concentrated (e.g. hilltops and ridges), thus in prime foraging habitat for bats. Open spaces around turbines may also create favourable foraging habitats; and

- decompression – sudden changes in air pressure created by turbine turbulence which can cause barotraumas in some species (BL&A 2011).

In Australia, bats display some migratory behaviour but migrations are local and not considered to cover significant distances (BL&A 2011).

Twelve microbat species were identified with varying levels of confidence during the field surveys. This included three species listed as vulnerable under the TSC Act; the Eastern False Pipistrelle, the Eastern Bent-wing Bat and the Greater Broad-nosed Bat. These threatened species may be susceptible to rotor strike and barotrauma. In particular, the Eastern False Pipistrelle and the Eastern Bent-wing Bat forage near to RSA.

The Eastern Bentwing-bat migrates annually to maternity caves, where the females breed and hibernate. Males remain dispersed throughout suitable habitat, and females emerge following the breeding period, to disperse across the landscape. The Study Area is within 150km of two known maternity caves, Wee Jasper 140 km to the south west and Bungonia 85 km to the south east (Dwyer & Hamilton-Smith 1965; OEH 2013). The Eastern False Pipistrelle and the Greater Broad-nosed Bat roost mainly in tree hollows. Although the woodland areas in and around the Development Footprint contain mature eucalypts, few hollow bearing trees were observed.

The exposed ridges and hilltops, typically chosen for the wind turbine locations, are not optimal foraging habitat, however it is difficult to assess utilisation of the site without surveys throughout the summer and spring months. The proportion of bats that would be at risk of rotor collision impacts in the Study Area is expected to be relatively low as the species recorded are likely to be dispersed over a wide area, although this has not been confirmed in this study.

4.2.3 Barotrauma

The decompression hypothesis proposes that many bats are killed by barotrauma that is caused by rapid air-pressure reduction near moving turbine blades (Baerwald *et. al*. 2008). Barotrauma involves tissue damage to air-containing structures caused by rapid or excessive pressure changes, pulmonary barotrauma is lung damage due to expansion of air in the lungs that is not accommodated by exhalation (Baerwald *et. al.* 2008). As with any airfoil, moving wind- turbine blades create zones of low pressure as the air flows over them. Animals entering these low pressure areas may suffer barotrauma (Baerwald *et. al.* 2008).

Species most at risk of barotrauma within the Study Area are species of microbats. Eight species of microbats are nationally listed as threatened and are protected under the EPBC Act 1999. Sixteen species are listed as threatened under the NSW TSC Act (Australian Bat Society Undated). All reported fatalities of bats from wind turbines, in Australia and overseas, have been microbats (Australian Bat Society Undated). Where reliable data are available, the bat deaths reported range from 1.6 per turbine per year to over 90 bats per turbine per year (Australian Bat Society Undated).

The Eastern False Pipistrelle, Eastern Bent-wing Bat and the Greater Broad-nosed Bat may be at risk of mortality due to the effects of barotrauma. In particular, the Eastern False Pipistrelle and the Eastern Bent-wing Bat forage near to RSA and may fly into the low pressure areas created by moving turbine blades.

4.2.4 Alienation of Habitat

The alienation of habitat involves changes in behaviour of species. Species may respond to the introduction of wind turbine infrastructure by avoiding breeding or foraging resources and habitat utilisation such as avoidance of areas where turbines are located due to the unfamiliar object being perceived as a potential threat.

Careful planning to avoid the placement of turbine clusters in or near areas of high habitat values will manage the risk of alienation of habitat to threatened woodland species. The potential impact upon the Scarlet Robin and Flame Robin is unknown as these species were recorded in areas of open pasture and may be displaced or remain largely unaffected by the presence of the turbines. Therefore, the precautionary approach has been adopted in consideration of impacts to these species.

Wedge-tailed Eagles were observed frequently flying at RSA height and, based on the results of monitoring programs at operational wind farms, it is anticipated that they will avoid areas containing WTGs (Smales 2005). This species is common within the area and higher habitat for the species is widespread within the surrounding area. There is not expected to be a significant impact on this species which is not listed on either the EPBC Act or TSC Act.

4.3 AVOIDANCE OF IMPACTS

The site selection assessment undertaken with regard to ecological considerations took into account broad scale ecological features such as areas of remnant woodland vegetation and riparian areas. The Development Footprint has undergone a series of amendments to take account of environmental, social and economic factors. The amendments related to ecological features considered the following factors:

- areas of native vegetation, particularly those that are in good condition and / or meet the description of a TEC or EEC;
- habitat features for native fauna, including hollow bearing trees, exposed rock and native tussock grassland; and
- wildlife corridors.

This approach has resulted in a series of adjustments, as outlined in *Table 4.2*.

Table 4.2 Avoidance Measures Applied to Site Selection

Project Feature	Original Location	Adjusted Location	Reason
Overhead Transmission Line	South from the PAA to the Crookwell 2 Wind Farm substation	North-east of the PAA to the Mt Piper to Bannaby 500kV transmission line	To avoid removal or modification of a large area of remnant native vegetation.
WTG: P2, P6 and P7 and their associated access tracks and crane pads	Within the Box Gum Woodland Environmental Stewardship Block	Removed	To avoid removal or modification of an area of Box Gum Woodland that is being managed under the Environmental Stewardship Program.
WTG P11 and its associated access tracks and crane pads	Within remnant native woodland	Removed	To reduce removal of areas of remnant native woodland.
WTG: P10, P13 and P14 and their associated access tracks and crane pads	Within remnant Red Stringybark Woodland and Broad-leaved Peppermint Woodland	Closer to the edge of the remnant	To reduce removal or modification of areas of remnant native woodland.

4.4 MITIGATION MEASURES

The mitigation measures presented here relate specifically to the ecological features identified in *Chapter 3* of this report, that is:

- native vegetation within the Study Area; and
- bird and bat collision risk.

Management of impacts will be facilitated through the development and implementation of a Construction Environmental Management Plan (CEMP) and an Operational Environmental Management Plan (OEMP). Specific mitigation measures to be included in these plans are outlined below.

4.4.1 *Native Vegetation*

Vegetation Clearing

Measures to mitigate the impacts of vegetation clearing will include:

- all site staff are to be inducted on the procedures of the CEMP in relation to flora and fauna;
- the area to be cleared at the site will be clearly demarcated using flagging or fencing, and mapped on construction plans, to prevent breaches of the construction boundary;
- laydown or temporary disturbance areas will be located in already disturbed areas to avoid any unnecessary clearing of native vegetation and habitat;
- vehicles will remain on formed roads or tracks designed specifically for the purposes of the wind farm construction where possible;
- care will to be taken when working near wooded areas to prevent damage to adjacent tree roots and indirect impact to habitat areas;
- trenches will be excavated at least 15 m away from the base of trees where possible to prevent root damage;
- where practical, suitable fencing to be erected along trenches to prevent fauna falling in;
- habitat features such as logs, large rocks and fallen hollows within the proposed clearance footprint will be relocated to adjacent areas to supplement habitat where possible;
- any individual hollows removed will be replaced with artificial hollows within adjacent suitable habitat;

- Environmental Compliance Manager or field officer qualified in the handling of fauna to be present on-site during clearing to capture and re-release fauna (where appropriate);

- regular checking of trenches by the Environmental Compliance Manager to ensure any captured fauna are released according to the CEMP;

- pre-clearance surveys (including diurnal and nocturnal) undertaken to determine if roosts, nests or dens are present in any trees proposed for clearing;

- implement a two stage approach to clearing works;

    - non-hollow bearing trees will be cleared before habitat trees to allow fauna an opportunity to move from the hollow bearing trees and allow time to concentrate rescue efforts on the trees that are most likely to be inhabited; and

    - hollow bearing trees will be felled after a minimum 24 hour delay after clearing of non-habitat trees.

- native vegetation that is removed will be chipped and mulched for on-site use where practical;

- where practical, native vegetation greater than 3 m in height to be retained during transmission line construction; and

- rehabilitation of internal access roads that are not required following construction to be undertaken.

Weed Management

Measures to mitigate the impacts of weed incursion on the Project will include:

- where a specific weed risk has been identified, all machinery, equipment and vehicles are to be washed down before entry and egress of the Project site;

- piling of soil that may contain seeds of exotic species at least 50 m away from creeks, drainage lines and other areas of native vegetation, to prevent spread into adjacent areas during rainfall or wind events;

- topsoil recovery will be undertaken in areas that have a high proportion of native vegetation and few weeds in the ground layer of vegetation;

- all construction staff and sub-contractors educated on noxious weeds present at the Project site and ways to prevent spread;

- where practical, topsoil that has very few weeds to be harvested to salvage the native soil seed bank and reintroduced into disturbed areas. Otherwise, revegetate with locally native endemic species characteristic of the cleared vegetation type;

- control of perennial weed grasses within the disturbance zone for 3 to 5 years after construction;

- where practical, and in consultation with host landowners, manage stock access during periods of revegetation; and

- imported soil and rubble to be certified as free of weeds and weed seeds.

4.4.2 Ecological Restoration Plan

An Ecological Restoration Plan will be developed that will outline the specific measures for rehabilitation, including:

- revegetation (including use of locally occurring species);

- instructions for how to reuse cleared vegetation in situ (including the spreading of mulched vegetation over cleared areas);

- areas of pasture should be re-seeded with pasture grass species removed; and

- areas where crane pads have been sited in native vegetation should be mechanically loosened with machinery to alleviate compaction, enhancing seed germination potential in loose soil and micro-topography to enhance seed retention from surrounding woodland areas.

4.4.3 Birds and Bats

A specific Bird and Bat Monitoring Plan will be developed with the objective of minimising the impacts of the operational wind farm on threatened and targeted bird and bat species. The Bird and Bat Monitoring Plan will outline the required monitoring measures, key thresholds for determining permissible impacts and corrective actions that are required in order to achieve the objectives of the plan. The plan will also outline the roles and responsibilities for the proponent, operator and agencies in implementing, assessing and enforcing the plan.

The plan will be developed in consultation with OEH to ensure the plan meets the requirements of the agency. The frequency of report strike data will be determined during the preparation of the monitoring programme. The adaptive management measures that could be implemented should strike thresholds be reached, will be negotiated with OEH when significant strike rates are detected. Bird and bat strike monitoring will be undertaken with consideration for the monitoring guidelines provided by the Australian Wind Energy Association.

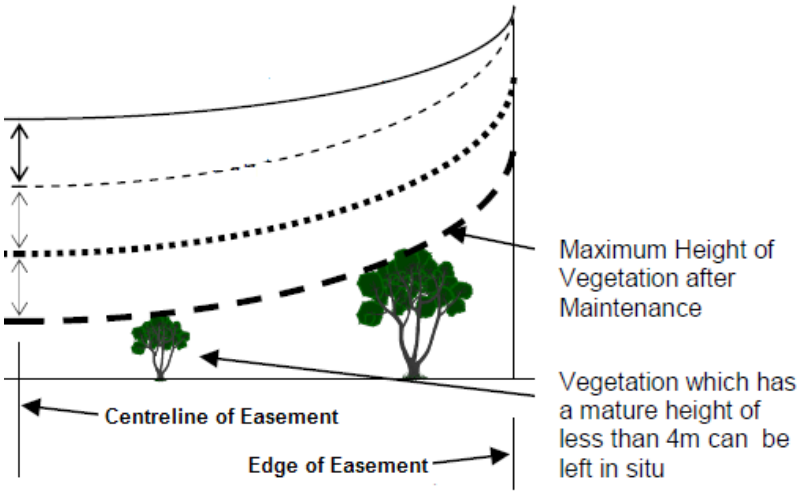
4.5 RESIDUAL IMPACTS

This section describes the residual impacts that are anticipated to occur as a result of the Project, following consideration of the avoidance and mitigation measures outlined above. The residual impacts discussed in this section relate specifically to the potential impacts described in *Section 4.2.*

4.5.1 *Native Vegetation*

The Development Footprint covers a total area of 106.5 ha. This includes a permanent impact area of 33.1 ha, a temporary impact area of 13.0 ha and 60.4 ha of limited impact associated with the northern transmission line option. The 60.4 ha associated with the northern transmission line option would undergo limited clearing, i.e. only the vegetation within the power pole locations would be removed. Outside of the power pole locations, vegetation up to four metres in height would remain and vegetation up to 15 m in height at the edges of the easements would remain (see *Figure 4.1*).

Figure 4.1 Vegetation Clearance within the Transmission Line Easement



Of the total Development Footprint, 92.5 ha comprises exotic pasture, cropping, planted vegetation or bare ground. The remaining 14.0 ha comprises native vegetation, as shown in *Table 4.3*. *Table 4.3* shows the breakdown of areas for both permanent and temporary impacts.

Table 4.3 Area of Each Vegetation Zone in Development Footprint

BVT Code	Vegetation Zone	Area in Study Area (ha)	Total Area in Development Footprint (ha)[1] (including transmission line)	Permanent Impact Area (ha)	Temporary Impact Area (ha)	Partial Clearance (transmission line) (ha)
LA103_MG_PG	Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands_Mod-Good_Poor-Grassland*	21.9	2.9	1.9	1.0	0.0
LA124_MG_M	Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands_Mod-Good_Mod	47.0	6.9	0.1	0.0	6.8
LA124_MG_PG	Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands_Mod-Good_Poor-Grassland	11.2	0.0	0.0	0.0	0.0
LA124_MG_Shrubby	Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands_Mod-Good_Shrubby	11.7	2.3	0.0	0.0	2.3
LA182_MG_M	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion_Mod-Good_Mod	23.1	1.4	1.0	0.4	0.0
LA182_MG_Shrubby	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion_Mod-Good_Shrubby	1.0	0.2	0.2	0.0	0.0
LA186_MG_PW	River Oak forest and woodland of the NSW South Western Slopes and South Eastern Highlands Bioregions_Mod-Good_Poor-Weedy	1.2	0.3	0.0	0.0	0.3
	Total	**117.1**	**14.0**	**3.2**	**1.4**	**9.4**

1. The BVT Code is provided here with a suffix which is an abbreviation of the condition class

2 * indicates this vegetation forms part of the TSCAct-listed Box Gum Woodland EEC occurring in the Study Area and Development Footprint as Derived Native Grassland.

As shown in *Table 4.3,* vegetation removal as part of the Development Footprint will include 2.9 ha of DNG (comprising Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands_Mod-Good_Poor-Grassland) that constitutes Box Gum Woodland DNG under the TSC Act. The remaining areas of the Development Footprint comprise mostly exotic pasture with some areas of native vegetation in moderate condition, ie there are areas with intact canopy layers fringing the Study Area and other areas in various states of disturbance including where vegetation clearance has occurred and the vegetation occurs in a modified form.

Vegetation removal results in a direct reduction in the extent of native vegetation types and flora and fauna habitat in the Study Area. In addition to the direct impact of removal of native vegetation, indirect impacts to adjacent and nearby native vegetation can result from vegetation removal. This includes the operation of edge effects, whereby a vegetation community's susceptibility to factors such as weed invasion and erosion are increased due to its increased exposure to surrounding disturbed environments. The vegetation community becomes less resilient and able to undergo natural regeneration.

As the Development Footprint comprises small and linear components spread over a large area, the effects of vegetation removal are small in comparison to large developments in small areas. Where practicable, the Project infrastructure has been sited to avoid areas of woodland and open forest, with the results of the ecological field surveys being considered throughout the iterative design process. This has resulted in avoidance of most areas of intact Box Gum Woodland and habitat for threatened species. As such the connectivity of the Study Area to the surrounding Locality is unlikely to be impacted. The majority of vegetation to be removed comprises exotic pasture with a small proportion of native woodland / open forest.

As the majority of vegetation to be removed is not unique in the Study Area or Locality, removal would not impact on the viability of ecological communities or native flora species in the Study Area or Locality. It is unlikely to impact seed dispersal, animal movements or remove habitat features that are essential to species survival. The threatened species that are likely to be impacted by vegetation removal are discussed in *Section 4.6.*

4.5.2 Bird and Bat Collision Risk

Collision Risk Model

A Collision Risk Model (CRM) is the generally accepted method to estimate bird collision risk in impact assessments for wind farm developments. In this assessment, the CRM developed for Scottish National Heritage was used to calculate the collision risk as it is a robust and easily applied method. The estimated risk under two scenarios was calculated, the first assuming that birds would fly as if the wind turbine structures and rotors were not there and take no avoiding action. In reality most birds do take avoiding action and therefore the collision risk is usually adjusted by the avoidance factor. The second scenario assumes an avoidance rate of 99%. It is suggested that an avoidance rate of 99% is conservative enough for collision risk assessment (Smales & Muir, 2005). This rate assumes that birds will avoid collisions with the stationary components of a turbine in all but the most exceptional circumstances, and is a rate that has been used in a number of collision risk assessments carried out in Australia.

No threatened species were recorded flying at RSA height from the BUS surveys and therefore, collision risk to these species cannot be assessed using this methodology. For these species, the results of previous studies have been used to assess potential impacts (where available). Collision risk was estimated for the Wedge-tailed Eagle, as this species was recorded at RSA height in field surveys. The Wedge-tailed eagle was also selected as it is a large species and hence is at increased risk of rotor strike, although Raptors have been shown to demonstrate avoidance behavior (Smales & Muir, 2005). The following presents the results of the CRM for the Wedge-tailed Eagle. The calculations of collisions are detailed in *Annex B.*

Collision Risk for Wedge-Tailed Eagle

The Wedge-tailed Eagle was sighted 9 times throughout the BUS survey period flying at RSA height. Additional incidental observations were not included within the assessment. Wedge-tailed Eagles are known to avoid WTGs (Smales & Muir, 2005) and a 99% avoidance rate was applied to the model. The results indicate that Wedge-tailed Eagle has a collision risk which would result in 0.052 birds per month or 0.62 birds per annum colliding with rotors once the Project is operational.

Limitations

The BUS survey data was used for this model, which was undertaken over two days in May 2013 and therefore represents a small sample size. The data does not take into account varying activity levels or changes in the abundance of Wedge-tailed Eagles or other birds seasonally. Increased survey effort in a variety of seasons may pick up other species of birds flying at RSA height which could then be assessed using the model. The collision model used a predicted flying time of eight hours per day. This estimated flying time is likely to vary due to life cycle stages (e.g. breeding), weather conditions and seasonality.

4.6 ASSESSMENT OF SIGNIFICANCE

The revised field surveys identified patches of Box-Gum Woodland derived native grassland in areas where access tracks are proposed (see *Figure 3.1*). Two threatened birds (Scarlet Robin and Flame Robin) and three threatened bats (Eastern False Pipistrelle, Greater Broad-nosed Bat and the Eastern Bent-wing Bat) were recorded during the May 2013 field surveys. In accordance with Section 5A of the *Environmental Planning and Assessment Act, 1979* (EP&A Act), a revised set of A*ssessment of Significance* (7-part tests) were carried out to measure the impacts of the proposal on the ecologically endangered community and the five threatened species. The 7-part test involves the consideration of seven factors to assess if the threatened fauna species or endangered ecological communities will be impacted by the Project. The 7-part tests undertaken are detailed in full in *Annex C*.

Conclusions from the Seven-Part Test:

The proposal is unlikely to have a significant impact on either the Scarlet or Flame Robin, the three threatened bats or the ecologically endangered community (Box Gum Woodland) and therefore, further assessment under the NSW TSC Act is not required (refer *Annex C*). Measures to reduce potential impacts are discussed in *Section 4.4*.

5 OFFSET MEASURES

This offset measures section has been prepared to address the requirements of Issue 6 in the DOPI letter.

To satisfy the offset requirements, an offset strategy will be prepared. It is proposed that offsets will be secured onsite within areas of Box Gum Woodland, Red Stringybark Woodland, Broad-leaved Peppermint Woodland and River Oak Forest. Areas of native grassland derived from these vegetation types will be offset into open forest / woodland areas comprising the original equivalent vegetation type and areas of surrounding DNG where applicable, i.e. where this will help to achieve the 'improve or maintain' principle.

The vegetation zone areas used in the Biobanking assessment are based on the permanent Development Footprint and the southern sub-option for the transmission line (see *Table 4.1*).

The relevant BioBanking Assessment details are provided in *Table 5.1*.

Table 5.1 BioBanking Assessment Details

Component	Data
Proposal ID	0089/2013/0733D
Assessor Name/Accreditation Number	Evelyn Craigie/0089
Assessment Type	Development
Catchment	Lachlan
Local Government Area	Oberon
Mitchell Landscape	Mount David Basalts*

*Two Mitchell Landscapes occur across the Development Footprint, however, the majority of the Development Footprint falls within Mount David Basalts

The indicative area of offset that was calculated using the BBAM and the credit to hectare converter is shown in Table *5.2*.

Table 5.2 Credit requirements and their equivalent in hectares

BVT Code	BVT name	Area in Permanent Footprint (ha)	Required Credits	Equivalent Hectares required
LA103	Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	1.9	36	3.9
LA124	Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands	9.2	181	19.5
LA182	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion	1.2	66	7.1
LA186	River Oak forest and woodland of the NSW South Western Slopes and South Eastern Highlands Bioregions	0.3	6	0.6
	Total	12.6	289	31.1

1. Data is based on the Credit Report provided in Annex 0 and the BioBanking Credit Converter

It is proposed that the quantum of offset including the area, vegetation type and condition be defined and included in the consent so that the offset strategy reflects the requirements associated with the final approved Project. Subsequent to this, the location, management and securing mechanism will be included in the offset strategy to the satisfaction of OEH. The offset strategy will be prepared and its approval sought prior to commencement of works.

6 DISCUSSION

6.1 ISSUE 1: METHODOLOGY

The recommendations provided in the DoPI letter in relation to Issue 1 are:

- provide justification for not utilising adequate survey techniques as outlined in the *Threatened Species Survey and Assessment Guidelines* (the Guidelines). In particular, provide a discussion relating to the consequences of inadequate surveying for bats; and

- in the absence of surveys likely to detect a full range of fauna in the study site, the proponent should utilise whatever surveys are available to better inform which threatened species may occur within the project boundary.

The field surveys undertaken during May 2013 focussed on vegetation mapping, flora, habitat, bird and bat survey. These surveys were undertaken in accordance with the Guidelines, however, the limited extent and timing of the surveys has resulted in divergence from the Guidelines in some instances. Liaison was undertaken with OEH to confirm the suitability of this approach.

Surveys included the northern transmission line route, which had not been mapped in the previous surveys.

6.1.1 *Survey Techniques*

Flora

The flora surveys were undertaken in accordance with the Guidelines, the BBAM and the feedback provided in the DoPI letter. Floristic data for each plot is provided in *Annex A.*

The flora surveys have been undertaken in accordance with the Guidelines in terms of the techniques used, the level of effort and the information recorded. The quadrats were not undertaken during the appropriate season for optimal detection of threatened species and therefore, the potential for them to occur has been assessed based on the available habitat and the information provided in previous studies of the area.

Fauna

The fauna surveys included habitat survey, targeted surveys for birds and bats and opportunistic sightings. These were undertaken in accordance with the Guidelines, however, not all the techniques outlined in the Guidelines were considered appropriate for the Study Area or the season, ie late autumn. Due to the cold temperatures and late autumn survey period, it was anticipated that fauna activity would be low and any captured fauna would be subjected to an elevated chance of mortality due to the cold. Temperatures dropped below freezing on two of the survey nights, with the minimum

temperature at Taralga, minus five degrees centigrade. This rationale was discussed with David Geering (OEH Dubbo, 16/05/13).

6.2 *ISSUE 2: AVOIDANCE*

The recommendations provided in the DoPI letter in relation to Issue 2 are:

- include details of the site selection assessment with regard to ecological considerations;
- ensure that all avoidance measures implemented in finalising the location and design of the facility are detailed within the EA; and
- justify the level of avoidance implemented, based on further details regarding impacts to native vegetation throughout the site, including the northern transmission line.

Analysis of the flora survey results have confirmed the extent to which native vegetation will be impacted by the Project. The results of the habitat and fauna surveys have also been incorporated into consideration of the level of avoidance. This has informed the avoidance measures outlined in *Table 4.2*.

The infrastructure for the Project has been placed as much as possible within areas that do not support native vegetation or key habitat features. Potential fauna movements have also been considered. As the majority of the infrastructure has been placed in areas of exotic pasture, it is considered that the level of avoidance is appropriate to the scale of the Project and the ecological features of the area.

6.3 *ISSUE 3: ASSESSMENT OF IMPACTS*

The recommendations provided in the DoPI letter in relation to Issue 3 are:

- provide (in table format) for all areas of remnant native vegetation, including areas of derived native grassland (DNG):
  - the Biometric Vegetation Type;
  - condition of the vegetation (in accordance with the BioBanking Assessment Methodology (BBAM)); and
  - the impact area (in hectares) of all vegetation within the footprint of the development.
- provide more detailed vegetation maps showing each vegetation type, by condition, within the activity area. Include information to allow third party verification of areas mapped as improved pasture. Ideally, the BBAM should be used to guide these assessments;

- provide a map showing vegetation plot locations; and
- undertake an assessment of all cleared areas to determine the extent and quantum of areas of DNG in the Study Area (including along the northern transmission line).

This issue was raised specifically in relation to assessment of impacts on native vegetation. Vegetation within 100 m of proposed infrastructure was mapped during the May 2013 field surveys, including areas of pasture and DNG. As outlined in *Chapter 2* and *3,* the vegetation was mapped in accordance with the DoPI letter. Specifically, the following information has been provided to satisfy the requirements of Issue 3:

- the Biometric Vegetation Types that occur across the Study Area (refer *Table 3.2*);
- the condition of the vegetation in accordance with the BBAM (refer *Table 3.3* and *Figure 3.1*);
- the impact area in ha (refer *Table 3.3*);
- detailed vegetation maps (refer *Figure 3.1*); and
- plot data (*Annex A*) and plot references (refer *Figure 2.1*).

6.4 ISSUE 4: BIRD AND BAT IMPACT

The recommendations provided in the DoPI letter in relation to Issue 4 are:

- undertake an impact assessment of the risk of bird and bat collision, the significance and potential mitigation of the impact, including:
  - an adequately detailed rationale to support conclusions on the likely significance of impacts;
  - consideration of site specific and landscape specific factors including (but not limited to) habitat, topographical features, movement corridors and weather in assessing impacts on birds and bats;
  - genuine consideration of the potential for barrier effects and how this may effectively extend the footprint of the facility; and
- consider options for mitigation of impacts of collision on bats and birds.

Bird and bat field surveys and habitat assessments were undertaken to inform an impact assessment specifically in relation to bird and bat collision risk. The data collected was input into a collision risk model for birds and informed consideration of the potential impacts to bats. Assessments of significance were undertaken for two birds and three bats that were recorded in the Study

Area. Mitigation measures have been provided to reduce the potential impacts to birds and bats.

6.5 *ISSUE 5: MITIGATION*

The recommendations provided in the DoPI letter in relation to Issue 5 are:

- profile the range of mitigation measures that would be genuinely considered for implementation at the site to mitigate any potential impacts, including level of success of these measures at other sites (where known).

Mitigation measures aimed at reducing the impacts to native vegetation, birds and bats have been provided in *Section 4.4.*

The monitoring of birds and bat during the wind farm operation is recommended so that the impact of the WTGs can be determined. This monitoring should include bat and bird mortality, including that caused by collision and barotrauma for bats. This is valuable in order to determine which species are vulnerable to rotor impact and the abundance of animals affected. Appropriate mitigation measures can then be implemented if required. The data from the Woolnorth wind farm in north-west Tasmania have provided the most comprehensive data to date within Australia. Data also exists from Toora windfarm, Codrington windfarm and Hepburn Community windfarm, all of which are in Victoria (Elmoby Ecology, 2012; AusWEA, undated; ALA, 2013). These are all small wind farm cumulatively totalling 28 turbines, and no data was ascertained on the scale of rotor related mortality within NSW wind farms.

6.6 *ISSUE 6: OFFSETS*

The recommendations provided in the DoPI letter in relation to Issue 6 are:

- determine if an offset is required, based on the results of additional field survey and analysis; and

- prepare offset commitments prior to approval of the impact.

The vegetation mapping indicates that an offset would be required. The BBAM was used to provide an indication of the extent and type of offset that would be required. These indicative offsets will be used to inform development of an offset strategy in consultation with OEH and DoPI, which is consistent with the NSW Offsets Policy.

6.7 *MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE*

A referral regarding the proposed works was submitted to the Federal Department of Environment and Heritage (now Department of Environment)

in February 2005. In March 2005, the Minister declared that the action is not a controlled action and therefore, approval under Part 9 of the EPBC Act is not required (EPBC Reference 2005/2018).

Since this decision, the potential impacts to Matters of National Environmental Significance (MNES) associated with the Project have not changed. The ecological desktop and field studies have not revealed MNES that would require further assessment under the EPBC Act.

7 *RECOMMENDATIONS*

Having regard to the additional field survey and further assessment, the following measures and amendments to the project are recommended:

- select the southern sub-option for the transmission line as this option would minimise clearing of native vegetation. This is due to the existing cleared and weedy areas within this sub-option;
    - incorporate the mitigation measures outlined in *Section 4.4* into a CEMP and OEMP; and
- develop an offset package in accordance with the *Principles for the use of biodiversity offsets in NSW* (OEH 2011).

8 CONCLUSION

This ecological assessment has addressed the biodiversity issues raised in the DoPI letter, using information collected during the May 2013 field survey and subsequent data analysis. The potential impact of the Project to native vegetation, birds and bats has been assessed. The results indicate that the Project would not have a significant impact on any threatened ecological communities or species. The majority of the Development Footprint consists of improved pasture with scattered Eucalypt trees and small patches of derived native grassland around the periphery. Measures have been provided to manage impacts, including avoidance and mitigation measures. An offsets package is proposed to be developed that will compensate for the residual impacts to biodiversity.

REFERENCES

Anderson (2012) **Ecological Assessment for Proposed Paling yards Wind Farm**. Report prepared for Union Fenosa Wind Australia Pty Ltd.

Anderson Environmental Consultants (2013) **Ecological Assessment for Proposed Paling Yards Wind Farm.** Report prepared for Union Fenosa Wind Australia Pty Ltd.

Australasian Bat Society (Undated) **Bats and Windfarms** Fact sheet.

Auswind (2007) **Best Practice Guidelines for Implementation of Wind Energy Project in Australia**

AusWEA (undated) **Windfarm and Bird and Bat Impacts**. http://www.w-wind.com.au/downloads/CFS8BirdBatImpact.pdf. Accessed on 31/05/2013

Baerwald E.F, D'Amours G.H, Klug B.J and Barclay R.M.R. (2008) **Barotrauma is a significant cause of bat fatalities at wind turbines,** Current Biology, Vol 18, R695-R696.

Band W (2000) **Windfarms and Birds: Calculating a theoretical collision risk assuming no avoiding action**. Guidance Note Series. Scottish Natural Heritage

Benson, J, 1996. **What is a native grassland?** http://grasslandnsw.com.au/news/wp-content/uploads/2011/09/Benson-1996.pdf

Brett Lane & Associates (BL&A) (2011) **Proposed Rugby Wind Farm Flora and Fauna Assessment Report No. 9193 (2.3)** report to Suzlon Energy Australia Pty Ltd

Brett Lane and Associates (2005). **Wonthaggi Wind Farm Bird and Bat Management Plan.** Report for Wind Power Pty. Ltd.

Bureau of Meteorology (2013) **Climate Data Online.** Available from: http://www.bom.gov.au/climate/data/Accessed May 2013.

DECC (2009) **BioBanking Biodiversity Banking and Offsets Scheme: BioBanking Assessment Methodology and Credit Calculator Operational Manual** NSW Department of Environment and Climate Change.

DPI (2013) **Weed Definitions and FAQs** NSW Department of Primary Industries. Available from: http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/definition. Accessed: May 2013.

Dwyer PD. and Hamilton-Smith E (1965) **Breeding Caves and Maternity Colonies of the Bent-winged Bat in South-Eastern Australia**. *Helictite, Journal of Australasian Cave Research*. 1:3

Elmoby Ecology (2012) **Quantifying the Effects of Wind Turbines on Birds and Bats. Prepared for the Hepburn Community Wind Park Cooperative Limited**

ERM (2005) **Renewable Energy by a Wind Turbine System on Lamma Island, Final Environmental Impact Assessment Report**. For Hongkong Electric Co.

M.G. Tozer, K. Turner, D.A. Keith, D. Tindall, C. Pennay, C.Simpson, B. MacKenzie, P. Beukers and S. Co (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. **Cunninghamia** 11(3): 359-406.

NWCC (2001). **Avian Collisions with Wind Turbines: A Summary of Existing Studies and Comparisons of Avian Collision Mortality in the United States.**

OEH (2011). **Principles for the use of biodiversity offsets in NSW**. NSW Office of Environment and Heritage. http://www.environment.nsw.gov.au/biocertification/offsets.htm Accessed: May 2013.

OEH (2012). **Threatened Species Profiles.** http://www.environment.nsw.gov.au/threatenedspeciesapp/default.aspx?keywords=button

OEH (2013). **Priority actions by type of threatened species – Eastern Bentwing Bat.** NSW Office of Environment and Heritage. Accessed from www.environment.nsw.gov.au/threatenedspeciesapp/PasSearchSpecies.aspx?speciesName=Eastern+Bentwing-bat&generalType=Bats. Accessed on 30/05/13

OEH (2013b) **Threatened Species Profiles** Available from: http://www.environment.nsw.gov.au/threatenedSpeciesApp/ Accessed between 26/05/13 and 03/05/13.

RBG&DT (2012) **PLANTNET: The Plant Information Network System of The Royal Botanic Gardens and Domain Trust (RBG&DT) Version 2.0** Royal Botanic Gardens and Domain Trust. Available from: http://plantnet.rbgsyd.nsw.gov.au/. Accessed: May 2013.

Scottish Natural Heritage (2000) **Guidance & Information Specific to Bird Interests –** Avoidance Factor. Accessed from www.snh.gov.uk/docs/C205425.pdf, on 24/04/2013

Scottish Natural Heritage (2010) Use of Avoidance Rates in the SNH Wind Farm Collision Risk. Accessed from www.snh.gov.uk/docs/B721137.pdf, on 24/04/2013

Simpson and Day (2004) **Field Guide to the Birds of Australia, 7th Ed**. Penguin.

Smales I & Muir S (2005). **Modelled cumulative impacts on the Tasmanian Wedge-tailed Eagle of wind farms across the species' range**. *Biosis Research Pty. Ltd.*

Smales, I (2005) **Modelled cumulative impacts on the Swift Parrot of wind farms across the species' range in south-eastern Australia.** In: Biosis Research Pty Ltd (2006) **Wind Farm Collision Risk for Birds. Cumulative risks for threatened and Migratory species.** Prepared for the Australian Government Department of the Environment and Heritage.

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

Spaar R & Bruderer B (1996) **Soaring Migration of Steppe Eagles *Aquila nipalensis* in Southern Israel: Flight behavior under Various Wind and Thermal Conditions**. *Journal of Avian Biology*. 27:289-301

Spaar R & Bruderer B (1996) **Soaring Migration of Steppe Eagles *Aquila nipalensis* in Southern Israel: Flight behavior under Various Wind and Thermal Conditions**. *Journal of Avian Biology*. 27:289-301

Tract Consultants Pty Ltd (April 2013) **Paling Yards Wind Farm: Environmental Assessment.** Report prepared for Union Fenosa Wind Australia Pty Ltd.

Woehler, E and Belbin L (undated) **Wind, Wind-farms, Birds and Bats, Insights and predictions from the Atlas of Living Australia**. Atlas of Living Australia http://www.ala.org.au/faq/spatial-portal/wind-wind-farms-birds-and-bats/ Accessed on 31/05/13

Annex A

Vegetation Zone Species Lists

Vegetation Zone	Plot	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
LA103_MG_PG	B	7	0	0	88	0	6	18	0	0	0	748776	6214908	55
LA103_MG_PG	O	4	0	0	96	0	6	32	0	0	0	750528	6215161	55
LA124_MG_M	G	8	18	0	24	0	4	24	0	1	128	751612	6214936	55
LA124_MG_M	I	17	16.5	0.6	32	0	16	20	0	1	4.4	757561	6221190	55
LA124_MG_PG	L	11	0	0.1	78	0	6	20	0	1	0	759986	6223175	55
LA124_MG_Shrubby	K	15	2.4	2.2	62	14	10	6	0	1	12	759930	6222963	55
LA182_MG_M	E	7	24.5	0	1	0	1	0	2	0.75	40	750540	6215342	55
LA182_MG_Shrubby	D	14	7	0	38	10	4	6	0	1	31	750052	6215207	55
LA186_MG_PW	H	8	20.5	1	4	0	4	84	0	1	7.5	757722	6221536	55
Non-native Vegetation	A	4	0	0	0	0	6	98	0	0	8	748516	6214806	55
Non-native Vegetation	C	4	0	0	0	0	2	100	0	0	0	749045	6215100	55
Non-native Vegetation	F	3	0	0	4	0	0	90	0	0	0	751181	6214433	55
Non-native Vegetation	J	5	0	0	0	0	8	94	0	0	0	760612	6223004	55
Non-native Vegetation	M	9	11.5	0	0	0	2	92	0	0.5	26	757217	6217429	55
Non-native Vegetation	N	1	0	0	0	0	0	92	0	0	0	753777	6218062	55

Family	Species	Common Name	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Incidental
Fabaceae	Acacia brownii	Heath Wattle				3												
Fabaceae	Acacia dealbata	Silver Wattle									1							
Fabaceae	Acacia falciformis	Broad-leaved Hickory	1															
Fabaceae	Acacia gunnii	Ploughshare Wattle				1												
Fabaceae	Acacia melanoxylon	Blackwood								1								
Rosaceae	Acaena echinata	Sheep's Burr	2	1	1			2		1	1				1			
Polygonaceae	Acetosella vulgaris*	Sheep Sorrel		2					2			1			1		1	
Orchidaceae	Acianthus collinus	Hooded Mosquito-orchid											1					
Amaranthaceae	Amaranthus powellii*	Powell's Amaranth	1		1													
Loranthaceae	Amyema spp.	Mistletoe											2					
Poaceae	Aristida ramosa	Purple Wiregrass				3												
Poaceae	Aristida spp.	A Wiregrass									1							
Rubiaceae	Asperula conferta	Common Woodruff													1			
Aspleniaceae	Asplenium flabellifolium	Necklace Fern																I
Asteraceae	Asteraceae indeterminate*	Daisies	3	2	2						1						4	
Poaceae	Bothriochloa macra	Red Grass		6													5	
Ericaceae	Brachyloma daphnoides	Daphne Heath				1					2		2					
Poaceae	Bromus molliformis*	Soft Brome	6		7			4				5						
Poaceae	Bromus spp.*	A Brome		3										3	6			
Cyperaceae	Carex appressa	Tall Sedge								2								
Asteraceae	Cassinia arcuata	Sifton Bush									1		2	1				
Asteraceae	Cassinia longifolia												1					
Asteraceae	Centaurea solstitialis*	St Barnabys Thistle	2	1	3													
Asteraceae	Cirsium vulgare*	Spear Thistle	2									1			2		2	
Poaceae	Dactylis glomerata*	Cocksfoot						1		4	3				5	7		
Apiaceae	Daucus glochidiatus	Native Carrot											1	2				
Chenopodiaceae	Einadia hastata	Berry Saltbush							2						1			
Poaceae	Elymus scaber	Common Wheatgrass												6				
Myrtaceae	Eucalyptus blakelyi	Blakely's Red Gum								4								
Myrtaceae	Eucalyptus bridgesiana	Apple Box	1				2											
Myrtaceae	Eucalyptus dives	Broad-leaved Peppermint				2			3		4		4					
Myrtaceae	Eucalyptus goniocalyx	Bundy							3									
Myrtaceae	Eucalyptus macrorhyncha	Red Stringybark					3				3							
Myrtaceae	Eucalyptus melliodora	Yellow Box																I
Myrtaceae	Eucalyptus rossii	Inland Scribbly Gum				3	4											
Myrtaceae	Eucalyptus rubida	Candlebark																I
Myrtaceae	Eucalyptus stellulata	Black Sally																I
Myrtaceae	Eucalyptus viminalis	Ribbon Gum					1			4	2		2		3			
Asteraceae	Euchiton involucratus	Star Cudweed										1	1					
Asteraceae	Gamochaeta calviceps*	Cudweed				1												
Geraniaceae	Geranium solanderi	Native Geranium									2	2			2	1		
Haloragaceae	Gonocarpus elatus	A Raspwort				1					2		2	2				
Fabaceae	Hardenbergia violacea	False Sarsaparilla				2												
Dilleniaceae	Hibbertia obtusifolia	Hoary Guinea Flower				3	2				2							
Poaceae	Holcus lanatus*	Yorkshire Fog										2			4			
Poaceae	Hordeum leporinum*	Barley Grass	1															
Fabaceae	Hovea heterophylla					1												
Apiaceae	Hydrocotyle laxiflora	Stinking Pennywort		1					1		2			1				
Cyperaceae	Isolepis hookeriana			1					2									
Juncaceae	Juncus filicaulis											1		1	2			
Juncaceae	Juncus subsecundus	Finger Rush										2		1	2			
Poaceae	Lolium perenne*	Perennial Ryegrass			1	2		1				3						
Lomandraceae	Lomandra spp.	Mat-rush				2	1				1							
Proteaceae	Lomatia myricoides	River Lomatia											1					
Solanaceae	Lycium ferocissimum*	African Boxthorn													1			
Malvaceae	Malva parviflora*	Small-flowered Mallow	2		2													
Lamiaceae	Marrubium vulgare*	White Horehound	2		2													
Fabaceae	Medicago arabica*	Spotted Burr Medic		1	1							2				2		
Fabaceae	Medicago spp.*	A Medic						2				2	1		2	2		
Poaceae	Microlaena stipoides	Weeping Grass							2									
Malvaceae	Modiola caroliniana*	Red-flowered Mallow													2			
Poaceae	Nassella trichotoma*	Serrated Tussock						3				4	2				2	
Poaceae	Phalaris canariensis*	Canary Grass			2			6										
Plantaginaceae	Plantago lanceolata*	Lamb's Tongues		2	1					1							1	
Poaceae	Poa sieberiana	Snowgrass				1	1			4	5		7	3				
Pteridaceae	Pteridium esculentum	Bracken								2	2	3		3				

Family	Species	Common Name	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Incidental
Rosaceae	Rosa rubiginosa*	Sweet Briar	2							2	1	2						
Rosaceae	Rubus fruticosus sp. agg.*	Blackberry complex	1							6		4						
Polygonaceae	Rumex brownii	Swamp Dock			1			1							1			
Poaceae	Rytidosperma pallidum	Redanther Wallaby Grass				5												
Poaceae	Rytidosperma setaceum	Small-flowered Wallaby-grass			1				6		5						3	
Poaceae	Rytidosperma spp.			2														
Lamiaceae	Salvia verbenaca*	Vervain										1						
Caryophyllaceae	Scleranthus biflorus	Two-flowered Knawel									2		1	2				
Asteraceae	Senecio spp.	Groundsel, Fireweed											1					
Asteraceae	Silybum marianum*	Variegated Thistle	4		2										2	1		
Asteraceae	Taraxacum officinale*	Dandelion		2		1				2	2		1	2	2		2	
Urticaceae	Urtica incisa	Stinging Nettle	3	2	2			2	2	1					2			
Plantaginaceae	Veronica persica*	Creeping Speedwell											1					
Poaceae	Vulpia myuros*	Rat's Tail Fescue			1								2				2	
Campanulaceae	Wahlenbergia luteola	Bluebell		2													2	
Campanulaceae	Wahlenbergia stricta	Tall Bluebell				1								2			1	
Asteraceae	Xerochrysum bracteatum	Golden Everlasting											1					

Cover Abundance Values: **1**=<5% & rare; **2**=<5% & common; **3**= 6-15%; **4**=16-25%; **5**=26-50%; **6**=51-75%; **7**=76-100%

Annex B

Collision Risk Model

B.1 COLLISION RISK MODEL

B.1.1 Calculating Bird Collision Risk

The Collision Risk Model (CRM) used in this assessment has been developed by Scottish National Heritage and is referred to as the Band Model (SNH 2000 & 2010, Band 2000). This model provides a means of estimating collision risks and hence the potential bird mortality, which may be caused by a wind farm.

Stage 1

The first stage is to determine the risk (probability) of a bird being hit by a turbine blade when making a transit through a rotor without any avoidance. The probability depends on the bird length, wingspan, likely traveling speed (Spaar & Bruderer 1996) and if they are likely to be flapping or soaring. The Wedge-tailed Eagle length and wingspan were taken from Simpson and Day (2004) and average bird speed was estimated from the known speeds of similar species (Spaar & Bruderer, 1996; ERM 2005). The estimated operational measures of the wind turbine are also considered and are specified below;

- Maximum chord width of rotor = 4.5m
- Pitch angle of rotor = 24 degrees
- Rotor diameter = 136 m
- Rotation period = 4.29 m/s

Collision risk was estimated for the identified species recorded within the Study Area. However, some bird species were not included in the assessment because all individuals recorded within the Study Area were below the rotor height during the surveys and thus the risk cannot be determined by the adopted calculations. The predicted collision risk from the CRM generates an average collision risk for each of the subject species of upwind flying direction and downwind flying direction. The tables below are taken from the Band Model for the calculation of collision risk for each of the subject species.

Table B.1 Collision Risk for Wedge-tailed Eagle

CALCULATION OF COLLISION RISK FOR WEDGE-TAILED EAGLE PASSING THROUGH ROTOR AREA												
K: [1D or [3D] (0 or 1)	1		**Calculation of alpha and p(collision) as a function of radius**									
NoBlades	3						Upwind:				Downwind:	
MaxChord	4.5	m	r/R	c/C	□	collide		contribution	collide		contribution
Pitch (degrees)	24		radius	chord	alpha	length	P (collision)	from radius r	length	P (collision)	from radius r
BirdLength	1.05	m	0.025	0.575	6.02	24.11	1.00	0.00125	22.01	1.00	0.00125
Wingspan	2.3	m	0.075	0.575	2.01	8.74	0.41	0.00306	6.63	0.31	0.00232
F: Flapping (0) or gliding (+1)	1		0.125	0.702	1.20	6.52	0.30	0.00380	3.95	0.18	0.00230
			0.175	0.860	0.86	5.88	0.27	0.00480	2.73	0.13	0.00223
Bird speed	15	m/sec	0.225	0.994	0.67	5.54	0.26	0.00581	1.90	0.09	0.00199
RotorDiam	136	m	0.275	0.947	0.55	4.67	0.22	0.00598	1.20	0.06	0.00154
RotationPeriod	4.29	sec	0.325	0.899	0.46	4.04	0.19	0.00612	0.75	0.03	0.00113
			0.375	0.851	0.40	4.01	0.19	0.00702	1.20	0.06	0.00210
			0.425	0.804	0.35	3.69	0.17	0.00731	1.35	0.06	0.00268
			0.475	0.756	0.32	3.42	0.16	0.00757	1.45	0.07	0.00321
Bird aspect ratio: □	0.46		0.525	0.708	0.29	3.18	0.15	0.00779	1.51	0.07	0.00370
			0.575	0.660	0.26	2.97	0.14	0.00796	1.55	0.07	0.00415
			0.625	0.613	0.24	2.78	0.13	0.00810	1.56	0.07	0.00456
			0.675	0.565	0.22	2.60	0.12	0.00819	1.57	0.07	0.00493
			0.725	0.517	0.21	2.44	0.11	0.00824	1.56	0.07	0.00526
			0.775	0.470	0.19	2.28	0.11	0.00826	1.53	0.07	0.00554
			0.825	0.422	0.18	2.14	0.10	0.00823	1.51	0.07	0.00579
			0.875	0.374	0.17	2.00	0.09	0.00816	1.47	0.07	0.00600
			0.925	0.327	0.16	1.87	0.09	0.00805	1.43	0.07	0.00616
			0.975	0.279	0.15	1.74	0.08	0.00790	1.38	0.06	0.00629
				Overall p(collision) =			**Upwind**	**13.4%**		**Downwind**	**7.3%**
								Average	**10.3%**		

Stage 2

The second stage is to estimate the number of birds flying through rotors (i.e. number of bird at risk) per month. The Study Area measures approximately 11 km across and the number of birds at risk will be estimated for this area. This is to provide a more conservative approach by assuming all birds recorded in close proximity will pass through the Study Site. The flight risk window was first estimated by multiplying the width of the assessment area (11 km) with the maximum height of the turbine (175 m). The total rotor area as proportion to the flight risk window was then calculated by considering the total number of wind turbine (55) and the maximum area of each rotor.

The number of birds at risk in each month was then estimated using adapted methodology from ERM (2005). The number of birds flying at RSA height was divided by the total number of BUS surveys, giving the number of birds per BUS survey. As each BUS survey was 15 minutes long, this number was quadrupled to give the number of birds per hour. The *birds at risk per day* was then calculated by multiplying by the flying time, which was 8 hours for the Wedge-tailed Eagle. The flying time was less than the amount of daylight, as the species is most active when thermals are present, and was not recorded during the early morning period flying at RSA height. This figure was then multiplied by 30.4 to give the number of birds per month flying at RSA height. The number of birds passing through the rotor area was calculated by multiplying the amount of birds at risk per month by the proportion of the area risk window that was made up of the rotor area.

Finally, the number of bird collisions per year will be predicted by multiplying the risk (1st stage) with the number of birds at risk (2nd stage). This number, however, assumes the birds fly as if the wind turbine structures and rotors were not there and take no avoiding action (i.e. death). In reality most birds do take avoiding action and therefore the predicted number is usually adjusted by the avoidance factor. An avoidance rate of 99 % was also applied as this rate assumes that moist species would avoid collision 99 % of the time (Smales & Muir 2005; Smales 2006).

B.1.2 Results

The results of the collision risk model for Wedge-tailed Eagle indicate that between 0.259 and 0.052 birds per month will collide with turbines across the entire Study Area, based on a 95% to 99% avoidance band. This equates to 0.62 birds per year.

Table B.2 Collision Risk Model Results

Species	Band Collision	Birds within RSA	Number of Surveys	Birds at risk per BUS survey (15 mins)	Birds at risk per BUS survey (per hour)	Birds at risk per day	Birds at risk per month	Birds passing rotor area through	No Avoidance	95% Avoidance	99% Avoidance
Wedge-tailed Eagle	0.104	9	18	0.5	2	4	120	49.80591233	5.17981488	0.2589907	0.051798
Risk Window - 0.798969844	*Rotor Area Proportion - 0.415049269*										

Annex C

Seven Part Tests

White Box – Yellow Box – Blakely's Red Gum Grassy Woodland

White Box – Yellow Box – Blakely's Red Gum Grassy Woodland EEC is characterised by the presence or prior occurrence of White Box, Yellow Box and/or Blakely's Red Gum. The understorey at intact sites is characterised by native grasses and a high diversity of herbs. Shrubs are generally sparse or absent, though they may be locally common. Remnants generally occur on fertile lower parts of the landscape where resources such as water and nutrients are abundant. Disturbed remnants form part of the community, referred to as derived native grasslands, including where the vegetation would respond to assisted natural regeneration (DEC 2002).

White Box – Yellow Box – Blakely's Red Gum Woodland (Box Gum Woodland) occurs in the Development Footprint as small, discrete patches of derived native grassland with no canopy trees surrounded by pasture dominated by introduced grasses. It occurs in the Study Area as the derived native grassland with scattered Apple Box (*Eucalyptus bridgesiana*) and Yellow Box (*E. melliodora*) trees.

(a)	*in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*
	Not applicable.
(b)	*in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*
	Not applicable.
(c)	*in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
	(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
	The Project will reduce the extent of Box Gum Woodland in the Study Area. The majority of the Box Gum Woodland that would be removed comprises DNG dominated by Red Grass (*Bothriochloa macra*) and Weeping Grass (*Microlaena stipoides*), with very few native herbs. Field observation indicated Red Grass dominated slopes outside and adjacent to the Study Area. The patches of native grasses as DNG in the Development Footprint are not likely important to the survival of the EEC in the local area as they are small and not unique in the local area. They are unlikely to be important seed sources for regeneration of any Box Gum Woodland stands surrounding the Development Footprint due to the occurrence of similar grasslands outside the Study Area. There is a stewardship block near the south western extent of the Study Area that is managed to maintain and enhance the integrity of Box Gum Woodland in the local area. The small discrete patches of DNG in the Development Footprint are not connected to this block and their loss will not adversely impact the ecological integrity of this Box Gum Woodland Environmental Stewardship block. A number of mitigation measures will be implemented during both the construction and operation phases to further reduce the impacts of the Project. The removal of these DNG patches of Box Gum Woodland would not have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

	(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
	The area of the Project is small, linear and narrow and impacts of the development of the Project will be restricted to the Development Footprint. The Project will remove 2.9 ha of DNG of low local ecological value. No element of the development will adversely impact areas of DNG or Box Gum Woodland outside of the Development Footprint as all impacts will be restricted to this footprint. A number of mitigation measures will be implemented during both the construction and operation phases to minimise the impacts of the Project. The removal of Box Gum Woodland would not adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.
(d)	*in relation to the habitat of a threatened species, population or ecological community:*
	(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
	A total of 21.9 ha of Box Gum Woodland occurs in the Study Area, all of which is derived native grassland (DNG) with scattered Apple Box and Yellow Box trees. A total of 2.9 ha of Box Gum Woodland occurs within the Development Footprint and will be removed as part of the Project. Of this, 1.0 ha of DNG is part of the temporary construction footprint and will be rehabilitated upon completion of construction. Thus, the residual area of Box Gum Woodland that will be removed comprises 1.9 ha of DNG.
	(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
	The DNG in the Study Area is already highly fragmented, consisting of small, discrete patches of native grasses. The development narrow, linear development will not exacerbate this fragmentation.
	(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the Locality,
	The DNG patches in the Study Area are small and are of very low floristic diversity. They are not herb-rich and are predominantly comprised only of the native grasses. Grass diversity is low with each patch dominated by only one grass species (Red Grass or Weeping Grass). The patches of DNG in the Development Footprint are of a poor quality and are not important to the survival of the EEC in the local area.
(e)	*whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*
	At the time of writing, critical habitat for this EEC had not been listed under Part 3 of the TSC Act.
(f)	*whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,*
	No recovery or threat abatement plans have been prepared for Box-Gum Woodland under the NSW TSC Act. However, a draft national recovery plan has been prepared for White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland (DECCW 2010). The overall objective of the recovery plan is to promote the recovery and prevent the extinction of this ecological community.

	The specific objective to be achieved within the life-span of the recovery plan is to minimise the risk of extinction of the ecological community through: • achieving no net loss in the extent and condition of the ecological community throughout its geographic distribution; • increasing protection of sites in good condition; • increasing landscape functionality of the ecological community through management and restoration of degraded sites; • increasing transitional areas around remnants and linkages between remnants; and • bringing about enduring changes in participating land manager attitudes and behaviours towards environmental protection and sustainable land management practices to increase extent, integrity and function of Box-Gum Grassy Woodland. The proposed action will contravene certain objectives of the draft national recovery plan, mostly in regards to net loss to the extent of the EEC. The extent of this removal has been reduced through the iterative design process, with infrastructure being moved away from areas of intact Box Gum Woodland protected in the Box Gum Woodland Environmental Stewardship block.
(g)	*whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*
	The proposed action constitutes, is part of, or is likely to result in the operation of, or increase the impact of the following key threatening processes (KTPs) as listed in schedule 3 of the TSC Act: • clearing of native vegetation; and • invasion of native plant communities by exotic perennial grasses. Areas of Box Gum Woodland protected in the Box Gum Woodland Environmental Stewardship block near the south western extent of the Study Area have been avoided during the design process. A number of mitigation measures will be implemented during both the construction and operation phases to minimise the impacts of clearing. The TSC act also refers to disturbed habitat from clearing permitting the establishment and spread of exotic species which may displace native species. The invasion of the remaining patches of DNG surrounding the Development Footprint community by exotic perennial grasses constitutes a threat to the EEC. Schedule 3 of the TSC Act lists this KTP as a specific threat to White Box - Yellow Box - Blakelys Red Gum Woodland specifically in regards to Coolatai grass (*Hyparrhenia hirta*) invasion. This exotic species was not identified during any surveys within the Study Area however the clearing of this community means the remaining areas are more likely to be subject to increased weed incursion, including the invasion of perennial grasses.
	Conclusion
	Box Gum Woodland occurs as a number of small, discrete patches of DNG in the Study Area of very low ecological quality. The Project will involve the clearing of 2.9 ha of DNG. This will reduce the extent of the EEC, however the Project is not likely to have a significant impact on the EEC as the patches are of very low ecological quality, are small and are not considered unique in the local area.

Threatened Robins – Vulnerable TSC Act

Scarlet Robin (*Petroica boodang)* and ***Flame Robin*** (*Petroica phoenicea)* (V TSC Act),

Scarlet Robin

In NSW, this species occurs from the coast to the inland slopes. After breeding, some Scarlet Robins disperse to the lower valleys and plains of the tablelands and slopes. The Scarlet Robin lives in dry eucalypt forests and woodlands, usually with an open grassy understorey with few scattered shrubs. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Scarlet Robin habitat usually contains abundant logs and fallen timber, which are important for foraging (OEH, 2013b). Several ANSWW records exist for the Scarlet Robin within 10 km of the Study Area which included sighting within the last two years. Nineteen Scarlet Robins were recorded by ERM within the Study Area in areas of open improved pasture and pasture with scattered trees.

Flame Robin

This species is endemic to south eastern Australia. In NSW, it breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes, with a ground layer dominated by native grasses. In winter, the species moves to inland slopes and plains, where it occurs in dry forests, open woodlands and in pastures and native grasslands, with or without scattered trees. The species is occasionally found in temperate rainforest, herbfields, heathlands, shrublands and sedgelands. The species prefers clearings or areas with open understoreys (OEH, 2013b). Two records from the ANSWW exist within 10 km of the Study Area. Nine Flame Robins were recorded by ERM within the Study Area in areas of open improved pasture and pasture with scattered trees.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

The Project involves the construction and commissioning of wind turbine generators (WTG's) together with ancillary structures such as access tracks, electrical substations, building and crane pads, and electrical infrastructure (both underground and overhead power lines). The main impacts to Scarlet and Flame Robins would be habitat removal, and habitat alienation. These species do not typically fly at RSA height and therefore collision risk is low.

Both the Scarlet and Flame Robins are known to occupy more open habitats in winter including pasture and their prevalence within the Study Area is likely to occur on a seasonal basis, with woodland and forested areas likely to be occupied during the breeding season. Although relatively high numbers of these birds were found within the open pasture, there are large amounts of this habitat within the locality of the Study Area. The pasture areas are unlikely to provide significant habitat and are largely devoid of microhabitat features which are important to both of these species in other seasons. The abundance of the threatened Robins in the Study Area is likely to be related to its close proximity to large areas of Woodland and Forest which offers suitable breeding habitat for both species. The proposal aims to avoid clearance of large remnants of woodland habitat thus there is a reduced likelihood of removal of breeding habitat and disruption of nesting. Pre-clearance inspections for nests and implementation of management measures as appropriate may further limit any likely disturbance of nesting.

The Project will involve the permanent removal or modification of approximately 1.9 ha of derived native grassland and 10.7 ha of woodland. Temporarily impacted areas would include 1.0 ha of Derived Native Grassland and 0.4 ha of Woodland. The size of the development footprint is 106.5 ha with 87 % of the infrastructure located in non-native vegetation which is likely to have lower value to the Scarlet and Flame Robin than areas of woodland which may be used for breeding.

	The impact of habitat alienation on woodland birds such as the Scarlet and Flame Robins is yet to be understood. To monitor and quantify this impact post construction and operation surveys should be carried out in those areas potentially affected. The proposed action is considered unlikely to impact the life cycle of threatened woodland bird species such that viable local populations of these species will be placed at risk of extinction.
(b)	*in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*
	Not applicable.
(c)	*in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
	(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
	Not applicable.
	(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
	Not applicable.
(d)	*in relation to the habitat of a threatened species, population or ecological community:*
	(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
	The Project will involve the permanent removal or modification of approximately 1.9 ha of derived native grassland and 11.1 ha of woodland. Temporarily impacted areas would include 1.0 ha of Derived Native Grassland and 0.4 ha of Woodland. The size of the development footprint is 106.5 ha with 86.9% of the infrastructure located in non-native vegetation. Although pasture areas will be impacted, a large proportion will remain within the locality. The pasture areas do not contain habitat which is restricted in range, nor that has high value to the species. Small areas of forest will be impacted, however much of this habitat has been avoided by the proposal. An expanse of forest exist immediately adjacent to the development footprint represents more optimal habitat including possible breeding habitat or linkages to breeding habitat. Hollow-bearing trees and fallen timber would be retained where possible to mitigate impacts.
	(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
	No habitats will be fragmented significantly by the proposal. The small areas of clearance within the forested area will not isolate any areas of habitat, as there will still be continuous forest surround the cleared areas. Clearing with the woodland will be limited to the widening of existing tracks, the creation of new access tracks, corridors for transmission lines and clearing for crane pads and WTGs. This will occur for three WTGs.
	(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,
	The importance of the habitats to be removed as part of the proposal to the threatened woodland birds is unlikely to be crucial to the survival of a local viable population. Widening of existing tracks, the creation of new access tracks, corridors for transmission lines and clearing for crane pads and WTGs is not expected to threaten the long-term survival of local populations of threatened Robins. The habitat to be impacted by the proposed action is not considered to be critical to the long-term survival of these species in the locality.

(e)	*whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*
	No critical habitat for either the Flame Robin or the Scarlet Robin is listed under Part 3 of the TSC Act.
(f)	*whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,*
	No recovery plans have been prepared for any of the threatened Robins.
(g)	*whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*
	There are currently 37 key threatening processes listed under the Threatened Species Conservation Act 1995. Two are relevant to the threatened woodland bird species: • clearing of native vegetation; • removal of dead wood and dead trees; and A number of avoidance and mitigation measures will be adopted to minimise these processes including avoiding and/or minimising clearance of native vegetation, avoiding or minimising removal of dead trees where possible.
	Conclusion
	The proposal will lead to the loss of suboptimal pasture habitat and a small loss of Forested habitat for the Scarlet and Flame Robin. However, considering the clearance area and the much large area of more optimal potential breeding habitat surrounding the Study Area, it is unlikely that the proposal will lead to a significant impact on these species.

Eastern False Pipistrelle (*Falsistrellus tasmaniensis),* **Eastern Bent-wing Bat** (*Miniopterus schreibersii oceanensis)* and Greater Broad-nosed Bat *(Scoteanax ruepellii)* (V TSC Act)

Eastern False Pipistrelle

The Eastern False Pipistrelle occurs in tall forests with trees taller than 20 m. It prefers moist habitats where it generally roosts communally in eucalypt hollows, but has also been found under loose bark on trees and in buildings and caves. The species hunts for beetles, moths, weevils and other flying insects above or just below the tree canopy. The species hibernates over winter and females are pregnant in late spring to early summer (OEH 2012). It is likely this species occurs in the area as it has previously been recorded in the Abercrombie River National Park. It is probable (ie the calls were identified with a greater than 60% level of confidence) that the species' call was recorded 19 times using the Songmeter bat detectors. There were 181 calls that may have been the Eastern False Pipistrelle or the Eastern Broad-nosed Bat (*Scotorepens orion*) as the two species are difficult to distinguish based upon call type alone. As there were a reasonable number of probable records of the species' call and as it has previously been recorded in the Abercrombie River National Park to the west of the Study Area and in the Wiarborough Nature Reserve to the south east of the Study Area, the species is considered likely to occur in the Study Area.

Eastern Bentwing-bat

The Eastern Bentwing-bat hunts in forested areas, catching moths and other flying insects above the canopy. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. This species forms discrete populations centred on a maternity cave with specific temperature and humidity regimes that is used annually in spring and summer for the birth and rearing of young. At other times of the year, populations disperse within about 300 km range of maternity caves (OEH 2012). The nearest known maternity roost site is Bungonia, approximately 85 km to the south east of the Study Area (OEH 2012). A maternity roost site also occurs at Wee Jasper, approximately 140 km to the south west. There was one possible (20 – 60% likelihood) recording of this species' call and three recordings that may have been this species or the Large Forest Bat (*Vespadelus darlingtoni*). The species has been recorded previously in the Abercrombie River National Park and in the Wiarborough Nature Reserve. It is considered likely there may be higher activity of this species during warmer times of year and therefore, the species is assumed to occur in the Study Area.

Greater Broad-nosed Bat

The Greater Broad-nosed Bat uses a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. It usually roosts in tree hollows, however, it has also been found in buildings. The species forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m searching for beetles and other large, slow-flying insects. It has been known to eat other bat species. Open woodland habitat and dry open forest suits the direct flight of this species. Little is known of its reproductive cycle, however a single young is born in January; prior to birth, females congregate at maternity sites located in suitable trees, where they appear to exclude males during the birth and raising of the single young (OEH 2012). There were four possible recordings of this species' call and it has been recorded previously in the Abercrombie River National Park. Therefore, it is considered likely to occur in the Study Area.

(a)	*in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*
	The Project involves the construction and commissioning of wind turbine generators (WTG's) together with ancillary structures such as access tracks, electrical substations, building and crane pads, and electrical infrastructure (both underground and overhead power lines). The main impact to the three threatened bats would be blade strike, barotrauma and some habitat loss where woodland will be removed. The three threatened bats have the potential to fly at RSA height within the study area. The majority of the turbines have been sited to avoid woodland areas and as such, have been placed in open areas, reducing the likelihood of collision. Canopy heights in the woodland areas on the hill tops in the vicinity of potential turbine locations are typically 10-15 m in total height. RSA height has been conservatively estimated at 25 – 192 m. It is likely that some bats would fly within RSA and as such collisions or barotrauma may occur. All of the known maternity caves for the Eastern Bent-wing Bat are a considerable distance from the Study Area; therefore it is unlikely that a significant proportion of the population of this species is likely to be impact by the proposal as the bats will be spread out over a large geographic range. The Project will involve the permanent removal or modification of approximately 10.7 ha of woodland and temporary removal of 0.4 ha of woodland, however, large tracts of intact native woodland surround the Study Area and would not be affected by the proposed action. The proposed action is unlikely to impact the life cycle of any of the threatened bat species such that viable local populations of these species will be placed at risk of extinction.
(b)	*in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*
	Not applicable.
(c)	*in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
	(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
	Not applicable.
	(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
	Not applicable.
(d)	*in relation to the habitat of a threatened species, population or ecological community:*
	(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
	The Project will involve the permanent removal or modification of approximately 10.7 ha of woodland and temporary removal of 0.4 ha of woodland. The woodland areas comprised mature eucalypts, however, there were few hollow bearing trees within the Development Footprint. Large tracts of native vegetation surround the Study Area and represent more optimal habitat. Hollow-bearing trees would be retained where possible to mitigate impacts.

	(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
	No habitats will be fragmented significantly by the proposal. The small areas of clearance within the forested area will not isolate any areas of habitat, as there will still be continuous forest surrounding the cleared areas. Clearing within the woodland will be limited to the widening of existing tracks, the creation of new access tracks, corridors for transmission lines and clearing for crane pads and WTGs. This will occur for three WTGs.
	(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,
	The importance of the habitats to be removed as part of the proposal is unlikely to be crucial to the survival of a local viable population of any of the three threatened bats. Widening of existing tracks, the creation of new access tracks, corridors for transmission lines and clearing for crane pads and WTGs is not expected to threaten the long-term survival of local populations of the three threatened bats. The habitat to be impacted by the proposed action is not considered to be critical to the long-term survival of these species in the locality.
(e)	*whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*
	No critical habitat for either the three threatened bats is listed under Part 3 of the TSC Act.
(f)	*whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,*
	No recovery plans have been prepared for any of the threatened bats.
(g)	*whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*
	There are currently 37 key threatening processes listed under the Threatened Species Conservation Act 1995. Three are relevant to the Eastern Bentwing Bat, the Eastern False Pipistrelle and the Greater Broad-nosed Bat; • clearing of native vegetation; • removal of dead wood and dead trees; and • loss of hollow-bearing trees. Avoidance and mitigation measures will be adopted to minimise these processes including avoiding clearance of native vegetation in large tracts, avoiding or minimising removal of dead wood, dead trees and hollow-bearing trees where possible. This has largely been achieved through avoidance of large tracts of forested/woodland habitat in the Study Area.
	Conclusion
	Whilst the proposal would reduce potential foraging habitat for the three threatened bats and potential roosting habitat for the Eastern False Pipistrelle and Greater Broad-nosed Bat, the loss of habitat would be very small in comparison to the resources available in the tracts of native woodland that surround the Study Area . The three threatened bats could be impacted by turbine collision/barotrauma as they fly in the sweep zone. It is difficult to determine the level of impact associated with turbine collision and barotrauma due to the lack of survey data for the species. However, it is considered that the majority of bat movements would not be within RSA due to the difference in height between the RSA and the woodland canopy, and the majority of turbines having been placed in open areas. While it is likely that some bats would fly within the RSA, leading to collisions or barotrauma, it is considered unlikely that this would occur to the extent that it would significantly impact the threatened bat species. Nevertheless, the three threatened bats are considered to be key species and would be monitored as part of a bird and bat monitoring program.

Annex D

Biobanking Credit Calculator Reports

BioBanking Credit Calculator

Ecosystem credits

Proposal ID :	0089/2013/0733D
Proposal name :	Paling Yards Wind Farm
Assessor name :	Evelyn Craigie
Assessor accreditation number :	0089
Tool version :	1.1
Report created :	03/06/2013 16:11

Assessment circle name	Landscape score	Vegetation zone name	Vegetation type name	Condition	Red flag status	Management zone name	Management zone area	Current site value	Future site value	Loss in site value	Credit required for bio diversity	Credit required for TS	TS with highest credit requirement	Average species loss	Species TG Value	Final credit requirement for management zone
AC1	12.00	LA103_Moderate/Good_Poor	Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	Moderate/Good_Poor	Yes	Hardstand	1.90	11.46	0.00	11.46	11	36	Spotted-tailed Quoll	22.22	0.35	36
AC1	12.00	LA124_Moderate/Good_Medium	Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands	Moderate/Good_Medium	No	Hardstand	0.10	42.71	0.00	42.71	1	0		0.00	0.00	1
AC1	12.00	LA124_Moderate/Good_Medium	Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands	Moderate/Good_Medium	No	Powerline	6.80	42.71	10.94	31.77	74	155	Spotted-tailed Quoll	27.77	0.35	155
AC1	12.00	LA124_Moderate/Good	Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands	Moderate/Good	No	Powerline	2.30	38.19	15.80	22.39	20	25	Spotted-tailed Quoll	11.11	0.35	25
AC1	12.00	LA182_Moderate/Good_Medium	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)	Moderate/Good_Medium	No	Hardstand	1.20	51.04	0.00	51.04	19	66	Spotted-tailed Quoll	72.22	0.35	66
AC1	12.00	LA186_Moderate/Good_Poor	River Oak forest and woodland of the NSW South Western Slopes and South Eastern Highlands Bioregions (Benson 85)	Moderate/Good_Poor	Yes	Powerline	0.30	49.48	18.75	30.73	3	6	Squirrel Glider	33.33	0.45	6

BioBanking Credit Calculator

Species credits

Proposal ID :

Proposal name :

Assessor name :

Assessor accreditation number :

Tool version : 1.1

Report created : 03/06/2013 16:11

Scientific name	Common name	Species TG value	Identified population?	Can Id. popn. be offset?	Area / number of loss	Negligible loss	Red flag status	Number of credits
			No					

BioBanking Credit Calculator

BioBanking credit report

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

Date of report: 3/06/2013 Time: 4:13:01PM Tool version: 2.0

Development details

Proposal ID:	0089/2013/0733D
Proposal name:	Paling Yards Wind Farm
Proposal address:	Abercrombie Rd Paling Yards NSW 2580
Proponent name:	Union Fenosa Wind Australia Pty Ltd
Proponent address:	Suite 403, 68 York St Sydney NSW 2000
Proponent phone:	02 82978700
Assessor name:	Evelyn Craigie
Assessor address:	Buidling C, 33 Saunders Street PYRMONT NSW 2009
Assessor phone:	8586 8719
Assessor accreditation:	0089

Improving or maintaining biodiversity

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

Red flag	Reason
Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
River Oak forest and woodland of the NSW South Western Slopes and South Eastern Highlands Bioregions (Benson 85)	Vegetation type being > 70% cleared; or it contains an endangered ecological community;

The application for a red flag determination should address the criteria set out in the BioBanking Assessment Methodology. Please note that a biobanking statement cannot be issued unless the determination is approved.

Additional information required for approval:

- ☐ Change to percent cleared for a vegetation type/s
- ☐ Use of local benchmark
- ☐ Change negligible loss
- ☐ Expert report
- ☐ Predicted threatened species not on site
- ☐ Change threatened species response to gain (Tg value)

Ecosystem credits summary

Vegetation type	Area (ha)	Credits required	Red flag
Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands	0.10	1	No
Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands	6.80	155	No
Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	1.90	36	Yes
Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands	2.30	25	No
Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)	1.20	66	No
River Oak forest and woodland of the NSW South Western Slopes and South Eastern Highlands Bioregions (Benson 85)	0.30	6	Yes
Total	12.60	289	

Credit profiles

1. Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands, (LA103)

Number of ecosystem credits required	36
CMA sub-region	Crookwell - Lachlan
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands, (LA103) Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands, (CW102) Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (CW112)	Crookwell - Lachlan Upper Slopes - Central West

2. Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290), (LA182)

Number of ecosystem credits required	66
CMA sub-region	Crookwell - Lachlan
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions

Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290), (LA182) Broad-leaved Stringybark - Mountain Ribbon Gum - Messmate open forest of escarpment ranges of the North Coast and New England Tablelands, (HU518) Red Stringybark - Red Box - Long-leaved Box - Scribbly Gum shrub - tussock grass open forest of the southern section of the NSW South Western Slopes Bioregion (Benson 290), (MU573)	Crookwell - Lachlan Wollemi (Part A) Wollemi - Central West Capertee Bathurst - Central West Hill End Orange - Lachlan Yengo - Hunter/Central Rivers Cumberland - Sydney Metro Wyong Walcha Plateau - Northern Rivers Armidale Plateau Rocky River Gorge Northeast Forest Lands - Northern Rivers Tenterfield Plateau Kerrabee - Central West Hunter Liverpool Range - Central West Liverpool Range - Namoi Peel - Namoi Upper Slopes - Lachlan Upper Slopes - Central West Stanthorpe Plateau

3. Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands, (LA124)

Number of ecosystem credits required	181
CMA sub-region	Crookwell - Lachlan
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	**Offset options - CMA sub-regions**
Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands, (LA124)	Crookwell - Lachlan Wollemi (Part A) Wollemi - Central West Capertee

	Bathurst - Central West Hill End Orange - Lachlan Yengo - Hunter/Central Rivers Cumberland - Sydney Metro Wyong Walcha Plateau - Namoi Walcha Plateau - Northern Rivers Armidale Plateau Rocky River Gorge Oberon - Central West Eastern Nandewars Murrumbateman - Murrumbidgee Bondo Bondo (Part A) Bondo (Part B) Wongwibinda Plateau Nightcap Northeast Forest Lands - Northern Rivers Tenterfield Plateau Kerrabee - Central West Hunter Liverpool Range - Central West Liverpool Range - Namoi Peel - Namoi Upper Slopes - Lachlan Upper Slopes - Central West Stanthorpe Plateau

4. River Oak forest and woodland of the NSW South Western Slopes and South Eastern Highlands Bioregions (Benson 85), (LA186)

Number of ecosystem credits required	6
CMA sub-region	Crookwell - Lachlan
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
River Oak forest and woodland of the NSW South Western Slopes and South Eastern Highlands Bioregions (Benson 85), (LA186)	Crookwell - Lachlan Orange - Lachlan Pilliga - Central West Pilliga (Part B) Upper Slopes - Lachlan Upper Slopes - Central West Liverpool Plains (Part A) Liverpool Plains (Part B)

ERM has over 100 offices across the following countries worldwide

Australia
Argentina
Belgium
Brazil
China
France
Germany
Hong Kong
Hungary
India
Indonesia
Ireland
Italy
Japan
Korea
Malaysia
Mexico
Netherlands
Peru
Poland
Portugal
Puerto Rico
Singapore
Spain
Sri Lanka
Sweden
Taiwan
Thailand
UK
USA
Venezuela
Vietnam

Environmental Resources Management

Building C, 33 Saunders Street
Pyrmont NSW 2009
Locked Bag 24,
Broadway NSW 2007

T: 61 2 8584 8888
F: 61 2 8584 8800
www.erm.com

ERM