

PROPOSED BERRYBANK WIND FARM

**FLORA, FAUNA AND TARGETED
BROLGA ASSESSMENT**

Union Fenosa Australia Wind Pty Ltd



Brett Lane & Associates Pty. Ltd.
Ecological Research & Management

**605 Nicholson Street, North Carlton
P O Box 592, North Carlton, Vic. 3054**

Ph. (03) 9387 5008

Fax. (03) 9387 6115

June 2009

Report No. 7152 (7.3)

CONTENTS

1.	EXECUTIVE SUMMARY	1
2.	INTRODUCTION.....	4
2.1.	Stage 1 - 2007	4
2.2.	Stage 2 – 2008 - 2009	4
3.	SOURCES OF INFORMATION AND ASSESSMENT METHODOLOGY	6
3.1.	Existing information	6
3.2.	Field methodology.....	6
3.2.1.	Botanical assessment	6
3.2.2.	Fauna assessment.....	7
3.2.3.	Targeted Brolga Assessment	8
3.3.	Limitations.....	10
4.	SITE DESCRIPTION	12
5.	FLORA AND FAUNA OF THE SITE	13
5.1.	Flora and vegetation.....	13
5.1.1.	Ecological Vegetation Classes.....	13
5.1.2.	Plant species	14
5.1.3.	Conservation significance according to the Framework	15
5.2.	Fauna.....	22
5.2.1.	Habitat assessment.....	22
5.2.2.	Fauna Species.....	22
5.3.	Bird Utilisation Survey.....	26
5.3.1.	Methods.....	27
5.3.2.	Limitations.....	28
5.3.3.	Results of the bird utilisation survey	30
5.3.4.	Bird Observations.....	30
5.4.	Bat Surveys.....	39
5.4.1.	Methods.....	39
5.4.2.	Results.....	40
6.	TARGETED BROLGA ASSESSMENT	43
6.1.	Aims of investigation.....	43
6.2.	Distribution and movement of Brolgas in Victoria	43
6.3.	Previous records	44

6.4.	Brolga habitat assessment	44
6.5.	Brolga sightings.....	45
6.6.	Summary	47
7.	IMPACTS AND REGULATORY IMPLICATIONS OF THE PROPOSAL.....	48
7.1.	Planning Controls	48
7.2.	Native Vegetation Management Framework	48
7.2.1.	How the Framework operates	48
7.2.2.	Vegetation proposed to be removed	49
7.2.3.	Offset targets for removal from habitat zones.....	50
7.3.	Impact of the proposed wind farm on birds.....	51
7.3.1.	Mortality caused by wind turbines.....	51
7.3.2.	Conclusions	55
7.4.	EPBC Act	56
7.5.	FFG Act.....	57
7.6.	Environment Effects Act 1978.....	57
7.7.	Native Vegetation Management Framework	59
7.8.	Other issues	60
7.9.	Summary of key implications	61
8.	REFERENCES	63

LIST OF TABLES

Table 1:	Areas of native vegetation at the site of the proposed Berrybank wind farm.....	17
Table 2:	List of FFG Act and EPBC Act listed threatened plant species and their likelihood of occurrence in the study area.	20
Table 3:	Threatened fauna with potential habitat at the proposed Berrybank wind farm	23
Table 4:	Times of day when points* were counted during each survey day.	27
Table 5:	Summary of numbers of individual birds and their height distribution seen on surveys points at the Berrybank Wind Farm site. A=below rotor swept area (RSA) height (30 m); B= at RSA height (30-120 m); C= above RSA height (>120m).....	34
Table 6:	The number of birds counted at each of the survey points at Berrybank Wind Farm. A=below rotor swept area (RSA) height (30 m); B= at RSA height (30-120 m); C= above RSA height (>120 m).	36
Table 7:	Species flying at rotor swept area height during bird utilisation surveys at the Berrybank Wind Farm.	37

Table 8: Timetable for Anabat recording of bat calls at the proposed Berrybank Wind Farm site..... 39

Table 9: Species of bats recorded during the impact assessment of the Berrybank Wind Farm site..... 41

Table 10: Bat activity (calls per night) at the Berrybank Wind farm..... 42

Table 11: A comparison of activity levels of bat species recorded on Berrybank Wind Farm site..... 42

Table 12: Summary of habitat quality of wetlands visited during the breeding season survey, including confirmed sighting of feeding and nesting Brolgas..... 45

Table 13: Likely response to applications for removal of intact native vegetation..... 49

Table 14: Application referral criteria 49

Table 15 Offset targets in habitat hectares for the removal of native vegetation at two crossovers 50

Table 16: Summary of bird mortality estimates for wind farms in Europe and North America (Sources: Erickson *et al* 2001; Percival 2003; NWCC 2004). 52

Table 17: Studies of the possible disturbance effects of wind farms on birds (after Percival 2003)..... 54

Table 18: Environmental Effects Referral Criteria and its relevance to the proposed Berrybank Wind Farm development 58

LIST OF FIGURES

Figure 1: Study area and native vegetation 16

Figure 2: Bird Utilisation Survey Points 29

Figure 3: The cumulative number of species of birds recorded during consecutive counts at the observation points on the Berrybank Wind Farm. 30

Figure 4: Historical Brolga records and 2008 sightings within 20 km of the proposed wind farm..... 46

APPENDICES

Appendix 1: Plant species recorded in the Berrybank study area..... 67

Appendix 2: Fauna species that occur or are likely to occur in the Berrybank study area. 69

1. EXECUTIVE SUMMARY

Union Fenosa Wind Australia Pty Ltd commissioned Brett Lane & Associates Pty Ltd to undertake a flora and fauna assessment of a site proposed for wind farm development at Berrybank, 80 kilometres west of Geelong in south-west Victoria.

The assessment involved a review of existing flora and fauna literature and databases, and field inspections to identify any significant flora and fauna issues that may be associated with the development of the wind farm. In particular, this assessment focussed on whether any issues may arise as a result of the development in relation to the federal *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act), the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act) and *Environment Effects Act 1978*, and the state Native Vegetation Management Framework and other planning policies covering flora and fauna.

The study area is almost entirely cleared of native vegetation and the land use is agricultural, including cropping and grazing. As a result the likelihood of threatened flora or fauna species occurring in the study area is considered to be low. Primary production on the site includes sheep, cattle, wheat and canola. Native vegetation that remains is mostly restricted to roadsides within and around the boundaries of the wind farm site. This remnant vegetation varies from low to high quality and contains two threatened species, Spiny Rice-flower and Trailing Hop-bush. A number of other threatened flora species also have the potential to occur within these roadside areas, or along the Chain of Ponds Creek: Adamson's Blown-grass, Button Wrinklewort, Clover Glycine, Curly Sedge, Fragrant Leek-orchid, Hairy Tails, Large-fruit Fireweed, Maroon Leek-orchid, Small Milkwort, Swamp Fireweed and White Sunray.

Most of the remnant patches of vegetation on roadsides are classed as Western (Basalt) Plains Grassland Community or Western Basalt Plains (River Red Gum) Grassy Woodland Floristic Community, both of which are listed as threatened under the state's FFG Act. These patches are also classified as Natural Temperate Grassland of the Victorian Volcanic Plain, an ecological community listed as Critically Endangered under the EPBC Act. The applicable Ecological Vegetation Class is Plains Grassland (EVC 132).

The current proposal involves seventeen track – road crossovers to provide access from public roads onto the wind farm site. These areas are referred to herein as crossovers. The locations of crossovers have been carefully chosen based on vegetation mapping of roadsides within the study area. Two (12%) of these crossovers involve the unavoidable removal of native vegetation. All other crossovers have been chosen with the 'avoid' and 'minimise' principles of the state Native Vegetation Management Framework in mind.

The area of vegetation proposed to be removed for these two crossovers totals 0.11 hectares. To meet the principles of the framework, removed native vegetation will need to be appropriately offset.

Literature review and the site inspection found potential habitat for several listed threatened fauna species in the region and the likelihood of occurrence on the site has been assessed. These include the nationally threatened (EPBC Act listed) Striped Legless Lizard and the Golden Sun Moth, which may inhabit areas of roadside vegetation.

In addition, the Growling Grass Frog, another nationally threatened species, has the potential to occur within the wind farm site. However, wetland habitats on the site are limited in extent, lack suitable fringing vegetation and are not linked to nearby areas

where the species occurs. The probability that it occurs in the study area is considered to be low.

Several state threatened waterbirds, including the Brolga, have the potential to occur in the study area based on wider regional records. Historical records of the Brolga, together with a targeted breeding season survey within 20 km of the wind farm indicated that there is a low probability of significant numbers of Brolgas occurring on or near the wind farm on a regular basis. No flocking sites occur nearby. Risks to the Brolga from the project are considered to be low.

Anecdotal reports suggest there are Wedge-tailed Eagle nests within the proposed wind farm site. No evidence of a Wedge-tailed Eagle nest was found during the current assessment.

Potential flora and fauna issues do not represent significant constraints to the future development of the wind farm. The key issues and appropriate responses are presented summarised below.

- *Finding:* The site was mostly cleared of native vegetation for agriculture, although intact native vegetation occurred along roadsides. The state Native Vegetation Management Framework requires that clearing of native vegetation be avoided in the first instance, with unavoidable removal being minimised and offset with vegetation protection, enhancement and rehabilitation works nearby.
- *Response:* Vegetation mapping in the study area shows remnant grassland was confined mostly to roadside reserves. Most crossover points for site access tracks have been located to avoid this vegetation. Appropriate offsets have been calculated for the unavoidable removal of native vegetation at two crossover locations and for the maximum likely number of overhead power poles for the grid connector. No offset site is likely to be found within the wind farm site and a financial contribution to a third-party (off-site) offset is considered the most practical means of meeting the very limited offset target (i.e. 0.1 habitat hectares).
- *Finding:* Threatened plant species listed under the EPBC Act or the FFG Act, or listed as rare or threatened on the DSE Advisory List, may occur in remnant vegetation on public roadsides, which covers a small percentage of the proposed wind farm site.

Response: Native vegetation remnants occur on a small proportion of the area potentially proposed for wind farm infrastructure. Layout plans have been carefully assessed and planned to avoid removing native roadside vegetation wherever possible. Currently, only two of the seventeen crossover points involves the removal of roadside native vegetation. Initial layout plans should be assessed before finalisation to ensure micro-siting takes this matter into consideration. (Note that this may occur after a planning permit is issued, given the limited extent of native vegetation).

- *Finding:* One pair of Wedge-tailed Eagles may occur on or near the site. Utilisation rates for this species during the bird utilisation survey are considered low.

Response: Significant risks to the eagle population are considered unlikely therefore no further investigation of eagle use of the site is warranted. Impacts on a single eagle pair from the wind farm are not considered to represent a significant impact on the regional or wider population of this widespread species.

- *Finding:* The bird utilisation survey found that common farmland species dominate the avifauna of the site. No threatened species were found. The most abundant birds at rotor swept area were also common farmland birds.

Response: No further investigation of bird risks is warranted, other than the work that has been undertaken on the Brolga (see below).

- *Finding:* Some waterbirds, including the threatened Brolga (listed on the FFG Act, or considered threatened on DSE's Advisory List) may occur occasionally in small numbers on the proposed wind farm site. A Level Two risk assessment for the Brolga, and in particular a targeted breeding season survey of the region within 20 km of the wind farm, was initiated. This located three Brolga pairs (none breeding) between 14 and 20 kilometres from the wind farm site. This is well beyond the distance at which direct or indirect impacts on this species would be expected from a wind farm (i.e. usually up to 5 km from a wind farm).

Response: Usage of the wind farm site and its surrounds by Brolgas on a regular basis is considered unlikely and impacts on this species are unlikely to be of concern. No Level Three (*sensu* AusWEA 2005) risk assessment is therefore warranted.

- *Finding:* Nine species of bats were recorded utilising the wind farm site. Species were common, secure, and none was listed as threatened either nationally or at the state level. Some bat species recorded relatively high activity levels, particularly at sites where large Sugar Gum plantations were present and may have been used as roosting sites.
- *Response:* No significant impacts on threatened bat species are anticipated so no further investigations are warranted.

2. INTRODUCTION

Union Fenosa Australia Wind Pty Ltd is seeking planning approval for the establishment of a wind farm in predominantly farming country near Berrybank, approximately 80 km west of Geelong in southwest Victoria. Brett Lane & Associates Pty Ltd was engaged to undertake a flora and fauna assessment of the area proposed for the wind farm. The scope of this assessment is described below.

2.1. Stage 1 - 2007

- A preliminary flora and fauna assessment, including a review of existing DSE flora and fauna databases and EPBC Act Protected Matters Search Tool, and an inspection of the site was undertaken in 2007;
- To determine if there are any significant flora and fauna issues associated with the development of this project;
- To assess specifically the implications for the project arising from:
 - The federal *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act);
 - Victorian biodiversity protection legislation such as the *Flora and Fauna Guarantee Act 1988* (FFG Act);
 - The Victorian *Environment Effects Act 1978*; and
 - The state Native Vegetation Management Framework and any other relevant planning provisions;
- To undertake a Level 2 Risk Assessment of the proposal on the Brolga, to ascertain whether the proposal is likely to pose a significant impact on the species.

2.2. Stage 2 – 2008 - 2009

- Spring threatened flora surveys and native vegetation mapping; and
- A flocking season survey of the brolga;
- Further detailed breeding season surveys of the Brolga; and
- An autumn bat survey (2009)

This report presents the results of the flora and fauna assessment and it is divided into the sections described below.

Section 3 describes the sources of information and methodologies used in the current assessment.

Section 4 describes the site.

Section 5 presents the results of the flora and fauna assessment.

Section 6 describes the results of the targeted Brolga investigation.

Section 7 discusses the implications of the findings for the development planning, assessment process and timing of relevant investigations.

This report was prepared by a team of Brett Lane & Associates Pty Ltd comprising Davide Coppelino (Botanist), Justin Sullivan (Botanist), Peter Lansley (Zoologist), Teisha Sloane (Zoologist), Khalid Al-Dabbagh (Ecologist), Jeremy Ward (Zoologist), Jennifer Prior

(Zoologist), Bill Wallach (Botanist), Mal Wright (Senior Ecologist) and Brett Lane (Principal Consultant).

3. SOURCES OF INFORMATION AND ASSESSMENT METHODOLOGY

This section of the report identifies the sources of information and methodology used to assess flora and fauna on the site and its surrounds. Only terrestrial vertebrate fauna and vascular plants were considered during this assessment.

3.1. Existing information

This investigation is based on the information sources described below.

- An *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Report was generated using the on-line search function on the federal Department of Environment, Water, Heritage and the Arts website (DEWHA 2008). This was used to identify matters of national environmental significance that are known from, or have the potential to occur in, the region within 15 kilometres of the proposed wind farm.
- Historical and current Ecological Vegetation Class mapping was reviewed, including the Corangamite (7521), Skipton (7522), Colac (7621) and Ballarat (7622) 1:100,000 Biomaps and the Biodiversity Interactive Mapping webpage of the Department of Sustainability and Environment.
- Data were reviewed on the occurrence of flora, and specifically rare and threatened flora, from the Viridans Flora Information System (FIS), a database administered by the Department of Sustainability and Environment.
- Data were reviewed on the occurrence of vertebrate fauna, including all records of rare and threatened fauna from the Viridans Victorian Fauna Database (also known as the Atlas of Victorian Wildlife or AVW), a database administered by the Department of Sustainability and Environment (also mapped on the 1:100,000 Biomaps referred to above).
- Data on bird occurrences were reviewed from the Birds Australia New Atlas of Australian Birds, covering the period 1998 to the present.
- Wetland data for the study area was obtained from 1:50,000 topographic maps of the region.

The search regions for the FIS and EPBC Protected Matters report and AVW were calculated within a radius of 15 kilometres from the approximate central point of the proposed wind farm site at coordinates: 37° 56' 37"S and 143° 30' 49"E.

3.2. Field methodology

3.2.1. Botanical assessment

Flora and fauna field assessments were conducted in early October 2007 and mid-October 2008. During the field assessments, the study area was surveyed by vehicle and accessible areas potentially supporting native vegetation were assessed on foot.

Vegetation type and quality, dominant species, threatened species habitat and other baseline flora observations were recorded.

Areas containing native vegetation subject to the state's Native Vegetation Management Framework (DNRE 2002), referred to herein as the 'Framework', were mapped using aerial photography interpretation and ground truthing.

Defining vegetation

Native vegetation in Victoria has been defined by the DSE as belonging to three categories (DNRE 2002, DSE 2007a). These are:

- Remnant patch;
- Scattered trees; and
- Degraded treeless vegetation.

These categories are described in detail below, together with the method DSE prescribes for their assessment.

Remnant Patch

Remnant patches of remnant native vegetation are composed of indigenous plant species considered part of a clearly definable Ecological Vegetation Class (EVC). Such vegetation includes remnant vegetation with the following attributes:

- Proportion of indigenous understorey species being greater than 25% total understorey cover (excluding bare ground); and/or
- Indigenous canopy trees with at least 20% projected foliage canopy cover (DSE 2007a).

Scattered trees

Scattered trees comprise indigenous trees with projected foliage canopy cover less than 20% and total cover of indigenous species (excluding bare ground) is less than 25% (DSE 2007a).

Degraded treeless vegetation

Degraded treeless vegetation comprises all other vegetation (DSE 2007a). This category includes the following:

- Treeless vegetation with less than 25% total cover of indigenous species (excluding bare ground); or
- Treeless vegetation that has greater than 25% total cover of indigenous species (excluding bare ground) but is dominated by a small number of opportunistic native species which were unlikely to have been dominant prior to a disturbance event (e.g. cropping).

3.2.2. Fauna assessment

The field survey was undertaken on 11th and 14th September 2007 during mostly fine and cool weather conditions with some patchy cloud cover and sunny breaks. Light to strong winds blew from a south westerly to north westerly direction. The daytime temperature averaged 15 °C. Some overnight rain was experienced prior to the morning of 14th September, but this had ceased by dawn and did not hamper daytime observations.

These conditions were considered to be suitable for detecting the majority of the species that were likely to occur on the site, based on the review of existing information and site habitat conditions. The study area was traversed and inspected by car. It was estimated that 85% of the land surface of the proposed wind farm was covered by this method. This level of inspection is considered to be detailed enough to document habitat types, and to

ascertain the likelihood that the site supports threatened fauna species that occur elsewhere in the search region. A number of techniques were used to detect fauna species inhabiting the study area, they included:

- Incidental searches for mammal scats, tracks and signs (e.g. diggings, signs of feeding and nests/burrows);
- Turning over logs and rocks for reptiles, frogs and small mammals;
- Bird observation during the day;
- General searches for reptiles and frogs, including listening to frog calls in seasonally wet areas (

No mammal trapping, reptile pitfall trapping or evening frog call playback was undertaken as habitats were not suitable for threatened species and targeted species surveys were therefore not warranted.

Fauna habitat types were characterised at the sites and are described in Section 5.2.1. The quality of fauna habitat was assessed based on the criteria detailed below. These criteria have been modified to suit particular vegetation types, such as treeless environments, as necessary. Three quality categories were used, as described below.

High: Fauna habitat components are usually all present (i.e. vegetation intact, old-growth trees and fallen timber) and habitat linkages to other remnant ecosystems in the landscape are intact;

Moderate: Some fauna habitat components are often missing (i.e. vegetation disturbed, old-growth trees, fallen timber), although linkages with other remnant habitats in the landscape are usually intact;

Low: Many fauna habitat elements in low quality remnants have been lost, including old-growth trees (eg. due to past timber harvesting) and fallen timber, and tree canopies are often highly fragmented. Remnants may be severely weed-invaded and possess few native structural and floristic components. Habitat linkages with other remnant ecosystems in the landscape have usually been removed by extensive past clearing.

3.2.3. Targeted Brolga Assessment

To provide additional information on the status, distribution and possible breeding of the Brolga on wetlands in the vicinity of the proposed Berrybank Wind Farm, targeted field surveys were undertaken. These focussed on the wind farm site and a zone within 20 km of the site.

The first survey involved by two observers between 1st and 3rd October 2007 to search for breeding Brolgas. A flocking season survey was undertaken from 11th to 13th February 2008. A further breeding season survey was undertaken by one observer during the period 17th to 21st November 2008. Surveys began at sunrise and finished before sunset each day.

Rainfall in this part of southwest Victoria was considered to be average in 2007 but below average in the winter and early spring of 2008 (Bureau of Meteorology 2008). It is unknown how many wetlands filled before the commencement of the Brolga breeding season, but due to the below-average rainfall in 2008 most were likely to have dried out during the breeding season. The 2007 survey is considered representative of an average rainfall year, while the 2008 survey is considered to be representative of a year of below average breeding habitat availability.

As far as possible, all wetlands not subject to significant private land access limitations were visited and surveyed, even if this involved searching by telescope from a public road. Wetlands were targeted if they were previous breeding sites in the Victorian Fauna Database or if they were designated as breeding sites in the 2006 breeding season survey results provided by the DSE (Appendix 3). The surveyed sites included the wetlands listed below:

- Corangamite region: Lake Corangamite, Kooraweera Lakes, Lake Struan, Lake Coradgill, Lake Terang Goodwitch, Lake Bulkil Narra, lake Punpundal, Lake Tatutong and Lake Gnarpurt.
- Lismore region: Lake Tooliorook.
- Mercer region: Dereel Lagoon and Baths Swamp.
- Hesse region: Lake Rosine, Cundare Pool (Lake Martin).
- Several creek valleys that were within the 20-kilometre search area, including: Mount Emu Creek, Woody Yaloak River, Corrindhap Creek, Gnarkeet Chain of Ponds and other smaller creeks and waterholes.
- Many unnamed wetlands of various sizes scattered within the survey area, including: freshwater meadows, shallow freshwater marshes, and permanent and semi-permanent saline water bodies.

Habitat quality, and the condition and extent of aquatic and emergent vegetation present, were recorded. The wetlands were assessed for their suitability as breeding habitat for the Brolga using the criteria detailed below. These criteria were based on current information on Brolga breeding habitat requirements in western Victoria (Marchant and Higgins 1993, Du Guesclin 2003). Three main habitat quality categories were used, as described below..

High: Habitat components listed below are usually all present.

- Shallow freshwater marsh or shallow freshwater meadow less than 0.5m deep;
- Wetlands with large areas of aquatic and emergent vegetation (e.g. Annual herbs, rushes *Carex* spp. or *Juncus* spp. or tussock grass *Poa* spp.);
- Little or no signs of changed water regimes (e.g. drained wetlands);
- Little or no signs of disturbance (e.g. Cultivation, native vegetation removal, grazing).

Moderate: Some fauna habitat components are often missing although wetlands still provide some characteristics to provide nesting opportunities.

- Water body likely to hold water throughout breeding season (July-December) (i.e. permanent, or largely permanent);
- Water body with some aquatic and emergent vegetation (e.g. Annual herbs, rushes *Carex* spp. or *Juncus* spp. or tussock grass *Poa* spp.);
- Some changes to water regime may have occurred (drainage lines);
- Wetland shows some signs of disturbance (such as limited access to stock, cultivation, feral predators).

Low: Many habitat elements have been lost. Wetland habitats that are:

- Likely to be ephemeral or drained (only hold water for limited time of the year);

- Little or no aquatic or emergent vegetation;
- Changed water regime, little water present;
- Showing signs of disturbance (such as heavily grazed by stock, cultivated, feral predators).

A total of 159 wetlands were marked on the 1:50,000 topographic map sheets, 93 of these wetlands were dry during the survey and had no birds, or had been dry for many years, as they had previously been converted to agricultural uses. These sites no longer held water and were unsuitable as breeding habitat for the Brolga. Predictably, no birds were seen on these sites and they were marked as Low or Low-Moderate Quality.

3.3. Limitations

Botanical and fauna field surveys usually fail to record all species present for various reasons, including the seasonal absence of some species and short survey duration. Rare or cryptic species are often missed in short surveys.

Surveying was carried out in early spring when some summer flowering grasses (native and exotic species) had not yet developed reproductive material, making positive identification to species level difficult. Heavy grazing by livestock also resulted in the absence of reproductive material in some areas. However, the timing of the survey and the condition of vegetation were considered suitable to ascertain the extent and quality of native vegetation and whether any significant native vegetation issues affected the proposed development.

At the time of the survey, weather conditions were suitable for detecting most fauna species likely to occur on the site. Some species, such as frogs and reptiles, for which potentially suitable habitat occurs in the study area, would not have been detected. These species are generally inactive during the cooler months and are difficult to detect at these times. Where this was a significant issue, in the case of the Growling Grass Frog, this limitation was overcome by undertaking a targeted survey in late spring 2008.

As the primary purpose of the investigation was to identify the extent and quality of native vegetation and fauna habitats and populations of significance in the study area, the review of existing information, combined with the extensive field investigations over more than twelve months were sufficient to inform a detailed flora and fauna impact assessment.

Wherever appropriate, a precautionary approach has been adopted in the discussion of implications. That is, where insufficient evidence is available on the occurrence or likelihood of occurrence of a species, it is assumed that it could be in an area of habitat, if suitable, and the implications under legislation and policy are considered accordingly.

The Brolga breeds from July to December and flocks between January and May. The timing of the two breeding Brolga breeding season surveys during October and November was deemed acceptable for the purposes of this assessment. Breeding behaviour had commenced at the time of the investigation although nesting was not identified.

Due to the large size of the study area and the majority of breeding habitat for Brolga being located on private land, access to some potential breeding sites was limited. Most of the wetland assessments were made from roadsides. In some cases wetlands on the 1:50,000 maps could not be viewed from the roads and could not be assessed. The number of confirmed breeding pairs of Brolga is likely to be the minimum number in the search area. Although some breeding pairs may have been missed due to access and

sight-line difficulties from public roads in areas where private land access could not be arranged. The limited numbers of historical Brolga records on and near the wind farm, combined with the lack of records during the current investigation, suggest that this is not a significant limitation. Brolgas, if breeding nearby, would have been observed moving about the area during field work and none were seen.

4. SITE DESCRIPTION

The Berrybank wind farm site lies between Lismore and Cressy, approximately 80 km west of Geelong in south-western Victoria. It is located north of the Hamilton Highway and east of Chain of Ponds Creek, between Lismore and Cressy. The study area lies on flat to gently undulating land that has been cleared of most of its original vegetation and is a mosaic of improved grazing pastures and crops. It has been highly modified from its pre-disturbance state and very little intact native vegetation remains. That which does is situated on public road reserves. Remnant trees such as River Red Gums are virtually absent within the boundary of the site, however many exotic trees have been planted around homesteads and along fence lines as windbreaks.

The study area lacks wetlands except for a few small farm dams. A modified grassy wetland (and dam) was located near the corner of Boundary and Bennett's Roads, just outside the wind farm site. Native fauna habitat was limited to a small number of remnant linear native grass patches within public road reserves, mainly along the Berrybank – Werneth Road and Urches Road.

The site is located in the Victorian Volcanic Plain bioregion. The catchment management authority is the Corangamite CMA and the local planning authority is Corangamite Shire Council and Golden Plains Shire Council.

5. FLORA AND FAUNA OF THE SITE

This section of the report summarises the findings of this flora and fauna assessment. Flora and vegetation are described first, followed by native fauna, including the results of the bird utilisation survey.

5.1. Flora and vegetation

The vegetation and flora of the site is described in this section.

5.1.1. Ecological Vegetation Classes

Pre-1750 Ecological Vegetation Class (EVC) mapping by the Department of Sustainability and Environment (DSE 2007b) models pre-disturbance vegetation in the region. This mapping indicates that the area proposed for the Berrybank Wind Farm supported Plains Grassland – Plains Grassy Woodland mosaic (EVC 897) prior to European settlement. Ground-truthing during this investigation identified the presence of the following EVCs within the study area:

- Plains Grassland/Plains Grassy Woodland mosaic (EVC 897);
- *Heavier-soils* Plains Grassland (EVC 132_63);
- Plains Grassy Wetland (EVC 125); and
- Aquatic Herbland (EVC 653).

Recorded examples of these EVC's range in quality depending on the level of degradation caused by weed invasion, over-grazing and other agricultural activities.

Plains Grassland/Plains Grassy Woodland mosaic

The DSE benchmark for Plains Grassland – Plains Grassy Woodland mosaic (EVC 897) describes this vegetation type as “a treeless or open eucalypt woodland to 15 m tall or non-eucalypt woodland to 10 m tall. [It] occupies poorly drained, fertile soils on flat or gently undulating plains at low elevations. The understorey consists of a few sparse shrubs over a species-rich grassy and herbaceous ground layer. Large shrubs may also be present in woodland areas”.

In the study area, this EVC was found to occur as treeless vegetation dominated by Common Tussock-grass (*Poa Labillardierei*), spear grasses (*Austrostipa* spp.), wallaby grasses (*Austrodanthonia* spp.) or Kangaroo Grass (*Themeda triandra*). In higher-quality patches, a diversity of native forbs occurred, including species such as Lemon Beauty-heads (*Calocephalus citreus*), Blue Devil (*Eryngium ovinum*), Common Everlasting (*Chrysocephalum apiculatum*), Cranesbill (*Geranium* sp.), Tall Sundew (*Drosera peltata* subs. *peltata*), Scaly Buttons (*Leptorhynchos squamatus*), Common Woodruff (*Asperula conferta*) and Vanilla Lily (*Arthropodium milleflorum*). Exotic elements comprised common pasture species, such as Oats (*Avena* spp.), Large Quaking-grass (*Briza maxima*), Cock's Foot (*Dactylis glomeratus*) and Toowoomba Canary-grass (*Phalaris aquatica*). This vegetation includes both the Western (Basalt) Plains Grassland Community and Western Basalt Plains (River Red Gum) Grassy Woodland Floristic Communities as defined and listed under the FFG Act.

Heavier-soils Plains Grassland

The DSE benchmark for *Heavier-soils Plains Grassland* (EVC 132_61) describes this vegetation type as “treeless vegetation mostly less than 1 m tall dominated by largely graminoid and herb life forms. [It] occupies fertile cracking basalt soils prone to seasonal water logging in areas receiving at least 500 mm annual rainfall”.

In the study area, this EVC generally occurred as vegetation dominated by spear grasses (*Austrostipa* spp.) or Kangaroo Grass (*Themeda triandra*). In higher-quality patches, a diversity of native forbs occur including species such as Lemon Beauty-heads (*Calocephalus citreus*), Blue Devil (*Eryngium ovinum*), Common Everlasting (*Chrysocephalum apiculatum*), Cranesbill (*Geranium* sp.), Tall Sundew (*Drosera peltata* subs. *peltata*), Scaly Buttons (*Leptorhynchos squamatus*) Common Woodruff (*Asperula conferta*) and Vanilla Lily (*Arthropodium milleflorum*). Exotic elements comprised common pasture species such as Oats (*Avena* spp.), Large Quaking-grass (*Briza maxima*), Cock’s Foot (*Dactylis glomeratus*) and Toowoomba Canary-grass (*Phalaris aquatica*). This vegetation is also classed as the Western (Basalt) Plains Grassland Community, defined and listed under the FFG Act.

Plains Grassy Wetland

The DSE benchmark for *Plains Grassy Wetland* (EVC 125) describes this vegetation type as an EVC that “... is usually treeless, but in some instances can include sparse River Red Gum *Eucalyptus camaldulensis* or Swamp Gum *Eucalyptus ovata*. A sparse shrub component may also be present. The characteristic ground cover is dominated by grasses and small sedges and herbs. The vegetation is typically species-rich on the outer verges but is usually species-poor in the wetter, central areas”.

In the study area, this EVC generally occurred as treeless vegetation of poor quality fringing farm dams. Indigenous elements were almost exclusively composed of Australian Sweet-grass (*Glyceria australis*) or Small Spike-sedge (*Eleocharis pusilla*).

Aquatic Herbland

The DSE benchmark for *Aquatic Herbland* (EVC 653) describes this vegetation type as “Herbland of permanent to semi-permanent wetlands, dominated by sedges (especially on shallower verges) and/or aquatic herbs. [It] occurs on fertile paludal (swamp) soils, typically heavy clays beneath organic accumulation.”

The one area found to support this EVC included the Gnarkeet Chain of Ponds in the southern portion of the wind farm site. This vegetation occurred within permanent and semi-permanent water and mostly included the species Water Ribbons (*Triglochin procera*), Tall Spike-sedge (*Eleocharis sphacelata*) and Common Reed (*Phragmites australis*).

Table 1 provides specific notes on the sites found to support native vegetation on the proposed wind farm site.

5.1.2. Plant species

A total of 35 species of flora were recorded within the study area. These species are presented in Appendix 1.

Flora Information System (FIS) records and the EPBC Act Protected Matters Search Tool indicated that within the broader search region (to 15 km radius), there were records of (or potential habitat for) 16 species of state or national conservation significance (Table 2).

The Spiny Rice-flower, listed as critically endangered under the EPBC Act and *threatened* under the FFG Act, was recorded during the current investigation in vegetation Site 1 within the study area (see Figure 1 and Table 1). The Trailing Hop-bush, listed as vulnerable under the EPBC Act, was sighted in vegetation Site 6 on the northern boundary of the site by a local landowner (see Figure 1).

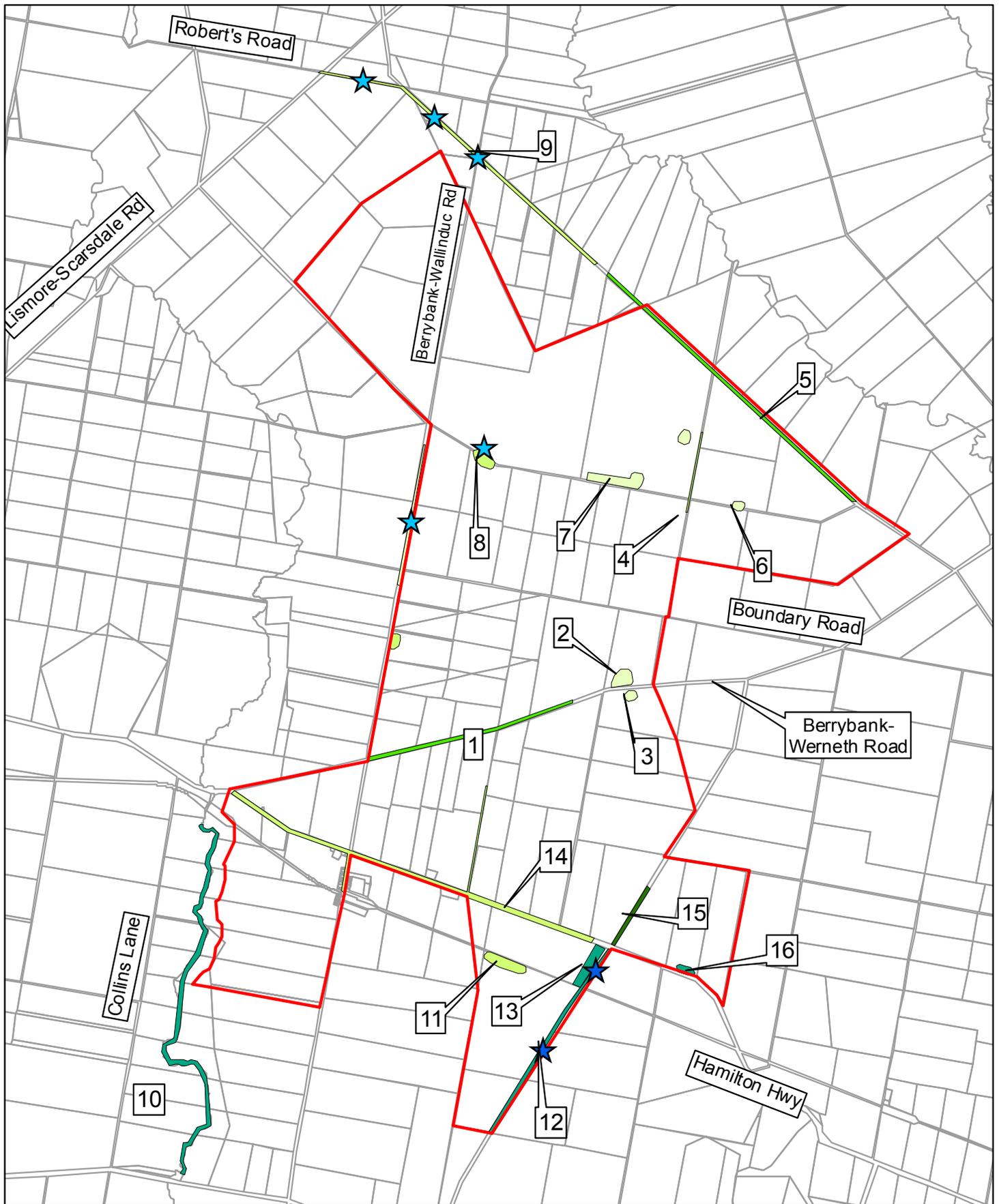
In addition to the Spiny Rice-flower and Trailing Hop-bush, an analysis of the likelihood of occurrence of state or nationally threatened species (listed under the FFG Act and EPBC Act) based on the initial field investigation suggests that 11 of threatened species may occur in intact remnant native vegetation in the area. These include Adamson's Blown-grass, Button Wrinklewort, Clover Glycine, Curly Sedge, Fragrant Leek-orchid, Hairy Tails, Large-fruit Fireweed, Maroon Leek-orchid, Small Milkwort, White Sunray and Swamp Fireweed. Table 1 identifies which vegetation sites may support each of these species and provides an overview of the condition and quality of habitat in each site.

The follow up survey in November 2008 failed to locate the species assessed as having potential to occur and no further records were obtained from the study area of threatened species apart from those mentioned earlier.

The remaining species identified by the FIS and EPBC Act Protected Matters Search Tool were considered unlikely to occur in the study area due to a lack of suitable habitat.

5.1.3. Conservation significance according to the Framework

No habitat hectare assessment of native vegetation has been undertaken. The conservation significance of native vegetation along roadsides and within the site has been assumed to have the applicable default score, based on guidance from the DSE Planning Practice Note (DSE 2006). Based on a combination of the endangered bioregional conservation status of the EVC's and the default habitat score of the vegetation, all native vegetation in the study area was assessed as being of very high conservation significance. This generates an offset target twice the habitat hectare value of any removal.



Legend



- Study Area
- ★ Powerline intersects Native Vegetation
- ★ Access Track intersects Native Vegetation

Vegetation Quality

- Low
- Medium
- Low to Medium
- Medium to High
- Low to High

Berrybank Windfarm		
Figure 1: Study Area and Native Vegetation		
Project No.: 7152	Date: 12/06/2009	Created by: J. Sullivan / B. Wallach
Brett Lane & Associates Pty. Ltd. Ecological Research & Management		
<ul style="list-style-type: none"> ● Experience ● Knowledge ● Solutions 	605 Nicholson Street PO Box 592, Carlton North VIC 3054 Australia	ph (03) 9387 5008 fax (03) 9387 6115 blane@ecologicalresearch.com.au www.ecologicalresearch.com.au

Table 1: Areas of native vegetation at the site of the proposed Berrybank wind farm

Site (See Figure 1)	EVC	Quality	Location Notes	Vegetation Notes	Potential threatened species (Table 2)
1	Plains Grassland / Plains Grassy Woodland	Low-High	Roadside; northern part of windbreak on Hirth property northern boundary; and a small part of the south-western corner of the Glover property	Treeless. Extensive linear patch. Alternates from exotic vegetation to herb-rich areas dominated by either Kangaroo Grass or Common Tussock-grass. Some wet depressions were also recorded.	2,3,4,5,6,7,11, 12*,14, 15,16, Striped Legless-lizard
2	Plains Grassland	Low	Area surrounding dam in southern part of Glover property	Area dominated by native Tussock Grass and Wallaby Grass	
3	Plains Grassy Wetland	Low	Fringing a dam which held standing water	Dominated by Spike-rush (<i>Eleocharis</i> sp.)	None
4	Plains Grassland	Low-Med	Roadside	small scattered patches possibly regarded as degraded treeless vegetation	2,3,5,6,7,11,12,15,16
5	Plains Grassland	Low-High	Southern Roadside	Extensive linear grassland reserve dominated by Kangaroo grass. Species rich. Weedy in areas.	2,3,5,6,7,11,12,15#, 16, Striped Legless-lizard
6	Plains Grassland / Plains Grassy Woodland	Low	Roadside and Rumler properties	Treeless. Area of Wallaby Grass under planted Sugar Gums	

Site (See Figure 1)	EVC	Quality	Location Notes	Vegetation Notes	Potential threatened species (Table 2)
7	Plains Grassy Wetland	Low	Fringing a dam which held standing water	Dominated by Spike-rush (<i>Eleocharis</i> sp.)	None
8	Plains Grassland	Low-Med	Roadside	Small to moderate size scattered remnant patches	2,3,5,6,7,11,12,15,16
9	Plains Grassland	Low-Med	Roadside	Large patches divided by substantial areas of exotic vegetation. Kangaroo Grass Dominated.	2,3,5,6,7,11,12,15,16
10	Aquatic Herbland	Low	Isolated sections of the Gnarkeet Chain of Ponds (Note, these ponds lie outside the wind farm boundary)	Wetland and aquatic vegetation associated with the Gnarkeet Chain of Ponds; dominated by Water Ribbons, Spike-rush and Common Reed)	1,4,14,
11	Plains Grassland /Plains Grassy Woodland	Low-Med	Northern boundary of Turner property	Treeless. Spear Grass dominated.	2,3,5,6,7,11,12,15,16
12	Plains Grassy Woodland	Med	Roadside	Small trees and shrubs present. Variety of herbs.	3,5,6,11,15,16
13	Plains Grassland	Med	South-eastern corner of Hirth property	Small herb patches under planted Sugar Gums	3,5,6,11,12,15

Site (See Figure 1)	EVC	Quality	Location Notes	Vegetation Notes	Potential threatened species (Table 2)
14	Plains Grassland / Plains Grassy Woodland	Low-Med	Roadside (Hamilton Highway) and linear strip on Hirth property	Linear area containing patches (some extensive) with Blackwood and other native shrubs recorded in some portions. Kangaroo Grass dominated other areas that were divided by exotic vegetation.	2,3,5,6,7,11,12,15,16, Striped Legless-lizard
15	Plains Grassland	Med-High	Roadside, and western boundary of Lewis property	High quality Kangaroo Grass dominated vegetation on west of Foxhow Road; lower quality Spear Grass dominated vegetation on east of road and under planted trees within Lewis property. Variety of herbs in each.	2,3,5,6,7,11,12,15,16, Striped Legless-lizard
16	Plains Grassland /Plains Grassy Woodland	Med	Roadside	Isolated patches with variety of herbs. Some small trees and shrubs present in areas. Some winter-wet areas.	3, 5,6,11,12,14,15,16

Notes: * = recorded during the current investigation; # = previously sighted by local landowner.

Table 2: List of FFG Act and EPBC Act listed threatened plant species and their likelihood of occurrence in the study area.

No.	Common Name	Scientific Name	Family Name	Conservation Status		Habitat	Likelihood of occurrence
				FFG	EPBC		
1	Adamson's Blown-grass	<i>Lachnagrostis adamsonii</i>	Poaceae	f	E	Known only from the type specimen. Slightly saline, seasonally wet area on and near the volcanic plain (Walsh, 1994)	Habitat present - Potential to occur
2	Button Wrinklewort	<i>Rutidosia leptorhynchoides</i>	Asteraceae	f	E	Basaltic grasslands (Jeanes, 1999)	Habitat present - Potential to occur
3	Clover Glycine	<i>Glycine latrobeana</i>	Fabaceae	f	V	Grasslands and grassy woodlands (Jeanes, 1996)	Habitat present - Potential to occur
4	Curly Sedge	<i>Carex tasmanica</i>	Cyperaceae	f	V	Confined to seasonally wet, heavy clay soils north of Melbourne and far west Vic (Wilson, 1994)	Habitat present - Potential to occur
5	Fragrant Leek-orchid	<i>Prasophyllum suaveolens</i>	Orchidaceae	f	E	Fertile grassy plains (Bates, 1994)	Habitat present - Potential to occur
6	Hairy Tails	<i>Ptilotus erubescens</i>	Amaranthaceae	f		Fertile soils with grassland and woodland communities (Walsh, 1996)	Habitat present - Potential to occur
7	Large-fruit Fireweed	<i>Senecio macrocarpus</i>	Asteraceae	f	V	Themeda grasslands on basalt (Walsh, 1999)	Habitat present - Potential to occur
8	Maroon Leek-orchid	<i>Prasophyllum frenchii</i>	Orchidaceae	f	E	Favouring heathland and Grassland on black clays (Bates, 1994)	Habitat present - Potential to occur
9	Metalic Sun-orchid	<i>Thelymitra epipactoides</i>	Orchidaceae	f	E	Coastal and inland in fertile loams, scrubby heaths or near swampy depressions (Weber & Entwisle, 1994)	No habitat present - Unlikely to occur

No.	Common Name	Scientific Name	Family Name	Conservation Status		Habitat	Likelihood of occurrence
				FFG	EPBC		
10	Salt-lake Tussock-grass	<i>Poa sallacustris</i>	Poaceae	f	V	Margins of brackish to salt lakes (Walsh, 1994)	No habitat present - Unlikely to occur
11	Small Milkwort	<i>Comesperma polygaloides</i>	Polygalaceae	f		Heavy soils supporting grasslands and grassy woodlands (Walsh, 1999)	Habitat present - Potential to occur
12	Spiny Rice-flower	<i>Pimelea spinescens</i> subsp. <i>spinescens</i>	Thymelaeaceae	f	C	Grasslands on basalt derived soils (Entwisle, 1996)	Recorded during current investigation
13	Spiral Sun-orchid	<i>Thelymitra matthewsii</i>	Orchidaceae	f	V	Slightly elevated sites to 300m in well-drained soils (sandy loams to gravelly limestone soils) in light to dense forest; sometimes in coastal sandy flats (Weber & Entwisle, 1994)	No habitat present - Unlikely to occur
14	Swamp Fireweed	<i>Senecio psilocarpus</i>	Asteraceae		V	Restricted to a few herb-rich winter-wet swamps on volcanic clays or peaty soils (Walsh, 1999)	Habitat present - Potential to occur
15	Trailing Hop-bush	<i>Dodonaea procumbens</i>	Sapindaceae		V	Grows in low lying often winter wet areas in woodland, low open-forest and grasslands on sands and clays. Largely confined to SW of Victoria (Duretto, 1999)	Occurs in the study area (local landowner pers.com.)
16	White Sunray	<i>Leucochrysum albicans</i> subsp. <i>albicans</i> var. <i>tricolor</i>	Asteraceae		E	Very rare in Vic. Roadside verges (Short, 1999)	Habitat present - Potential to occur

5.2. Fauna

This section describes the fauna habitat features of the site and the fauna recorded or likely to occur.

5.2.1. Habitat assessment

The proposed Berrybank wind farm site supports three main habitat types, including:

- Improved pastures;
- Planted Trees; and
- Aquatic habitat.

The **improved pasture** habitat type made up the majority of the study area. Intense farming practices have resulted in these areas being cleared of all native vegetation, fertilised regularly and sown with exotic pasture grasses or crops, such as canola and wheat. These areas have lost many fauna habitat components (mature trees, fallen logs and rocks). This habitat type was considered to be low quality habitat for fauna.

There were **planted trees** around the homesteads and along some of the fence lines and roadsides. Trees that were planted were usually pines, cypresses or eucalypts (mainly Sugar Gum). Some Golden Wattle was recorded at one site and Giant Honey-Myrtle at another. Planted trees were used as roosting and nesting places for common farmland birds utilising the surrounding areas. Due to the trees being the main treed vegetation in the region they were considered to be moderate quality habitat for native fauna.

The **aquatic habitat** at this site was made up mostly of farm dams. Small farm dams have been created throughout the study area for agricultural purposes. These areas generally lacked extensive or dense aquatic vegetation and supported common waterbirds. One modified wetland remained: a grassy wetland that has been dammed, located near the corner of Bennetts Lane and Boundary Road. There are some areas that may be prone to flooding during wetter than average seasons, although these areas have been drained to provide larger areas for cultivation and have been sown to pasture or crops. Overall the aquatic habitats at the site are considered to be low quality habitat for fauna.

5.2.2. Fauna Species

Based on the field assessment and the review of existing information, the proposed Berrybank wind farm site is known or likely to support 116 species of terrestrial vertebrate fauna, including 10 species of mammal (four introduced), 95 species of birds (six introduced), six species of reptile and five species of frog. One species of threatened invertebrate also has potential to occur. These species are listed with their scientific names in Appendix 2, which also indicates those species recorded during the field assessment.

The Atlas of Victorian Wildlife (AVW) search and the EPBC Act Protected Matters Report for the region within 15 kilometres of the wind farm produced 20 species listed on the EPBC Act, an additional two listed under the FFG Act and a further six

listed by DSE as threatened (DSE 2007c). The EPBC Act listed species included five species of mammal, 12 species of bird (including species listed as migratory and marine), one species of reptile, one species of frog and one species of invertebrate.

The majority of these threatened species are unlikely to occur in the study area due to a lack of suitable habitat or to habitat not being extensive enough to support a significant population. Species for which suitable habitat exists are presented in Table 3 and discussed in more detail below, including a discussion of their likelihood of occurrence on the proposed wind farm site.

Table 3: Threatened fauna with potential habitat at the proposed Berrybank wind farm

Common Name	Scientific Name	EPBC	DSE	FFG
Birds				
Australasian Shoveler	<i>Anas rhynchotis</i>		VU	
Brolga	<i>Grus rubicunda</i>		VU	L
Cape Barren Goose	<i>Cereopsis novaehollandiae</i>		NT	
Glossy Ibis	<i>Plegadis falcinellus</i>		NT	
Great Egret	<i>Egretta alba</i>		VU	L
Gull-billed Tern	<i>Sterna nilotica</i>		EN	L
Hardhead	<i>Aythya australis</i>		VU	
Latham's Snipe	<i>Gallinago hardwickii</i>		NT	
Whiskered Tern	<i>Chlidonias hybridus</i>		NT	
Reptiles				
Striped Legless Lizard	<i>Delma impar</i>	VU	EN	L
Frogs				
Growling Grass Frog	<i>Litoria raniformis</i>	VU	EN	L
Other fauna				
Golden Sun Moth	<i>Synemon plana</i>	CR	E	L

Notes:

EPBC = Listed under the EPBC Act; DSE = Listed on DSE advisory list (DSE 2007c); FFG – Listed under the FFG Act; L = Listed under the FFG Act; CR= Critically endangered; EN = Endangered; VU = Vulnerable; NT = Low risk, near threatened; and M = Migratory.

Birds

The majority of the threatened fauna listed in Table 3 are waterbirds. The presence of permanent water bodies such as farm dams at the proposed Berrybank site provides potential habitat for these species. Each of the threatened species recorded in the surrounding region with potential habitat at the study area is discussed in more detail below.

The Berrybank site had no wetlands of significance. One modified wetland that has been dammed is situated north-east of the corner of Bennetts Road and Boundary Road. This wetland has a marshy zone with wetland dependent vegetation and may provide habitat for some of the threatened species listed in Table 3.

The AVW, EPBC Act Protected Matters Search Tool and relevant Biomaps contain several records of waterbird species that are of conservation significance in

Victoria. Of those that have potential habitat to occur at the study area, the Brolga, Great Egret and Gull-billed Tern are threatened in Victoria and listed under the FFG Act and the remaining six are listed by DSE (2007c). The **Brolga** is considered in Section 5.4 of this report and the remaining species are considered below in more detail.

The **Gull-billed Tern** (listed as endangered in Victoria; DSE 2007c) and **Whiskered Tern** (listed as least concern, near threatened in Victoria; DSE 2007c) are migratory species generally present in Victoria in the spring and summer months. There are seven records of Whiskered Tern and three of Gull-billed Tern from the AVW search region, mostly from the larger lakes such as Lake Struan and Lake Martin. These species forage over lakes, marshes and nearby paddocks (Emison et al. 1987). Habitat for these species within the study area is limited and it is unlikely that they occur in the study area regularly or in significant numbers.

The **Great Egret** is listed as vulnerable in Victoria (DSE 2007c) and is listed under the FFG Act. The Great Egret has been previously recorded from the AVW search region, but not during the current investigation, at Berrybank. All but one record from the search region were from larger lakes to the south or south-east of Berrybank, such as Lake Struan, Lake Rosine and Lake Martin. This species has the potential to occur occasionally in the aquatic habitats in the study area but their limited extent and low habitat quality make it unlikely that it occurs regularly or in numbers.

The **Australasian Shoveler** has been recorded 41 times from the search region in the AVW, almost entirely from large lakes and water bodies of the Lake Corangamite complex south of the Hamilton Highway. This species is listed as vulnerable in Victoria (DSE 2007c). It was not recorded during the current investigation from the Berrybank site; however, it has the potential to occur on the dams and associated habitats on the proposed wind farm. One record from just northeast of the wind farm site exists in the Birds Australia Atlas. The limited extent and low quality of aquatic habitat in the study area make it unlikely that it occurs regularly or in significant numbers.

The **Hardhead** is considered to be vulnerable in Victoria (DSE 2007c). There are 19 records of Hardhead from the AVW search region. The species was not recorded from within the Berrybank site and prefers the larger lakes of the Corangamite complex – Lake Struan, Lake Rosine and Lake Martin in particular. The Hardhead has the potential to occur at larger farm dams and associated habitat within the study area but the low quality and limited habitat makes it unlikely that significant numbers occur in the study area.

The **Glossy Ibis** and **Cape Barren Goose** are both listed as least concern, near threatened in Victoria (DSE 2007c). There has been a single record of the Glossy Ibis from Lake Martin from November 1992 and it is likely to be an occasional visitor to the more extensive wetlands in the surrounding region, but unlikely to occur at the Berrybank wind farm site due to a lack of extensive, suitable marshy habitat. The Cape Barren Goose has been recorded 12 times from the AVW search region – all records with locality data were from Lake Martin. The Birds Australia Atlas also has a record from Lake Rosine. This species is considered

unlikely to occur regularly on the Berrybank site due to the lack of larger wetlands, at which it tends to congregate elsewhere.

The **Lathams' Snipe** is a migratory shorebird that is listed as least concern, near threatened in Victoria (DSE 2007c). There are three records of Latham's Snipe from the AVW search region, near Cressy and Skipton, both some distance from the proposed development site. Another record in the Birds Australia Atlas came from just south of Lismore, some 12 km from the proposed Berrybank wind farm site. It is possible this species may occasionally occur in shallow marshy habitats beside dams within the study area, but suitable habitat is very limited in extent and numbers are unlikely to be significant.

There is insufficient suitable habitat for the listed migratory species indicated by the EPBC Search Tool as potentially occurring in the Berrybank search region. These species are more likely to occur in the larger lakes associated with Lake Corangamite, well south and south-east of the study area.

Mammals

A total of ten species of mammals occurs or is likely to occur on the Berrybank wind farm site based on the AVW search and the site assessment (Appendix 2). This total includes four introduced species. One mammal species was recorded during the preliminary investigation; the introduced European Rabbit.

The EPBC Act Protected Matters Search Tool identified five mammal species as occurring or having potential habitat to occur within the search region. This species included: Spot-tailed Quoll, Long-nosed Potoroo, Smoky Mouse, Grey-headed Flying-Fox and Southern Bent-wing Bat. These species require forests, woodlands, or heathlands as habitat and there was no suitable habitat on the site for them so they are considered unlikely to occur.

Reptiles

A total of six reptile species occurs or is likely to occur on the proposed wind farm site based on the AVW search region and the field assessment (see Appendix 2). No reptiles were recorded during the current investigation. The EPBC Act protected matters search tool identified one species of reptile as occurring or having potential habitat within the search region: the Striped Legless Lizard.

The **Striped Legless Lizard's** preferred habitat is dense native grasslands, often with rocky rises, that were once extensive on the volcanic plains west of Melbourne (Webster *et al.* 1992, Hadden 1995). It utilises rocks, soil cracks, burrows and grass tussocks for sheltering (Smith and Robertson 1999). BioMaps show two undated records from close to the eastern boundary of the Berrybank site, from south of Wilgul along the Duverney Road. Another three, dated records come from Cressy, east of the study area. Native tussock grassland along road reserves, including Berrybank-Werneth Road and Urch's Road (Table 1/Figure 1) may be sufficiently extensive to support a small population of this species within the Berrybank site. No targeted surveys were undertaken as it is feasible to avoid any impacts on this habitat in planning the wind farm access from public roads as a precautionary measure and no significant impacts are expected in these areas.

Frogs

A total of four species of frogs occurs or is likely to occur based on the AVW (see Appendix 2). Two frog species were recorded from the study area during fieldwork for this investigation. The EPBC Act protected matters search tool identified one threatened species of frog, Growling Grass Frog, as occurring or with potential habitat occurring within the search region.

The **Growling Grass Frog** is listed as vulnerable under the EPBC Act, is listed as threatened under the FFG Act, and is considered to be endangered in Victoria (DSE 2007c). This frog was not recorded from the search region in the AVW. It inhabits areas of permanent water and farm dams; especially those with bulrushes and other dense fringing or floating vegetation cover (Organ 2002). The presence of this frog in the region would depend on the presence of suitable, permanent water bodies such as dams with vegetated fringes or permanent creeks. These habitats are sparse within the study area and it is considered that the connectivity of water bodies is poor. Ponds Creek, located in the south-west corner of the study area, is unlikely to support the Growling Grass Frog due to the absence of suitable aquatic vegetation, poor water quality and disturbance by stock. No frogs were heard calling from this creek.

Invertebrates

The EPBC Act Protected Matters Search Tool identified the **Golden Sun Moth** as occurring or having potential habitat to occur within the search region. This species is listed as critically endangered under the EPBC Act and it is also listed under the state FFG Act. Its range has contracted due to agricultural, urban and industrial development and in Victoria it is known from fewer than 10 sites (O'Dwyer *et al.* 2000). There were no records from the AVW search region.

An action statement has been prepared (O'Dwyer *et al.* 2000) and a National Recovery Plan is in preparation. The Golden Sun Moth inhabits native tussock grasslands dominated by Wallaby Grass (*Austrodanthonia* spp.), which exceed 40% cover (O'Dwyer and Attiwill 1999). Wallaby grass was recorded at a small number of sites within the study area but was not considered to occur in extensive enough stands to support this species.

5.3. Bird Utilisation Survey

The bird utilisation survey was undertaken over five days between 12th and 20th February 2009, focusing on locations of the study area where wind turbines are proposed to be located. Two reference points in similar landscape settings nearby were also surveyed.

This bird utilisation survey has been undertaken consistent with the requirements for a "Level One" bird risk assessment in accordance with 'Wind Farms and Birds - Interim Standards for Risk Assessment' issued by the Australian Wind Energy Association (AusWEA 2005). This approach has been endorsed in the Association's latest (2006) Best Practice Guidelines.

The methods used and the results of the survey are presented in this section of the report.

5.3.1. Methods

Fixed-point bird count method

Seven fixed-point survey points were established in the study area (see Figure 2). The fixed-point bird count method involved an observer stationed at a survey point for 15 minutes. During this period, all bird species and numbers of individual birds observed within 200 metres were recorded. Species, number, distance from the centre point and flight height were documented, with flight height being classified as below, at or above rotor swept area height (RSA height). RSA height lies between 30 and 120 metres above the ground.

During the surveys, each point was counted ten times during the survey period. Points were counted at different times of the day to allow for time-of-day differences in bird movements and activity. Table 4 indicates when each point was counted on each survey day. This schedule ensured that all points were visited at different times of day.

Table 4: Times of day when points* were counted during each survey day.

Day	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
	8:00	8:30	9:00	9:30	10:00	10:30	11:00	11:30	12:00	12:30
1							R1	R2	1	2
2	4	5	6	7	R1	R2	1	2	3	4
3	6	7	R1	R2	1	2	3	4	5	6
4	1	2	3	4	5	6	7	R1	R2	1
5	3	4	5	6	7	R1	R2	1	2	3
Day	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20
	1:30	2:00	2:30	3:00	3:30	4:00	4:30	5:00	5:30	6:00
1	3	4	5	6	7	R1	R2	1	2	3
2	5	6	7	R1	R2	1	2	3	4	5
3	7	R1	R2	1	2	3	4	5	6	7
4	2	3	4	5	6	7	R1	R2	1	2
5	4	5	6	7	R1	R2				

* See Figure 2 for survey point locations.

Locations of survey points

Figure 2 shows the location of the bird utilisation survey points. The survey points were spaced as evenly as possible across the study area.

At the Berrybank site, impact points were established as far as possible on elevated ground, and were placed near proposed sites for wind turbines (Figure 2).

Incidental observations

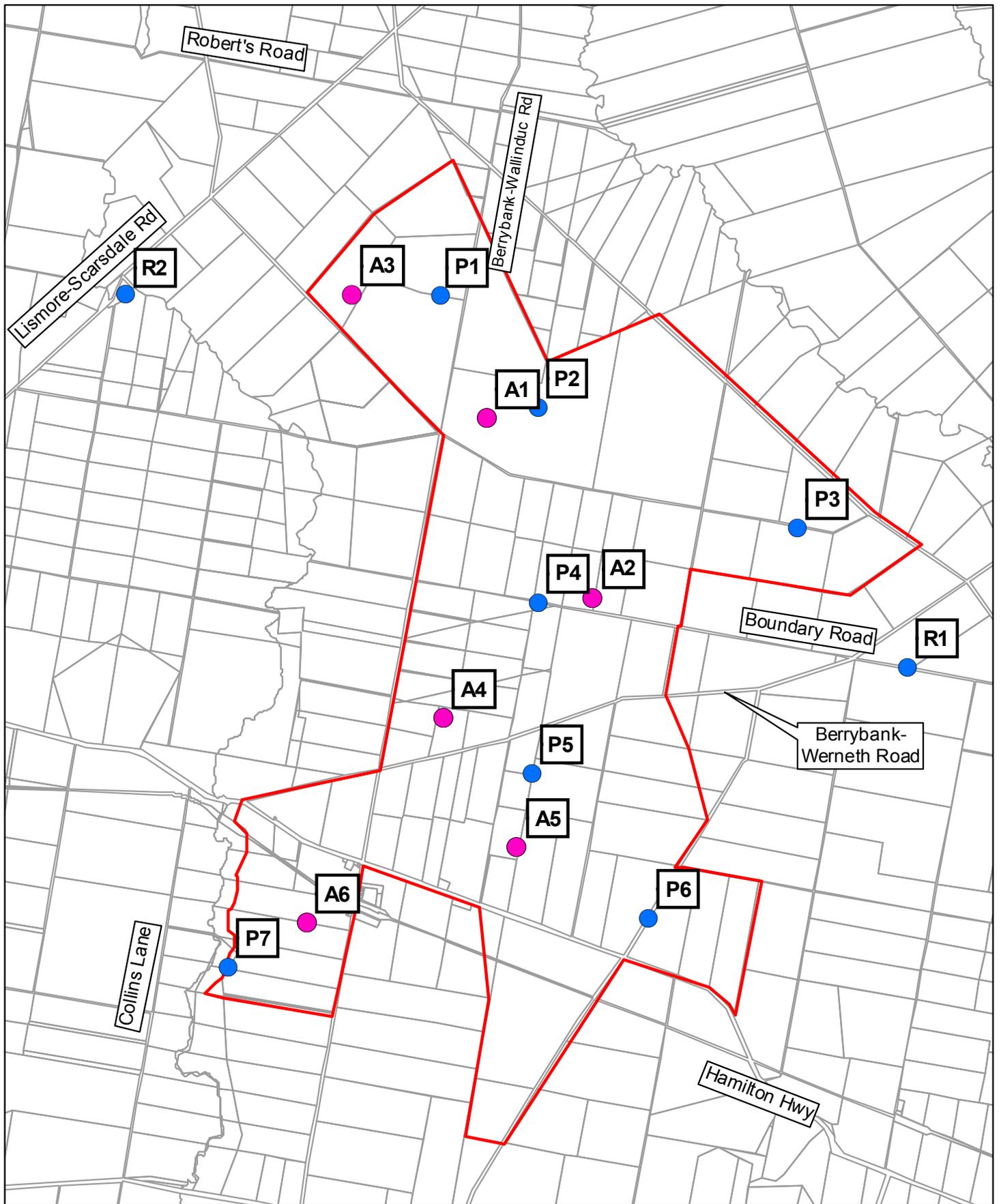
In addition to the observations during formalised, fixed-point counts, incidental observations of waterbirds and raptors were also made while moving about the study area. Emphasis was placed on observing birds that were moving about the

site at RSA height. Also, incidental observations were recorded for the Wedge-tailed Eagle to supplement information gathered during the formal bird utilisation counts.

5.3.2. Limitations

This bird utilisation survey was undertaken in summer 2009. At this time of year, many birds that normally spend the winter in flocks were still in pairs after the end of the breeding season. Some species, such as, magpies and ravens, had already started forming post-breeding flocks. At this time of year, most migratory bird species, including the summer visitors and some passage migrants, were in the region.

For these reasons, the utilisation rates and species recorded during the current survey are considered to be representative of the site and a good basis on which to assess the bird risks of the proposed Berrybank Wind Farm.



Legend

- Study Area
- Bat Survey Points
- Bird Utilisation Survey Points



Berrybank Windfarm		
Figure 2: Bird Utilisation Survey Points		
Project No.: 7152	Date: 12/06/2009	Created by: J. Sullivan / B. Wallach
Brett Lane & Associates Pty. Ltd. Ecological Research & Management		
● Experience ● Knowledge ● Solutions	605 Nicholson Street PO Box 592, Carlton North VIC 3054 Australia	ph (03) 9387 5008 fax (03) 9387 6115 blane@ecologicalresearch.com.au www.ecologicalresearch.com.au

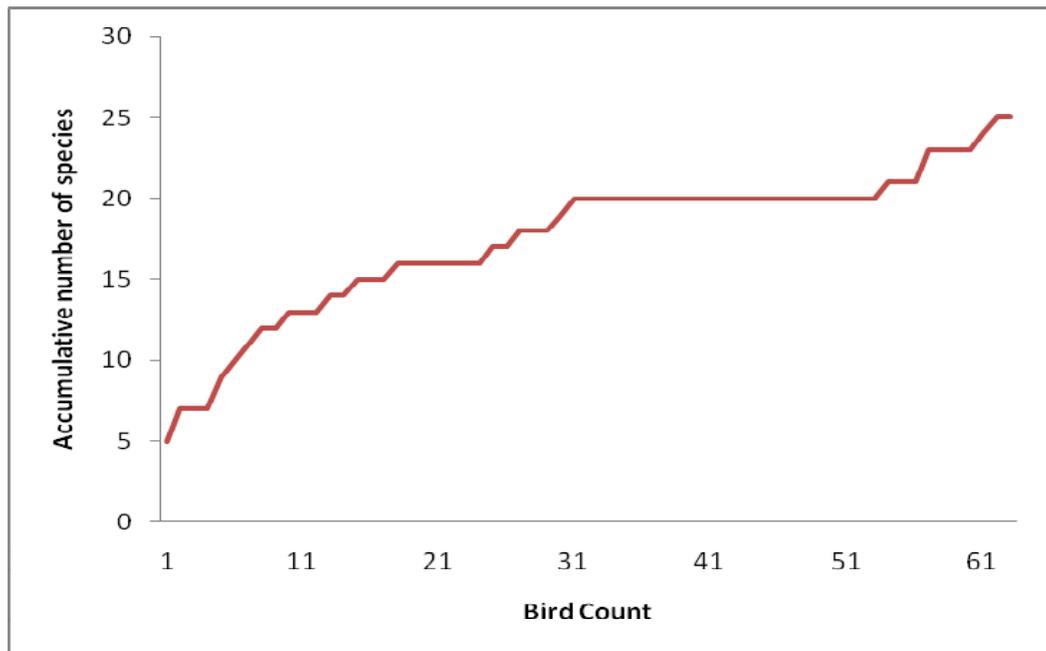
5.3.3. Results of the bird utilisation survey

This section presents the bird utilisation survey results.

Representativeness of the survey

The cumulative number of species observed from the consecutive fixed-point bird counts conducted at the observation points during the survey period has been plotted (see Figure 3). This revealed that the number of new species observed at the wind farm sites almost levelled off after about 30 counts, after which the occasional new species was found later in the survey. Over 70% of species were found after less than 50% of the surveys. This suggests that the surveys collectively provided a representative picture of the diversity of bird species flying over the wind farm during the survey period. Species recorded incidental to the fixed point counts either have very low utilisation rates or do not occur regularly on the parts of the wind farm site on which generators would be placed.

Figure 3: The cumulative number of species of birds recorded during consecutive counts at the observation points on the Berrybank Wind Farm.



5.3.4. Bird Observations

From information in the *Atlas of Victorian Wildlife (AVW)* it has been predicted that 94 species of birds from the search region may occur in the study area. Many of these birds were waterbirds. The wind farm study area lacked wetlands, except for a small number of farm dams with low habitat quality, therefore the actual number of bird species listed by the AVW and expected to occur on the wind farm study area is approximately 58 species. Of the 58 species of birds, 25 species were recorded during formal survey times at the impact points. The difference between the two figures reflects the highly altered nature

of the habitats in areas where wind turbines are to be built. The species observed utilising the observation points and consequently most of the wind farm site were common farmland birds.

The species diversity and numbers of birds observed during the survey at the impact points are shown in Table 5. Some 25 species of birds were observed during the survey.

On the impact points, species richness was broadly similar between the seven observation points, with the number of species recorded at each point ranging between 6 and 12 species. There was a tendency for species richness to be slightly higher at observation points 2 and 4, where more diverse habitats occurred compared with the other points.

Table 5 (A) presents a list of the species observed at impact points during the bird utilisation survey and the numbers in which they were seen in each height zone. The most abundant species at the impact sites were:

- Australian Magpie;
- Australasian Pipit;
- House Sparrow;
- Yellow-rumped Thornbill;
- Willy Wagtail; and
- Common Starling.

These six species, including two introduced species (House Sparrow and Common Starling), were by far the most abundant species and accounted for over 75 percent of the individual birds counted. These were common in most parts of the study area. The abundance of the remaining species ranged between 1 – 38 birds and their distribution among the observation points was uneven depending on the presence of preferred habitat components, such as planted native trees. The abundant species were, predictably, common farmland birds, generally species that are widely distributed in farmland areas across south-eastern Australia.

At the reference sites (Table 5[B]), the most common species, in order of abundance, were:

- Raven spp., mainly Little Raven;
- Australian Magpie;
- Yellow-rumped Thornbill;
- Common Starling; and
- Australasian Pipit.

The first three species accounted for more than 55 percent of individual birds counted and the five most abundant species accounted for more than 75 percent of individual birds counted during the survey. The most abundant birds were common farmland birds, of which one species is introduced. The abundant species at the reference points were similar to those on the impact points; this is expected since the reference sites were largely of similar habitat and structure as the impact sites.

Table 6 shows the distribution of bird numbers among the survey points. The total number of birds counted at the impact points varied between a minimum total of 51 birds at point number 5 to a maximum total of 117 birds at point number 7, with an average total of around 60 birds per point at the impact points (total of ten replicate counts per point). The high bird numbers at point number 7 was mainly due to the presence of large numbers of Magpie, Red Wattlebird and Yellow-rumped Thornbill during the formal bird count.

Bird abundance did not differ markedly between the seven observation points. The surrounding habitat at each of the observation points was almost similar, with some of them having more diverse habitat structure due to the presence of native and introduced planted trees.

Table 7 shows the numbers of individual birds of each species observed flying at Rotor Swept Area (RSA) height. During the survey period, 23 individual birds of nine species were observed flying at RSA height at the impact points, or about 3.8 percent of the total number of birds counted.

The most abundant species observed flying at RSA height were:

- Eurasian Skylark; and
- Little Raven;

These two species accounted for over 45 percent of the birds counted at RSA height. All bird species flying at RSA height were common farmland birds.

Ravens (mainly Little Raven) at this time of year are in flocks that vary in size. They usually fly close to the ground when foraging, but at times fly at RSA height when moving long distances between paddocks or to and from their roost sites. Skylarks are generally ground birds. They are not usually found flying at RSA height, except during the breeding season (September to February), when males ascend to heights above 50 metres and perform a territorial song.

The remaining seven birds at RSA height comprised three birds of prey and four farmland birds. Birds of prey, a group most likely to be observed regularly flying at RSA height, are discussed below in more detail. The remaining four farmland birds may occasionally fly at RSA heights although usually prefer flying close to the ground.

The number of birds at RSA height at the seven impact points varied between one bird at point one and eight birds at point 3 (Table 7). In common with the total number of birds at the observation points, there was no discernable geographical pattern in the distribution of birds at RSA height among the impact points.

Birds of Prey (Raptors)

Few birds of prey were observed on the site. During the formal bird counts at the impact points, three species were seen flying within the study area. The number of raptors was low in relation to the total number of birds recorded during the survey. Raptors formed 2.2 percent of all individuals surveyed on the wind farm site and 30.4 percent of birds seen at RSA height (Table 7).

The Brown Falcon was the most common raptor observed on the wind farm site. The next most abundant raptor was the Wedge-tailed Eagle.

The Wedge-tailed eagle was seen on two occasions during formal counts and five times incidentally outside the counts. This species is a bird of concern as it is prone to colliding with wind turbines. It was seen on one occasion at RSA height in the study area during the five-day survey. This indicates that the eagle may occasionally fly over the wind farm site, but the utilisation rate at the site is low compared with the utilisation rate at a number of other wind farm sites in Victoria (Brett Lane & Associates Pty Ltd, unpubl. data). The wind farm site is believed to be within the foraging territory of one pair of eagles.

One Nankeen Kestrel was observed during the survey.

Waterbirds

Waterbirds were scarce at the proposed Berrybank Wind Farm. No species were recorded at the observation points during formal counts.

The proposed Berrybank Wind Farm site contained a number of farm dams; most lacked vegetation and were used for stock watering. The wind farm site lacked naturally occurring water bodies and is a significant distance from any major lakes or reservoirs that could harbour any significant numbers of waterbirds.

The AVW contains historical records of Brolga from the region. During the current investigation no Brolga was sighted in or close to the wind farm site. However, historically the Victorian Fauna Database identified one Brolga sighting within the study area. During the current survey, six Brolgas (three pairs) were seen within the larger search region (20 kilometre radius). The status of the Brolga is discussed in Section 6.

Table 5: Summary of numbers of individual birds and their height distribution seen on surveys points at the Berrybank Wind Farm site. A=below rotor swept area (RSA) height (30 m); B= at RSA height (30-120 m); C= above RSA height (>120m).

A. Impact Points

Bird Species	P1			P2			P3			P4			P5			P6			P7			Total			Grand Total	% Imp.
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C		
Australian Magpie	36	0	0	13	0	0	9	0	0	6	0	0	17	0	0	7	0	0	37	0	0	125	0	0	125	20.9
Australasian Pipit	29	0	0	10	0	0	24	0	0	43	0	0	13	0	0	0	0	0	0	0	0	119	0	0	125	20.9
House Sparrow	0	0	0	32	0	0	0	0	0	17	0	0	0	0	0	16	0	0	14	0	0	79	0	0	79	13.2
Yellow-rumped Thornbill	0	0	0	10	0	0	0	0	0	3	0	0	0	0	0	9	0	0	20	0	0	42	0	0	42	7.0
Willie Wagtail	0	0	0	5	3	0	0	0	0	4	0	0	5	0	0	12	0	0	12	0	0	38	3	0	41	6.8
Common Starling	0	0	0	17	0	0	17	0	0	0	0	0	5	0	0	0	0	0	1	0	0	40	0	0	40	6.7
Eurasian Skylark	11	0	0	5	2	0	0	4	0	13	0	0	4	0	0	0	0	0	0	0	0	33	6	0	33	5.5
White-plumed Honeyeater	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	0	0	5	0	0	24	0	0	24	4.0
Little Raven	3	0	0	2	0	0	0	0	0	4	2	0	4	1	0	2	0	0	2	2	0	17	5	0	22	3.7
Red Wattlebird	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	22	0	0	22	3.7
Fairy Martin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	2	0	0	0	0	14	2	0	16	2.7
Brown Falcon	0	0	0	3	0	0	1	1	0	2	0	0	0	1	1	1	0	0	0	0	0	7	2	1	10	1.7
Galah	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	4	0.7
White-fronted Chat	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4	0.7
European Goldfinch	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	1	0	2	0.3
Horsfield’s Bushlark	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0.3
Noisy Miner	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	2	0	0	2	0.3
Wedge-tailed Eagle	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2	0.3
Common Blackbird	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0.2

Bird Species	P1			P2			P3			P4			P5			P6			P7			Total			Grand Total	% Imp.			
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C					
Magpie Lark	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0.2
Nankeen Kestrel	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0.2
Welcome Swallow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0.2
Eastern Rosella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Musk Lorikeet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Red-rumped Parrot	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Total	80	1	0	100	5	0	51	8	0	99	3	0	48	2	1	82	2	0	115	2	0	575	23	1	599	100.0			
No. of species at point	6			11			7			4			5			10			10										

B. References sites

Species	R1			R2			Total			Total	% Imp.
	A	B	C	A	B	C	A	B	C		
Little Raven	46	0	0	1	2	0	47	2	0	49	24.4
Australian Magpie	23	0	0	14	0	0	37	0	0	37	18.4
Fairy Martin	0	0	0	29	0	0	29	0	0	29	14.4
Noisy Miner	13	0	0	0	0	0	13	0	0	13	6.5
Australasian Pipit	2	0	0	10	0	0	12	0	0	12	5.9
Yellow-rumped Thornbill	5	0	0	7	0	0	12	0	0	12	5.9
Eurasian Skylark	0	0	0	9	0	0	9	0	0	9	4.5
Red Wattlebird	9	0	0	0	0	0	9	0	0	9	4.5
Musk Lorikeet	7	0	0	0	0	0	7	0	0	7	3.5



Species	R1			R2			Total			Total	% Imp.
	A	B	C	A	B	C	A	B	C		
Brown Falcon	2	1	0	3	0	0	5	1	0	6	3.0
Eastern Rosella	6	0	0	0	0	0	6	0	0	6	3.0
Willie Wagtail	3	0	0	1	0	0	4	0	0	4	2.0
Magpie Lark	3	0	0	0	0	0	3	0	0	3	1.5
Red-rumped Parrot	2	0	0	0	0	0	2	0	0	2	1.0
Nankeen Kestrel	0	0	0	0	1	0	0	1	0	1	0.5
Wedge-tailed Eagle	0	0	0	0	1	0	0	1	0	1	0.5
Welcome Swallow	0	0	0	0	1	0	0	1	0	1	0.497512
Total	121	1	0	74	5	0	195	6	0	201	100

Table 6: The number of birds counted at each of the survey points at Berrybank Wind Farm. A=below rotor swept area (RSA) height (30 m); B= at RSA height (30-120 m); C= above RSA height (>120 m).

Impact Points	Number of Birds at			Total	% of Total Birds	% at RSA Height
	A	B	C			
P 1	80	1	0	81	13.5	1.2
P 2	100	5	0	105	17.5	4.8
P 3	51	8	0	59	9.8	13.6
P 4	99	3	0	102	17.0	2.9
P 5	48	2	1	51	8.5	3.9
P 6	82	2	0	84	14.0	2.4
P 7	115	2	0	117	19.5	1.7
Total	575	23	1	599	100.0	3.8

Table 7: Species flying at rotor swept area height during bird utilisation surveys at the Berrybank Wind Farm.

Species	Birds flying at RSA Height							Total birds at RSA Height	Birds at all heights	% RSA Birds	% Birds at RSA Heights	% RSA Birds of all Birds
	P1	P2	P3	P4	P5	P6	P7					
Eurasian Skylark	0	2	4	0	0	0	0	6	33	18.2	26.1	1.0
Little Raven	0	0	0	2	1	0	2	5	22	22.7	21.7	0.8
Willie Wagtail	0	3	0	0	0	0	0	3	41	7.3	13.0	0.5
Brown Falcon	0	0	1	0	1	0	0	2	10	20.0	8.7	0.3
Fairy Martin	0	0	0	0	0	2	0	2	16	12.5	8.7	0.3
Galah	0	0	2	0	0	0	0	2	4	50.0	8.7	0.3
European Goldfinch	0	0	0	1	0	0	0	1	2	50.0	4.3	0.2
Nankeen Kestrel	0	0	1	0	0	0	0	1	1	100.0	4.3	0.2
Wedge-tailed Eagle	1	0	0	0	0	0	0	1	2	50.0	4.3	0.2
Australasian Pipit	0	0	0	0	0	0	0	0	125	0.0	0.0	0.0
Australian Magpie	0	0	0	0	0	0	0	0	125	0.0	0.0	0.0
Common Blackbird	0	0	0	0	0	0	0	0	1	0.0	0.0	0.0
Common Starling	0	0	0	0	0	0	0	0	40	0.0	0.0	0.0
Eastern Rosella	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0
Horsfield’s Bushlark	0	0	0	0	0	0	0	0	2	0.0	0.0	0.0
House Sparrow	0	0	0	0	0	0	0	0	79	0.0	0.0	0.0
Magpie Lark	0	0	0	0	0	0	0	0	1	0.0	0.0	0.0
Musk Lorikeet	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0

Species	Birds flying at RSA Height							Total birds at RSA Height	Birds at all heights	% RSA Birds	% Birds at RSA Heights	% RSA Birds of all Birds
	P1	P2	P3	P4	P5	P6	P7					
Noisy Miner	0	0	0	0	0	0	0	0	2	0.0	0.0	0.0
Red Wattlebird	0	0	0	0	0	0	0	0	22	0.0	0.0	0.0
Red-rumped Parrot	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0
Welcome Swallow	0	0	0	0	0	0	0	0	1	0.0	0.0	0.0
White-fronted Chat	0	0	0	0	0	0	0	0	4	0.0	0.0	0.0
White-plumed Honeyeater	0	0	0	0	0	0	0	0	24	0.0	0.0	0.0
Yellow-rumped Thornbill	0	0	0	0	0	0	0	0	42	0.0	0.0	0.0
Total	1	5	8	3	2	2	2	23	599	3.8	100.0	3.8

5.4. Bat Surveys

5.4.1. Methods

Guidelines for bat surveys issued by the Department of Sustainability and Environment (Lumsden 2007) have indicated that the optimum bat survey period is between November and March. Therefore, the surveys undertaken to assess the bat activity within Berrybank Wind Farm was carried out during the period April 8th to 27th, 2009. Two sites were recorded concurrently in each of the three weeks of the study (Table 8).

Whilst Lumsden (2007) recommends that all potential bat habitats at a wind farm site be surveyed, a targeted survey was undertaken here within suitable habitats at the potential turbine locations, thereby increasing survey efficacy. Within these sites, automated Anabat® (Titley Electronics, Ballina, NSW) bat detectors were placed at a series of sampling points representative of the habitats at the proposed turbine locations. These were programmed to record species-specific echolocation calls of free-flying bats between 30 minutes before dusk, and approximately 30 minutes after dawn. Data was stored on a Compact Flash Storage ZCAIM unit that recorded each bat echolocation call along with the time and date.

Calls from the units were downloaded and sent to Dr Greg Richards (Greg Richards and Associates Pty Ltd, Canberra) for identification. The files were viewed in Anabat software (Chris Corben, USA), which provides a sonogram display of frequency versus time for each call. Call identification was based on a key developed by comparing the characteristics of bat search calls with reference calls from known species recorded across Victoria, including reference calls provided by Dr Lindy Lumsden of the Victorian Department of Sustainability and Environment. Identification is largely based on changes to frequency patterns over time (*i.e.* the shape of the sonogram). Only those recordings that contained at least two definite and discrete calls were classified as bat calls. For most species, a call sequence of several seconds in duration is required before identification can be made confidently.

The identification of echolocation calls from microbats in southeastern Australia is facilitated by the fact that many calls are species-specific. However, not all species can be consistently or reliably identified. There is a large overlap in the call characteristics of some Victorian species and many calls are attributable only to species “complexes” and not to single species.

A significant limitation in the use of this technique is that it is not possible to census bats accurately. That is, the Anabat unit may record 10 calls of a particular species but it is not known if this represents 10 individuals or one individual flying past 10 times. Therefore, it is not possible to determine utilisation rates for bats as it is for birds.

Bat calls were recorded on the dates outlined in Table 8. During each period, Anabat systems operated concurrently at two different sites. A total of 40 detector nights were surveyed.

Table 8: Timetable for Anabat recording of bat calls at the proposed Berrybank Wind Farm site.

Recording site	Date of recording	nights of recording
Site 1, 2	8 th – 13 th April 2009	6
Site 3,4	14 th – 20 th April 2009	7

Recording site	Date of recording	nights of recording
Site 5, 6	21 st – 27 th April 2009	7

Six sampling points were selected to represent the habitats at the wind farm site that will be affected by turbines (see Figure 2). The location and characteristics of the recording sites are described below.

- Site 1: Located at the northern section of the wind farm site. The Anabat recorder was placed on edge of open paddock and close to a linear patch of planted Sugar Gum.
- Site 2: Located at the centre of the wind farm site. The Anabat recorder was placed on cleared land next to a line of recently planted pines.
- Site 3: Located in the north western section of the wind farm. The position of the Anabat recorder was in grazed and cropped land, with a small patch of old Sugar Gum about 10 metres from the recorder.
- Site 4: Located at a central-western section of the wind farm. The Anabat recorder was placed in an open cleared grazing paddock close to a line of planted Sugar Gum and a small farm dam.
- Site 5: Located on in the southern section of the wind farm site. The Anabat recorder was located on the side of large open grazing and cropping land but not far from a patch of sugar Gum.
- Site 6: Located on in the south western section of the wind farm site between two linear patches of planted pines and eucalypt trees.

5.4.2. Results

Species Recorded

A total of nine bat species were recorded during the survey from the six recording sites. These are listed in Table 10, together with their conservation significance and sites at which they were recorded.

The species recorded at the wind farm site were widespread, common and secure species and none was threatened or listed under any wildlife conservation legislation, nationally or in Victoria; however, the Inland Broad-nosed Bat is rather uncommon but widespread in northern and western Victoria (Menkhorst 1995).

The species of bats did not differ significantly between the recording sites: eight of the nine species recorded at the wind farm site were found in all sections of the wind farm site, and only one species, the White-striped Freetail Bat occurred in a small section of the wind farm site.

Long-eared bats are difficult to distinguish to species level, and hence are grouped under their genus name. The species that are likely to occur at the site are *Nyctophilus geoffroyi* and *N. gouldi*. The Southern Freetail Bat is currently under taxonomic revision and a specific name is unavailable.

Table 9: Species of bats recorded during the impact assessment of the Berrybank Wind Farm site.

Common name	Scientific name	Sites of records	Conservation status
Chocolate Wattle Bat	<i>Chalinolobus morio</i>	1, 2, 3, 4, 5, 6	Common, secured
Gould's Wattle Bat	<i>Chalinolobus gouldii</i>	1, 3, 4, 5, 6	Common, secured
Inland Broad-nosed Bat	<i>Scotorepens balstoni</i>	1, 3, 4, 5, 6	Uncommon, secured.
Large Forest Bat	<i>Vespadelus darlingtoni</i>	1, 3, 4, 5, 6	Common, secured
Little Forest Bat	<i>Vespadelus vulturnus</i>	1, 3, 4, 5, 6	Common, secured
Long-eared Bat	<i>Nyctophilus sp.</i>	1, 2, 3, 4, 5, 6	Common, secured
Southern Forest Bat	<i>Vespadelus regulus</i>	1, 3, 4, 5, 6	Common, secured
Southern Freetail Bat	<i>Mormopterus sp.</i>	1, 2, 3, 4, 5, 6	Common, secured
White-striped Freetail Bat	<i>Austronomus australis</i>	3, 4, 5, 6	Common, secured

Bat Activity

In total, the number of calls recorded varied significantly between the six recording sites. The total bat calls ranged between 9 and 1839 calls and averaged 1.5 – 262.7 calls per night for all species of bats recorded.

The highest activity levels were probably related to the presence of planted trees, mainly Sugar Gums. At sites where the gums were mature with significant number of hollows, such as sites 3, 5 and 6, bat activity, as measured by number of bat calls, was much higher than at sites with younger gums with less hollows (sites 1 and 4), and all were many times higher than activity at site 2 where no trees were present at the recording sites, except a small number of newly planted pines.

At the species level (Table 11), the number of bat calls differed significantly between the various species and within the same species between sites. The Southern Freetail Bat was the most common bat species and accounted for approximately 42 percent of total bat calls. The next most common species were the Southern Forest Bat and Large Forest bat. The three most active species accounted for approximately 74 percent of bat calls. The activity of the remaining species ranged between a total of 61 calls and 388 calls with no particular pattern of distribution among the six sites.

The above three common bat species are known to roost in tree hollows, under tree bark or in buildings (Menkhorst 1995). Their concentration, particularly at sites 3, 5 and 6 may indicate that the planted gum trees near these sites with their hollows provide roosting habitat.

Table 10: Bat activity (calls per night) at the Berrybank Wind farm.

Sites	No. Species recorded at site	Total Bat calls	Average calls/night	Average calls/species/night	No. days recording
Site 1	8	219	36.5	0.5 - 10.3	6
Site 2	4	9	1.5	0.2 - 1.0	6
Site 3	9	934	133.4	0.6 - 68	7
Site 4	9	301	43	0.1 - 19.3	7
Site 5	9	1839	262.7	3.1 - 148.7	7
Site 6	9	1028	146.9	3.3 - 58.3	7

Table 11: A comparison of activity levels of bat species recorded on Berrybank Wind Farm site.

Species	No. of calls at						Total
	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	
<i>Mormopterus sp.</i>	52	1	281	22	1041	408	1805
<i>Vespadelus regulus</i>	40		476	80	219	23	838
<i>Vespadelus darlingtoni</i>	62		73	38	329	41	543
<i>Austronomus australis</i>			57	135	107	89	388
<i>Chalinolobus gouldii</i>	12		1	1	35	332	381
<i>Scotorepens balstoni</i>	29		4	1	26	66	126
<i>Nyctophilus sp.</i>	20	6	18	14	22	17	97
<i>Vespadelus vulturnus</i>	3		18	6	36	28	91
<i>Chalinolobus morio</i>	1	2	6	4	24	24	61
Total	219	9	934	301	1839	1028	4330

6. TARGETED BROLGA ASSESSMENT

This section of the report presents a review of existing information on the status of the Brolga in a region within 20 kilometres of and including the proposed wind farm site. It also provides an account of the breeding season surveys within 20 kilometres of the site.

The **Brolga** is listed as vulnerable in Victoria (DSE 2007c) and is listed under the FFG Act.

6.1. Aims of investigation

The aims of the breeding season investigation were to:

- Identify the number and quality of wetlands known to be frequented regularly by Brolgas;
- Determine how Brolgas may use the proposed wind farm site and surrounding areas during the breeding season (within 20 kilometres of the wind farm boundary); and
- Identify known and potential breeding sites on the proposed wind farm site and surrounding areas (within 20 kilometres of the wind farm boundary).

6.2. Distribution and movement of Brolgas in Victoria

In Victoria, the range of the Brolga has contracted over time as a consequence of wetland drainage and loss of habitat due to agricultural development since European settlement. Currently birds have been found in the southwest and in the north of the State along parts of the Murray River (Du Guesclin 2003). Its former range included northeast Victoria, Gippsland and the Melbourne region.

Brolgas breed in territories based on a small, seasonal wetland in which they construct a nest. Breeding occurs between July and December, after which birds move to gather in larger flocks at traditional flocking sites.

Flocking sites of Brolgas in southwest Victoria occur in the regions listed below.

- The Grampians region;
- Strathdownie;
- Cressy;
- Streatham (mainly on Lake Wongan and in the Skipton area);
- Hamilton, Dunkeld and Penshurst areas;
- Edenhope area;
- Toolondo.
- Willaura and Stavely areas; and
- Lake Bernie Bolac, near Darlinghurst.

Approximately 250, or 75% of breeding sites in Victoria, are found on the volcanic plains in the southwest of the state.

Brolga movements in southwest Victoria are not completely understood. Regular movements in southeast Australia occur between flocking and breeding sites. Local movements can also take place when birds are moving between flocking sites and

nearby feeding areas (up to 5 kilometres, R. Hill, DSE, pers. comm.), or between breeding sites a nearby wetlands and pasture (up to approximately 3 kilometres, Brett Lane & Associates Pty Ltd, unpubl. data). Long-distance movements may take place in very dry years and populations may move from dry inland wetlands to wetlands associated with the Murray River (Marchant and Higgins 1993). In very wet seasons, birds may remain at breeding sites throughout the year and not move to flocking sites.

6.3. Previous records

Previous records of Brolgas from the search area (within 20 kilometres of the proposed Berrybank Wind Farm) are those reported in the Atlas of Victorian Wildlife and the Sheldon Database (2004). Sites where the species has historically occurred are shown in Figure 4.

Only three historical records are from within 5 kilometres of the wind farm site boundary. The first of these was located 4.5 kilometres west of the Berrybank township on the Hamilton Highway and the second historical sighting was located near the Hamilton Highway between Cressy and Lismore, approximately 2 kilometres east of the Berrybank township within the proposed wind farm site.

Historically (1979–2006, there have been 21 breeding records from at least 14 nesting sites within the search area (VFD records). There are no historical breeding records within the proposed wind farm boundaries or within 5 kilometres of these boundaries (Figure 4).

The majority of historic records were more than 10 kilometres from the boundary of the proposed wind farm. The greatest density of sightings and breeding records were located to the south east of the proposed wind farm site. The locations of sightings, breeding records and flocking sites are represented in Figure 4.

Within 20 kilometres of the boundary of the proposed wind farm, there are at least 16 historically known Brolga flocking records (VFD records), These include:

- Lake Martin (in the north of the wind farm);
- Cundare Pool (north at the 20-kilometre boundary of the search area); and
- Woody Yaloack River.

The number of Brolgas seen in the past on these sites ranged between 6 and 37 birds, with the maximum flock (37 birds) observed on Cundare pool.

6.4. Brolga habitat assessment

A total of 155 wetlands were visited and assessed during the current investigation undertaken between the 17th and 21st November 2008 in search of Brolgas and to classify habitat quality by the criteria in section 3. Four wetlands (3% of the 159 wetlands on the 1:50,000 topographic map sheets) were not classified because of access restrictions. Details of these wetlands are presented in Appendix 2, including habitat quality.

The majority of the wetlands surveyed were of low quality and did not contain habitat characteristics that make them suitable for Brolga breeding. Of the 159 wetlands on the 1:50,000 topographic map sheets, one site (<1% of the total) was considered of high habitat quality, 13 (8%) were of moderate–high habitat quality, 10 (6%) were of

moderate habitat quality, 36 (22%) were of low-moderate habitat quality and the remaining 95 wetlands (60%) were of low quality habitat.

Table 8 summarises the numbers of wetlands in each habitat quality class and the numbers of pairs of Brolgas observed in each quality class. No active nests were recorded during this survey.

Table 12: Summary of habitat quality of wetlands visited during the breeding season survey, including confirmed sighting of feeding and nesting Brolgas.

Habitat quality	No. of wetlands	Brolga observed
Low	95	0
Low-Moderate	36	0
Moderate	10	2
Moderate-High	13	2
High	1	0
Unclassified	4	2
Total	159	6

6.5. Brolga sightings

During the current field survey, six Brolgas (three pairs) were seen within the 20-kilometre radius of the survey area at distances between 14 and 20 kilometres from the proposed wind farm (Figure 4). Nesting sites were not found inside the proposed wind farm boundaries or near the wind farm.

One of the observed pairs was recorded from a location approximately 14 kilometres northeast of the proposed wind farm boundary (Figure 4), foraging in a cropped paddock. The nearest wetlands or water bodies (farm dams) were of low to low-moderate habitat quality. Although nests were not identified, there were numerous small farm dams (including a large farm dam that could not be accessed) that may provide potential suitable brolga breeding habitat.

The second Brolga pair was recorded from a location approximately 19 kilometres southwest of the proposed wind farm boundary (Figure 4). It was also observed foraging in a cropped paddock. A permanent freshwater lake adjacent to the paddock could potentially provide nesting habitat for Brolga. This large wetland was assessed from another point within the private property on which it is located and determined to be of moderate habitat quality. The detection of Brolga nests was made difficult by the lack of access to the wetland in its entirety; however, none were recorded notwithstanding this limitation.

The third pair of Brolgas recorded was observed foraging in and around the Woody Yaloack River that drains into Lake Martin, located approximately 15 kilometres southeast of the wind farm boundary. This section of the river contained emergent vegetation and open areas and was assessed as having moderate to high habitat quality.

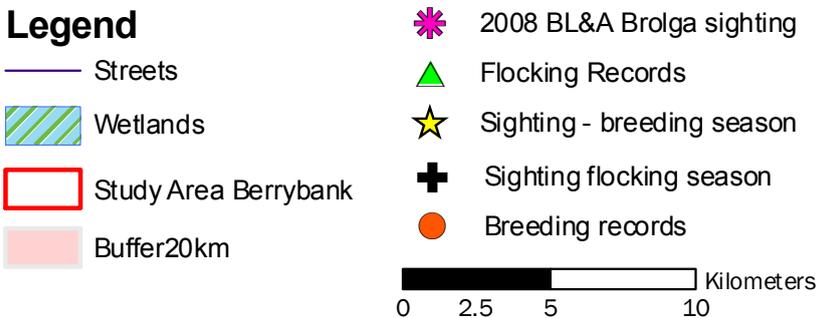
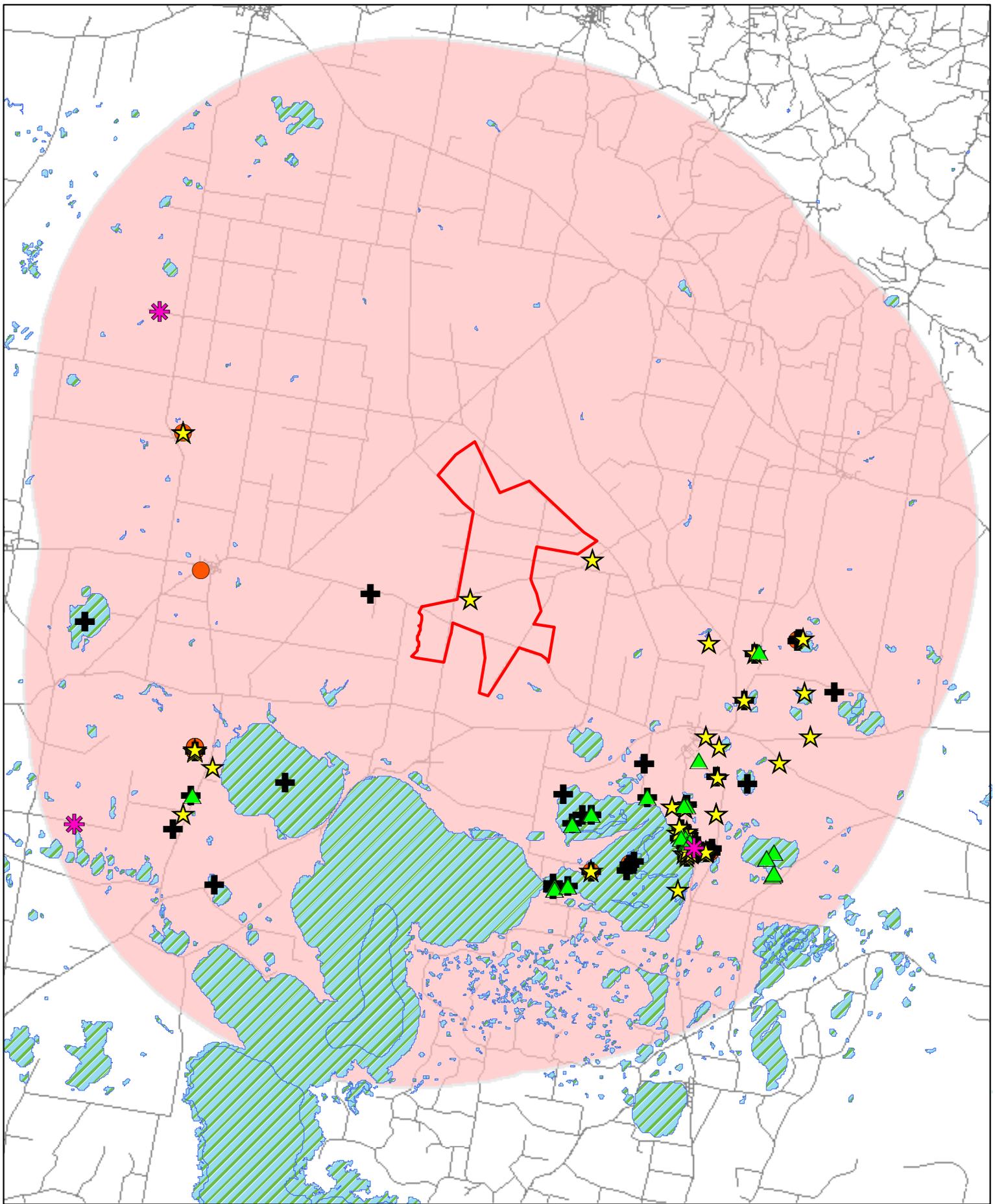


Figure 4 : Historical Brolga records

Project Title: Berrybank Wind Farm

Project No.: 7152	Date: 12/06/2009	Created by: J. Sullivan / B. Wallach
-------------------	------------------	--------------------------------------

BL&A Brett Lane & Associates Pty. Ltd.
Ecological Research & Management

- Experience 605 Nicholson Street ph (03) 9387 5008 | fax (03) 9387 6115
- Knowledge PO Box 592, Carlton North blane@ecologicalresearch.com.au
- Solutions VC 30 54 Australia www.ecologicalresearch.com.au

6.6. Summary

Three pairs of Brolgas were observed within 20 kilometres of the wind farm site during the 2008 Brolga investigation. There were no Brolgas identified as nesting within the proposed wind farm boundary or within 3 kilometres of the wind farm and no breeding/nesting Brolga sites were recorded.

The 2008 Level Two Breeding Survey indicated that suitable Brolga habitat in a 20-kilometre radius of the proposed Berrybank wind farm had fewer *high* (1%), *moderate to high* (8%) and *moderate* (6%) quality wetlands – accounting for a total of 15% of wetlands identified during the 2008 assessment. Wetland habitat assessed as *moderate to low* (22%) and *low* (60%) quality comprised a total of 82% of the wetlands identified (3% not assessed). Dry conditions and well below average rainfall records, i.e. 13mm recorded at Lismore for the 2008 spring season (DPI 2008), possibly account for shallow wetlands drying during the winter/spring breeding season.

The location of the Berrybank wind farm is elevated approximately 140-200 metres above sea level, increasing in a northerly direction. The proposed Berrybank Wind farm site is not located near shallow drainage lines where other water bodies naturally occur in the region.

The Victorian population of the Brolga is currently estimated at approximately 650 individuals (Du Guesclin 2003). The 2008 targeted Brolga investigation results indicate that one percent of the population was observed in the 20 km radius search area.

The results of this investigation indicate that the Berrybank Wind farm does not pose a significant threat to breeding habitats of the Brolga, given the paucity of suitable breeding habitat within the proposed wind farm site and up to at least 3 kilometres from the proposed site – the flight distance of the species during the breeding season. No traditional flocking sites occur within 5 km of the proposed wind farm – the flight distance of the species in the flocking season.

7. IMPACTS AND REGULATORY IMPLICATIONS OF THE PROPOSAL

The implications of the findings of this assessment are discussed below. Impacts of the proposed Berrybank wind farm on birds are discussed first. This is followed by consideration of the federal *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act), followed by the state *Flora and Fauna Guarantee Act 1988* (FFG Act), the *Environmental Effects Act 1978* (EES) and the state Victorian Native Vegetation Management Framework.

7.1. Planning Controls

Removal of native vegetation on roadsides requires a planning permit under Clause 52.17 of all Victorian Planning Schemes. Before issuing a planning permit, Responsible Authorities are obliged to refer to Clause 15.09 (Protection of Flora and Fauna) in the Planning Scheme. This refers in turn to the Native Vegetation Management Framework, discussed in the following section.

7.2. Native Vegetation Management Framework

This part of the report describes the Framework and applies its provisions to the proposed development. The Framework is a state-wide policy, separate from local planning overlays that may also require a permit for the removal of trees or vegetation. In the latter case, different criteria and controls may apply to those described below.

7.2.1. How the Framework operates

Any proposal to remove native vegetation from the study area must demonstrate that the three-step approach of ‘Net Gain’ outlined in the Framework has been applied. This approach is hierarchical and includes the following principles:

- Adverse impacts on native vegetation should be **avoided**, particularly removal of vegetation;
- Where impacts cannot be avoided, impacts should be **minimised** through responsive planning and design, with input from relevant experts; and
- Appropriate **offsets** need to be identified to compensate for native vegetation removal.

A combination of project design and offsetting should aim to achieve a net gain in the area and quality of native vegetation across Victoria.

Responses to planning permit applications to remove native vegetation vary depending on the conservation significance of the vegetation proposed for removal. Conservation significance determines both the likelihood of approval and, importantly, the scale of the required offset. This is summarised in Table 13.

Offset targets are directly related to the habitat hectare value of the removed vegetation. They can comprise indigenous vegetation retained for conservation purposes within the study area, or vegetation elsewhere, secured on a case-by-case basis by the proponent or through the DSE Bush Broker scheme. No vegetation is available within the study area so a third party offset site will need to be found. Alternatively, a financial contribution may be appropriate to Council or another offset site owner to assist in native vegetation management activities.

Table 13: Likely response to applications for removal of intact native vegetation

Framework conservation significance	Likely response to application for clearing	Likely offset requirements
VERY HIGH	Clearing not permitted unless exceptional circumstances apply. Offset Management Plan to be submitted with application.	Substantial Net Gain At least 2 X calculated loss in habitat hectares plus a large tree protection and replacement offset if any large trees are removed

Clause 66.02 of the planning scheme determines the role of the DSE in the assessment of indigenous vegetation removal planning permit applications. If an application is referred to the DSE then the Responsible Authority must follow that department's recommendation in relation to that permit application. The criteria presented in Table 14 indicate when the DSE becomes a referral authority.

Table 14: Application referral criteria

Applications will be referred to the Department of Sustainability and Environment under the following circumstances:
<p>Scattered Trees</p> <ul style="list-style-type: none"> ▪ To remove more than 15 trees of DBH less than 40 centimetres ▪ To remove more than 5 trees of DBH 40 centimetres or greater (DBH = diameter at 1.3 metres above ground)
<p>Remnant Patch Vegetation (may include trees)</p> <ul style="list-style-type: none"> ▪ To remove more than 0.5 hectares of vegetation in an EVC with Bioregional Conservation Status of Endangered, Vulnerable or Rare. ▪ To remove more than 1 hectare of vegetation in an EVC with Bioregional Conservation Status of Depleted or Least Concern.

For the current proposal, a referral to DSE would be triggered if more than 0.5 ha of roadside native grassland were to be removed. As it has been estimated that 0.11 hectares will be affected (see below), referral of the application to DSE is therefore not required.

7.2.2. Vegetation proposed to be removed

Within the wind farm site itself, no native vegetation will be removed for the construction of the proposed wind farm. Some native vegetation is proposed to be removed on roadsides for the purposes of gaining access to the site and, possibly, for the construction of powerlines from a central sub-station to the power distribution grid.

The selection of access points has considered the 'avoid' and 'minimise' principles of the Framework in the following ways:

- Where feasible, scattered trees that occur within roadside vegetation have been avoided in locating access track crossovers; and
- Native grassland vegetation in roadsides has been avoided in fifteen out of seventeen crossovers through careful siting of access tracks.

In total, access track crossovers will affect 0.08 hectares of Plains Grassland.

Six substation locations (none of which are in native vegetation) are under consideration, as well as an associated overhead powerline route to the grid. Four options (those for connection to the 220 kV powerline to the north-west of the wind farm site) involve potential impacts on native vegetation along roadsides. The proponent has indicated that power poles will need to be constructed using a 4 metre by 4 metre construction pad, with power poles spaced at 170m intervals. Depending on the option, a maximum of 15 power poles need to be located in roadside native vegetation. This results in the removal of a total of 0.024 hectares of Plains Grassland.

7.2.3. Offset targets for removal from habitat zones

Offset targets for the proposed removal of intact native vegetation are outlined in this section. Offset targets in habitat hectares are presented in Table 15. Note that habitat hectare values have been calculated using the default habitat score of 0.45.

Table 15 Offset targets in habitat hectares for the removal of native vegetation at two crossovers

Crossover Zone	Area of removal (ha)	Habitat Hectares to be removed	Framework conservation significance	Net Gain multiplier	Offset Target (habitat hectares)
N	0.04	0.02	Very High	2x	0.04
O	0.04	0.02	Very High	2x	0.04
15 power poles	0.03	0.01	Very High	2x	0.02
	0.11				0.1

Offsets for the removal of native vegetation from habitat zones are directly related to the habitat hectare value of the removed vegetation. These may include the permanent protection (e.g. Section 173 agreement under the *Planning and Environment Act 1987*) for conservation purposes of other existing remnant vegetation. Offsets may be located within the study area or offsite, and maintained for up to 10 years. Offsite offsets may be identified on a case-by-case basis by the proponent or through the DSE Bush Broker scheme. Offsets must be of a like-for-like nature as outlined in the Framework.

The process of calculating offsets is complex. Based on previous experience, approximately 0.5 hectares of suitable native vegetation may be required to achieve this offset target. This is based on a potential 0.2 habitat score improvement in vegetation at the offset site. It should be noted that this is an approximation only. The potential for an offset site to achieve the required offset target can only be calculated once the final offset site has been identified.

Offsets for the removal of native vegetation from habitat zones are directly related to the habitat hectare value of the removed vegetation. These may include the permanent protection (e.g. Section 173 agreement under the *Planning and Environment Act 1987*) for conservation purposes of other existing remnant vegetation. Offsets may be located within the study area or offsite, and maintained for up to 10 years. Offsite offsets may be identified on a case-by-case basis by the proponent or through the DSE Bush Broker scheme. Offsets must be of a like-for-like nature as outlined in the Framework.

This offset target is unlikely to be achieved within the study area and findings a stand-alone site for such a small offset gain is unlikely to be practical. A contribution to an

appropriate third party offset site (i.e. site located on another property) is considered more appropriate and this would need to be identified through discussions with the Responsible Authority or with the DSE Bush Broker coordinator, or with the Trust for Nature.

7.3. Impact of the proposed wind farm on birds

Wind turbines may affect birds in three ways:

- Birds may be killed or injured by colliding with rotors, towers, guy wires, or related structures.
- Birds may avoid wind energy developments and surrounding habitat.
- The footprint of the turbines, roads, power lines, and auxiliary buildings may directly impact habitat.

7.3.1. Mortality caused by wind turbines

The impact of operating wind turbines on birds is generally limited. Although mortality does occur, it appears to be very site-specific.

Table 8 summarises reported collision rates from a range of European and North American wind farms. The rate varied between 0.04 – 3.4 birds per turbine per year. A rate of 4.3 birds per turbine per year was recorded from two wind farms in the eastern U.S. outside California. However, variation among wind farms depends on several factors, including the amount of bird use, vegetation and other physical and biological characteristics of the specific wind farm and its surrounding area.

Studies at upland sites in the UK have generally reported very low collision rates, with some studies finding no collisions at all. This probably reflects the generally low bird densities present in these areas.

Overall it is clear that birds are generally able to avoid collisions and do not simply blindly fly into wind turbines. Collision rates typically in range of only 1 in 1,000–10,000 bird flights through wind farm, even in studies such as Zeebrugge where comparatively high numbers of collisions have been reported.

Studies using radar tracking have helped to provide further information on birds' general ability to avoid collisions. Dirksen *et al.* (1998), for example, showed that Pochard *Aythya ferina* and Tufted Duck *Aythya fuligula* flew regularly through a wind farm in the Netherlands at night under moonlight but flew around the turbines at greater distance from them when it was dark and foggy.

Analysis of North American and European bird collisions at wind farms (Erickson *et al.* 2001; Percival 2003; NWCC 2004) shows that bird species affected by operational turbines varied but were related to the type of habitat on which the wind farm was built (Table 16). Most wind farm bird mortality involved migrating birds. The northern hemisphere has a large number of both species and individuals of migrants due to the large area of land at high latitudes that becomes unsuitable for birds in winter. Australia's geography and latitude means that there are few night-migrating birds. For this reason, the numbers of birds likely to collide with operating wind farms in Australia would be about half that in Europe and North America.

Table 16: Summary of bird mortality estimates for wind farms in Europe and North America (Sources: Erickson *et al* 2001; Percival 2003; NWCC 2004).

Site	Habitat	Species present	Size of Windfarm	Collision rate*
USA sites (review of 12 projects outside California)	Various	Various	Mixed	2.3 (1.5–4.3)
Altamont, California	Ranch land	Raptors	VL	0.05– 0.06
Buffalo Ridge (all phases), Minnesota, USA	Various	Waterfowl & passerines	L	2.83
Tarifa, S. Spain	Coastal Hills	Raptors, storks and many migrants	VL	0.34
Navarre, Spain	Inland hills	Various, including raptors and passerines	VL	0.34
Burgar Hill, Orkney	Coastal moorland	Upland species	S	0.15
Blyth, Northumberland	Coastal Shoreline	Shorebirds	S	2.52
Zeebrugge, Belgium	Coastal shoreline	Gulls, terns & migrants	M	11–29**
Bryn Tytli, Wales	Upland moorland	Upland species, including peregrine falcon	M	0.0
Cemmaes, Wales	Upland moorland	Upland species	M	0.04
Urk, Netherlands	Coastal-on dyke wall	Waterfowl	M	1.7
Oosterbierum, Netherlands	Coastal-on Dyke wall	Waterfowl & migrants	M	1.8
Kreekrak, Netherlands	Coastal-on dyke wall	Waterfowl	S	3.4
Ovenden Moor, South Pennines	Upland moorland	Upland species	M	0.04
Tjaereborg, Denmark	Coastal grassland	Waders and gulls	S	3.0
Nasudden, Gothland, Sweden	Coastal marsh & arable	Waterfowl, including breeding waders & migrants	L	0.7
Utgrundun	Offshore	Eiders	S	0.0

Collision rate = Number of birds killed per turbine per year; all rates are corrected for observer efficiency and scavenging rate.

** The study included high correction factors (detecting only 11% of collisions).

VL=very large (>200 turbines); L=large (50–200); M=medium (10–50); S=small (<10).

It is clear that bird collisions with wind turbines can be a problem under some circumstances. From the evidence available from existing wind farms there are two main types of sites that have had collision problems:

- Sites with large raptors occurring regularly within the wind farm at the same height as the turbine blades. In Australia, the main species that would fall into this category would be Wedge-tailed Eagle and Nankeen Kestrel.
- Sites with very high densities of other birds flying at rotor height. These could include seabird breeding colonies and feeding concentrations, and wetlands (including

coastal sites) with large waterfowl concentrations, and significant migration flyways (mainly a northern hemisphere phenomenon).

Based on work undertaken for the current assessment, it is clear that the site does not meet these criteria. It is dominated by agricultural land uses that are unexceptional in a regional context. Furthermore, the bird utilisation surveys results indicate the avifauna is dominated by common farmland birds that are common and widespread throughout south-eastern Australia.

Australian Studies

Experience at wind farms in Australia is informative. Monitoring results in the public domain include:

- Codrington, Vic. (14 generators): 3 birds (2.5 years, weekly, monthly or six-weekly searches);
- King Island, Tas. (3 generators): 1 bird (5 years, weekly – monthly searches);
- Woolnorth, Tas. (6 generators): 8 birds, <1 year, daily to weekly searches);

(Source: Meredith, C [2003] Australian Wind Energy Association presentation, Sydney, July 2003).

Allowing for observer efficiency and scavenger correction, the Australian results correspond to a collision rate of between one and four birds per generator per year.

The Australian wind farms that were monitored for bird mortality are mostly in agricultural settings, although all are located on or close to the coast. Birds that fatally collided with turbines were mostly farmland birds, except at Woolnorth, where the list included three marine species and occasional, but repeated, Wedge-tailed Eagle collisions.

Indirect Habitat Disturbance

The second potential impact of wind farms on birds is through displacement from an area around the wind turbines, effectively resulting in habitat loss. Numerous studies have investigated this potential problem, with a range of results. In many cases, no significant disturbance effect at all has been detected, including studies at upland, coastal and offshore wind farms (Percival 2003) (see Table 17). European studies suggest that most displacement involves migrating, resting and foraging birds. Studies have reported displacement effects ranging from 75 metres to as far as 800 metres away from turbines and up to 300 metres for breeding birds (Percival 2003; Strickland 2004). Often studies have had confounding factors, such as increased human disturbance, lack of habitat studies to determine birds' preferences in relation to wind farm location, and lack of proper statistical testing/experimental design.

While birds appear to avoid flying near turbines, the presence of these structures does not seem to deter birds from their foraging areas (Danish Wind Industry Association 2001). Breeding birds appear to have a greater tolerance to turbines than migrating birds. Local breeding populations of waterfowl, grouse, shorebirds, gulls and passerines were not significantly affected by the construction of turbines in a bog in the Orkney Islands (Meeks *et al.* 1993). There was also little effect on breeding birds at other wind sites in Great Britain with many examples of birds breeding in close proximity to wind turbines (Percival 1998).

Table 17: Studies of the possible disturbance effects of wind farms on birds (after Percival 2003).

Site	Habitat	Species present	Size of wind farm	Distance affected (metres)
Tjaereborg, Denmark*	Coastal grassland	Waterfowl, mainly waders and gulls	S	Max 800
Urk, Netherlands	Coastal-on dyke wall	Waterfowl, including geese and swans	M	Max 300
Oosterbierum, Netherlands**	Coastal-on dyke wall	Waterfowl	M	Max 500
Vejlerne, Denmark	Farmland	Pink-footed Geese	L	1–200
Westermarsch, Germany	Farmland	Barnacle Geese	M	Max 600
Haverigg, Cumbria	Coastal grassland	Golden Plover, gulls	S	None
Blyth, Northumberland	Coastal shoreline	Cormorants, waders, gulls	S	None
Bryn Tytli, Wales	Upland moorland	Upland species, raptors	M	None
Carno, Wales	Upland moorland	Upland species	L	None
Ovenden Moor, NW England	Upland moorland	Golden Plover and Curlew	M	None
Nasudden, Gotland, Sweden	Coastal marsh	Waterfowl inc. geese and breeding waders	L	None
Various UK sites	Uplands	Lapwings, curlews, skylarks and pipits	M	None
Zeebrugge, Belgium	Coastal shoreline	Waterfowl	M	Up to 300
Novar	Upland Moorland	Upland species	M	None
Urgrunden	Offshore	Long-tailed Duck	S	None

* Breeding lapwing up to 300 m.

** No effect on breeding waders.

L=large (50–200 turbines); M=medium (10–50); S=small (<10).

Direct Habitat Disturbance

There are a variety of direct, long-term and short-term non-collision impacts that wind farms may have on birds. Direct loss of habitat results from the construction of turbine pads, roads and substations. Long-term habitat impacts results from the construction of relatively permanent structures that remove habitat for the life of the project and short-term impacts that occur while habitat has been disturbed temporarily during construction of the wind farm.

Examples of impacts can be found in studies from some American wind farms. Temporary impacts from the construction of roads, turbine pads and substation were 0.2 to 1.3 ha per turbine. Long-term impacts from permanent facilities were 0.3 to 0.5 ha per turbine or 0.2 to 0.35 ha per MW (Strickland 2004). A similar scale of direct impacts on agricultural land is likely to occur at the proposed Berrybank Wind Farm. As the study area lacks significant fauna habitat, including bird habitats, indirect impacts will not have a significant impact on avifauna.

Mortality caused by wind mast guys and powerlines

Bird collision with guy-wires used to hold wind monitoring masts are of concern (Kingsley and Whittam 2001). Birds that fly fast in flocks at low altitude, such as waterfowl and shorebirds, appear to be particularly susceptible to collisions with wires (James and Haak 1979). In addition, to waterfowl, raptors are also victims of wire strikes (Olsen and Olsen 1980; Brett Lane & Associates Pty Ltd, unpubl. data).

Several recommendations have been made to reduce wire-induced bird mortality (Kingsley and Whittam 2001):

- Lines should be built underground if possible;
- Line visibility should be increased by adding markers, and increasing the size of wire;
- Lines should not be built over water or other areas of high bird concentration;
- Lines should be oriented parallel to prevailing wind direction.

Other than the principal power lines, the turbines in the proposed Berrybank wind farm are connected to the substation by underground powerlines, thereby significantly reducing this potential risk to birds.

It is understood that the proponent will ensure that key sensitive habitats for birds will be avoided in the siting of any powerlines associated with the Berrybank wind farm.

7.3.2. Conclusions

The conclusions from the bird utilisation survey and review of existing information on the bird impacts of wind farms for the proposed Berrybank Wind Farm are presented below.

- The proposed wind farm site is a largely altered agricultural landscape supporting a low diversity and abundance of common, predominantly opportunistic and adaptable native bird species.
- The site supports bird species and relative abundances of bird species in line with observations from similar farmland settings elsewhere in southern Australia.
- The site supports only a few birds of prey, groups considered vulnerable to collision with operating wind turbines.
- The site lies close to the territory of one pair of Wedge-tailed Eagles, which used the area with low frequency during the bird utilisation surveys. Therefore, the risk of a collision by this species is considered to be very low.
- Studies of wind farms in many parts of the world indicate that the rate of bird collisions is between 0.04 and 4 birds per turbine per year. Similar collision rates have been observed at Australian wind farms.
- The proposed Berrybank Wind Farm is broadly comparable in terms of bird habitat characteristics and setting to other wind farms in southern Australia and a similar rate of mortality of common farmland birds is expected. This level of mortality is not considered to be of consequence for the regional and wider populations of the affected species, as they are widespread and abundant elsewhere.
- Areas surrounding the wind farm support similar habitat to the proposed wind farm and the level of bird usage and species present are likely to be comparable.

Therefore, indirect impacts from the proposed wind farm are likely only to affect common species of farmland birds.

- No threatened species of birds were observed on or near the proposed wind farm site and only one, the Brolga, is expected to occasionally occur in the region. Impacts on this species from the proposal are the subject of Section 6.
- No threatened species of bats were observed on or near the proposed wind farm site and none is expected to occur regularly.
- Use of the proposed wind farm site by migratory species listed on the Commonwealth EPBC Act is likely to be very low and significant impacts on regional populations of these species are not expected to occur.

7.4. EPBC Act

If a species that is listed under the EPBC Act is found on a proposed wind farm site, and there is a likelihood of an impact on it arising from the proposed wind farm, then a Referral to the Commonwealth Minister for the Environment is prudent.

A number of EPBC Act listed species have been found in the search region, although it is considered feasible to avoid any significant impacts on these species through careful siting of wind generators and associated infrastructure, particularly the access roads and power cabling that make up the largest component of the development footprint.

Two flora species listed under the EPBC Act, the Spiny Rice-flower and Trailing Hop-bush, have been recorded in the study area. Other listed threatened flora species recorded from or likely to occur in the search region include Adamson's Blown-grass, Button Wrinklewort, Clover Glycine, Curly Sedge, Fragrant Leek-orchid, Large-fruit Fireweed, Maroon Leek-orchid, Swamp Fireweed, and White Sunray. Targeted searches in spring 2008 failed to locate these species in the study area.

Positioning of turbines away from wetlands and the Chain of Ponds Creek will minimise any impacts upon potential threatened flora species that may occur there. Avoidance of native grassland remnants on road reserves would avoid impacts on areas of Natural Temperate Grassland of the Victorian Volcanic Plain and any Spiny Rice-flower or Striped Legless Lizard populations that may persist in the study area. This means that access to the site for construction and operations needs to be carefully located to avoid damage to these remnants, the best of which occur along Urches Road and along Berrybank – Werneth Road (Figure 1).

In areas where removal of native vegetation on roadsides is unavoidable, targeted surveys will need to be undertaken prior to construction to ensure that siting of access is in areas that do not support listed threatened flora species.

The Striped Legless Lizard may occur in roadside remnant grasslands in the study area. Avoidance of these areas in planning access track to the wind farm will ensure that no impact occurs to this species.

Growing Grass Frog, although potentially occurring in the search region, is unlikely to occur on the site due to a lack of habitat or linkages to known sites.

The Southern Bent-wing Bat was not recorded on the site during the bat surveys and habitat for it on the site is lacking. There are no roosting caves on the site as site geology is unsuitable.

7.5. FFG Act

Impacts on species and communities listed under the FFG Act that occur on private land are not protected by its provisions. DSE and the Planning Authority are also required to consider impacts on FFG Act listed species and communities under the policy and planning guidelines for wind energy developments in Victoria, as well as in general terms through the planning provisions (Clause 15.09).

Where native vegetation on public land (i.e. road reserves) is proposed for removal, a licence would be required under the FFG Act to remove protected flora (c.f. threatened species and communities - see below). Native plants of the family Asteraceae (Daisies; protected under the FFG Act) were identified on public land within the study area. If future development plans propose the removal of native vegetation on public land (i.e. roadsides), a more detailed survey would be required to determine whether any other protected or threatened species listed under the Act occurred at those sites. Proposed removal from public land of species or communities listed as threatened under the FFG Act would also require a licence under the Act.

Western (Basalt) Plains Grassland Community, Western Basalt Plains (River Red Gum) Grassy Woodland Floristic Community and the Spiny Rice-flower are threatened items listed under the FFG Act that were identified in privately and publicly-owned sections of the study area during the current investigation. Another nine plant species listed as threatened under the FFG Act may occur in the study area: Adamson's Blown-grass, Button Wrinklewort, Clover Glycine, Curly Sedge, Fragrant Leek-orchid, Hairy Tails, Large-fruit Fireweed, Maroon Leek-orchid and Small Milkwort. A more detailed survey in spring 2008 failed to locate these. A targeted spring survey for these species should be considered where native vegetation is proposed to be removed from roadsides to gain access to the proposed wind farm site.

The FFG Act listed Brolga has been recorded from the study area but not during this assessment. State wind farm policy and planning guidelines require impacts on FFG Act listed species to be assessed. The Level Two risk assessment undertaken for this investigation indicates that no Brolga breeding habitat exists within the wind farm and birds are likely to be occasional visitors to paddocks on the site. Significant risks to the species from the proposed wind farm are not expected.

7.6. Environment Effects Act 1978

If the proposed wind farm has the potential to cause an adverse environmental effect that, individually or in combination, could be significant in a regional or State context then the project should be referred to the State Minister for Planning for a decision on whether and Environment Effects Statement (EES) is required for the project. The criteria for referral are focussed on the potential for a significant effect on the environment. The criteria for biodiversity impacts are outlined below.

Individual impacts on biodiversity that might be of regional or State significance, and therefore warrant referral of a project are:

- Potential clearing of 10 hectares or more of native vegetation from an area;
- Potential long-term loss of a significant proportion (e.g. 1 to 5 percent depending on the conservation status of the species) of know remaining habitat or population of a threatened species within Victoria;
- Potential long-term change to the ecological character of a wetland listed under the RAMSAR Convention or in ‘A Directory of Important Wetlands in Australia’; or
- Potential extensive or major effects on health or biodiversity of aquatic, estuarine or marine ecosystems, over a long-term.

The significance of impacts of the proposed Berrybank wind farm for each of these matters is evaluated in Table 18.

Table 18: Environmental Effects Referral Criteria and its relevance to the proposed Berrybank Wind Farm development

Referral criteria	Relevance to proposed wind farm	Mitigation Actions
Clearing of 10 hectares or more of native vegetation	Limited area of native vegetation in the study area; will not clear 10 hectares or more of intact native vegetation.	Avoid clearing native vegetation in accordance with the Native Vegetation Management Framework. Provided that roadsides with mapped high quality native grassland or Plains Grassland EVC are avoided and site access carefully planned to avoid native vegetation then no adverse impacts are anticipated.
Long-term loss of habitat or population of threatened species within Victoria (listed under the FFG Act)	The Brolga is threatened in Victoria and may occur occasionally on the Berrybank site; Striped Legless Lizard may occur in roadside native grass remnants; Spiny Rice-flower occurs within vegetation Site 1 and may occur in other recorded areas of remnant grassland; Adamson's Blown-grass, Button Wrinklewort, Clover Glycine, Curly Sedge, Fragrant Leek-orchid, Hairy Tails, Large-fruit Fireweed, Maroon Leek-orchid, Small Milkwort, may occur in the study area (mostly within road reserves and the Chain of Ponds Ck); Natural Temperate Grassland of the Victorian Volcanic Plains, Western (Basalt) Plains Grassland Community and Western Basalt Plains (River Red Gum) Grassy Woodland Floristic Community 55-04 occur as small to large remnant patches, mostly on roadsides.	Regional study has been undertaken to gain an understanding of any impacts, if any, on the Brolga. Three pairs were found within 20 km of the site and historical breeding and flocking record indicate limited occurrence near the wind farm site. No significant impacts are therefore anticipated. Avoidance of native grassland on roadsides will preserve Striped Legless Lizard habitat, if present. Targeted surveys of any proposed wind farm footprint would be required if it intersects remnant native vegetation to ascertain the presence of any threatened flora species. The avoidance of vegetation Site 1 would be necessary to avoid disturbance to known populations of the Spiny Rice-flower. Avoid clearing Western (Basalt) Plains Grassland Community and Western Basalt Plains (River Red

Referral criteria	Relevance to proposed wind farm	Mitigation Actions
		Gum) Grassy Woodland Floristic Community patches. It is considered feasible to avoid any impacts on native vegetation and habitats potentially supporting threatened species so significant impacts are not anticipated.
Long-term change to the ecological character of a wetland listed under RAMSAR or in 'A Directory of Important Wetlands in Australia'	Some Western District Lakes (Ramsar site) are located within 20 km of the proposed Berrybank wind farm.	Given the paucity of wetlands within the wind farm footprint, there are unlikely to be significant numbers of water birds from these wetlands using the area and therefore no adverse effects upon Ramsar site fauna from the Western District Lakes Ramsar site. The bird utilisation survey of the site confirmed the lack of waterbird usage of the site and, combined with the limited low quality habitat available, waterbird impacts are not anticipated.
Extensive or major effects on the health of aquatic, estuarine or marine ecosystems	The proposed wind farm development is unlikely to disturb or affect any waterways.	Disturbance of wetlands and waterways can be avoided by carefully designing the wind farm to avoid these habitats. Any runoff into waterways from works sites should be controlled using sediment and erosion control methods during construction and operation of the wind farm. Provided these measures are adopted then impacts on aquatic ecosystems in the southern part of the site are not considered to be significant.

An EES referral has been submitted and no EES is required.

7.7. Native Vegetation Management Framework

If any part of the wind farm development requires the unavoidable removal of native vegetation then a planning permit for removal of that vegetation would be required under Clause 52.17 of the planning scheme. Under the Native Vegetation Framework, before a permit is granted, the proponent must demonstrate how they have attempted to meet the three key requirements of the native vegetation management framework, namely:

- Avoid the removal of native vegetation wherever possible;
- Minimise unavoidable vegetation removal; and
- Offset unavoidable removal through vegetation protection, enhancement and rehabilitation.

Permission to remove native vegetation and the extent of any required offsets depends on the bioregional conservation status and quality of the affected vegetation. Quality is determined by a Habitat Hectare assessment, the methodology for which is set under the Framework. Avoidance would therefore remove the need for such an approval (see below).

Where native vegetation is to be unavoidably removed, then a full botanical survey of the affected areas will need to be undertaken during seasonally appropriate conditions for threatened plant species. In addition, habitat-hectare assessments of any affected vegetation should also be undertaken to ascertain the extent of removal and the likely offset vegetation protection and rehabilitation works required.

To meet the requirements of the framework, the layout of the proposed wind farm, including generators, access roads and other infrastructure, should be designed to avoid patches of native vegetation, wherever possible. This would be consistent with the 3 step approach of Net Gain (i.e. avoid, minimise and offset) as required under the Native Vegetation Management Framework. The limited proportion of the site occupied by native vegetation and the flexible nature of wind farm layouts make it feasible to significantly avoid impacts on native vegetation. In the current proposal, only two of the seventeen crossovers for access tracks occur within native vegetation.

7.8. Other issues

During the operational phase of the wind farm, turbines may pose a risk to birds, especially those that fly high or soar while foraging. Birds that belong to this category include the waterbirds and most of the birds of prey that have been recorded in the region. One nest of the Wedge-tailed Eagle was reported by the landowner of 'Binga', east of the Berrybank – Wallinduc Road, and the presence of the species in the area was corroborated by another landowner. The nest was not seen during field work for the current investigation. The wind farm may affect the pair of eagles that uses the proposed wind farm site but this is not expected to result in a significant impact on the regional or wider population of this widespread species.

Based on existing AVW records and anecdotal evidence, as well as the results of field investigations undertaken for this assessment, it is considered that birds common to cleared farmland habitat dominate the wind farm site. This assessment has not identified any likely significant risk to threatened bird species.

The cumulative impacts of wind farms in southwest Victoria on the Brolga have been the subject of discussions with the Department of Sustainability and Environment. A collaborative investigation of potential impacts on the Brolga for all wind farms in southwest Victoria is currently underway.

Bats have been investigated in detail on the site and no rare or threatened species were found during Anabat® surveys. Although the threatened Southern Bent-wing Bat occurs in the wider region, the site lacks suitable forested habitat for this species. Notwithstanding significant bat activity at some Sugar Gum plantations on the site, no Southern Bent-wing Bats were recorded.

7.9. Summary of key implications

- *Finding:* The site was mostly cleared of native vegetation for agriculture, although intact native vegetation occurred along roadsides. The state Native Vegetation Management Framework requires that clearing of native vegetation be avoided in the first instance, with unavoidable removal being minimised and offset with vegetation protection, enhancement and rehabilitation works nearby.

Response: Vegetation mapping in the study area shows remnant grassland was confined mostly to roadside reserves. Most crossover points for site access tracks have been located to avoid this vegetation. Appropriate offsets have been calculated for the unavoidable removal of native vegetation at two crossover locations and for the maximum likely number of overhead power poles for the grid connector. No offset site is likely to be found within the wind farm site and a financial contribution to a third-party (off-site) offset is considered the most practical means of meeting the very limited offset target (i.e. 0.1 habitat hectares).

- *Finding:* Threatened plant species listed under the EPBC Act or the FFG Act, or listed as rare or threatened on the DSE Advisory List, may occur in remnant vegetation on public roadsides, which covers a small percentage of the proposed wind farm site.

Response: Native vegetation remnants occur on a small proportion of the area potentially proposed for wind farm infrastructure. Layout plans have been carefully assessed and planned to avoid removing native roadside vegetation wherever possible. Currently, only two of the seventeen crossover points involves the removal of roadside native vegetation. Initial layout plans should be assessed before finalisation to ensure micro-siting takes this matter into consideration. (Note that this may occur after a planning permit is issued, given the limited extent of native vegetation).

- *Finding:* One pair of Wedge-tailed Eagles may occur on or near the site. Utilisation rates for this species during the bird utilisation survey are considered low.

Response: Significant risks to the eagle population are considered unlikely therefore no further investigation of eagle use of the site is warranted. Impacts on a single eagle pair from the wind farm are not considered to represent a significant impact on the regional or wider population of this widespread species.

- *Finding:* The bird utilisation survey found that common farmland species dominate the avifauna of the site. No threatened species were found. The most abundant birds at rotor swept area were also common farmland birds.

Response: No further investigation of bird risks is warranted, other than the work that has been undertaken on the Brolga (see below).

- *Finding:* Some waterbirds, including the threatened Brolga (listed on the FFG Act, or considered threatened on DSE's Advisory List) may occur occasionally in small numbers on the proposed wind farm site. A Level Two risk assessment for the Brolga, and in particular a targeted breeding season survey of the region within 20 km of the wind farm, was initiated. This located three Brolga pairs (none breeding) between 14 and 20 kilometres from the wind farm site. This is well beyond the distance at which direct or indirect impacts on this species would be expected from a wind farm (i.e. usually up to 5 km from a wind farm).

Response: Usage of the wind farm site and its surrounds by Brolgas on a regular basis is considered unlikely and impacts on this species are unlikely to be of concern. No Level Three (sensu AusWEA 2005) risk assessment is therefore warranted.

- *Finding:* Nine species of bats were recorded utilising the wind farm site. Species were common, secure, and none was listed as threatened either nationally or at the state level. Some bat species recorded relatively high activity levels, particularly at sites where large Sugar Gum plantations were present and may have been used as roosting sites.
- *Response:* No significant impacts on threatened bat species are anticipated so no further investigations are warranted..

8. REFERENCES

- Australian Wind Energy Association 2005. 'Wind Farms and Birds: Interim Standards for Risk Assessment.' Report prepared by: Brett Lane and Associates and AIRA Professional Services; Report No. 2003.35(2.2), July 2005.
- Barrett, G. *et al.* 2003. *The New Atlas of Australian Birds*. Birds Australia, Melbourne.
- Bates, R.J. 1994 *Prasophyllum*, In Walsh, N.G. and Entwisle, T.J. (eds) *Flora of Victoria: Ferns and Allied Plants, Conifers and Monocotyledons*, V.2, Inkata Press, Melbourne, pp 869-886.
- Brett Lane and Associates 2006. *Starfish Hill Wind Farm: bird monitoring program final report: autumn 2004 – autumn 2006; March 2006*. Report No. 2003.30(3.0).
- Bureau of Meteorology 2008, *3-monthly rainfall totals for Corangamite, October to December 2008*. Bureau of Meteorology, Australia, viewed 5th December 2008, <http://www.bom.gov.au/cgi-bin/silo/rain_maps.cgi?map=points&variable=totals&area=vic&period=3month®ion=corangamite&time=latest>
- Danish Wind Industry Association 2001. *Birds and Wind Turbines*. URL: <http://www.windpower.dk/tour/env/birds.html>.
- Department of Environment, Water, Heritage and the Arts 2008. EPBC Act Protected Matters Search Tool. <http://www.environment.gov.au>. Australian Department of Environment, Water, Heritage and the Arts, Canberra.
- Department of Natural Resources and Environment 2002, *Victoria's Native Vegetation management - a Framework For Action*, State of Victoria, [Then] Department of Natural Resources and Environment, Victoria.
- Department of Primary Industries 2008, *Victorian Rainfall Deciles 2008*, Department of Primary Industries, Victoria, viewed 5th December 2008, <<http://www.dpi.vic.gov.au/DPI/nrenfa.nsf/childdocs/-80E62E2EAB672EE24A256B520005A0AF-C5C1899E958127624A256B520005C2A1-9B5EB1BE2EA959E9CA2571BD00000C31?open>>
- Department of Sustainability and Environment 2007a. *Native Vegetation: Guide for assessment of Referred Planning Permit Applications*. Department of Sustainability and Environment, East Melbourne, Victoria.
- Department of Sustainability and Environment 2007b. *Ecological Vegetation Class Benchmarks by Bioregion*. www.dse.vic.gov.au/nativevegetation. Department of Sustainability and Environment, East Melbourne.
- Department of Sustainability and Environment 2007c, *Advisory List of Threatened Vertebrate Fauna in Victoria*. Department of Sustainability and Environment, Melbourne.
- Dirksen, S. Spaans, A.L., and Winden, v.d.J. 1998. Nocturnal collision risks with wind turbines in tidal and semi-offshore areas. In *Wind Energy and Landscape*. Proc. 2nd European and African Conference on Wind Engineering, 1997, 99–108.

- Du Guesclin, P. 2001. Action Statement No 119. Brolga *Grus rubicunda*. Department of Natural Resources and Environment, Victoria, Australia.
- Duncan, A., Baker, G. B. Montgomery, N. 1999. The Action Plan for Australian Bats. Environment Australia, Canberra.
- Duretto, M.F. 1999 Sapindaceae, In Walsh, N.G. & Entwisle, T.J. (eds) Flora of Victoria: Dicotyledons, Cornaceae to Asteraceae, V.4, Inkata Press, Melbourne, pp. 139-149.
- Emison, W.B., Beardsell, C.M., Norman, F.I., Loyn, R.H., & Bennett, S.C. 1987. *Atlas of Victorian Birds*. Department of Conservation, Forests and Lands & Royal Australasian Ornithologists Union, Melbourne.
- Entwisle, T.J. 1996 Thymelaeaceae, In Walsh, N.G. and Entwisle, T.J. (eds) Flora of Victoria: Dicotyledons: Winteraceae to Myrtaceae, V.3, Inkata Press, Melbourne, pp 912-930.
- Erickson, W.P., Johnson, G.D.; Strickland, M.D.; Young, D.P. Jr; Sernka, K.J., and Good, R.E. 2001. Avian collisions with wind turbines: a summary of existing studies and comparisons to other sources of avian collision mortality in the United States.' Resource Document of the National Wind Coordinating Committee, Washington.
- Garnett, S.T. and Crowley, G.M. 2000. The Action Plan for Australian Birds. Environment Australia, Canberra.
- Gerjets, D 2006 'Studie zur Verträglichkeit der Windkraftplanungen Schweringhausen/Wietinghausen'. mit den Erhaltungszielen des EU-Vogelschutzgebietes Diepholzer Moorniederung und desFFH-Gebietes Wietingsmoor.
- Goldstraw, P.W. and Du Guesclin, P.B. 1991. Bird Casualties from from the collisions with a 500kv transmission line in south-western Victoria, Australia. Proc. 1987. International Crane Workshop: 219-224.
- Hadden, S. 1995. 'Distribution, status and habitat requirements of the Striped Legless Lizard *Delma impar* (Fischer)'. Final report for Department of Conservation and Natural Resources (Vic.) to Australian Nature Conservation Agency, April 1995.
- Higgins, P.J. (ed) 1999. 'Handbook of Australian, New Zealand and Antarctic Birds, Volume 4: Parrots to Dollarbird', Oxford University Press, Melbourne.
- James, B.W., and Haak, B.A. 1979. Factors affecting avian flight behaviour and collision mortality at transmission lines. Prepared for Bonneville Power Administration, Portland, Oregon.
- Jeanes, J.A. 1996 Fabaceae, In Walsh, N.G. and Entwisle, T.J. (eds) Flora of Victoria: Dicotyledons: Winteraceae to Myrtaceae, V.3, Inkata Press, Melbourne, pp 663-829.
- Jeanes, J.A. 1999 Asteraceae, In Walsh, N.G. and Entwisle, T.J. (eds) Flora of Victoria: Dicotyledons, Cornaceae to Asteraceae, V.4, Inkata Press, Melbourne, pp 652-984.

- Kingsley, A., and Whittam, B. 2001. Potential Impacts of Wind Turbines on Birds at North Cape, Prince Edward Island. Bird Studies Canada, Atlantic Region, Sackville, Canada.
- Langeston, R.H.W., and Pullan, J.D. 2002. Wind farm and birds: An analysis of the effects of windfarms on birds and guidance on environmental assessment criteria and site selection issues. Report written by BirdLife on behalf of the Bern Convention.
- Marchant, S., and Higgins, P. J. (eds) 1993. Handbook of Australian, New Zealand & Antarctic Birds. Vol. 2. Oxford University Press, Melbourne.
- Meeks, E.R., Ribbands, J.B., Christer, W.G., Davt, P.R., and Higginsin, I. 1993. The effects of aerogenerators on moorland bird populations in the Orkney Islands, Scotland. Bird Study 40: 140–143.
- Meredith, C 2003. Australian Wind Energy Association presentation, Sydney, July 2003
- National Wind Coordinating Committee 2004. Wind Turbine Interactions with Birds and Bats: A summary of Research Results and Remaining Questions. National Wind Coordinating Committee.
- O'Dwyer, C. and Attiwill, P. M. 1999. A comparative study of habitats of the Golden Sun Moth *Synemon plana* Walker (Lepidoptera: Castniidae): implications for restoration. *Biological Conservation* **89**: 131-141.
- O'Dwyer, C., Hadden, S., and Arnold, A. 2000. Action Statement No 106 Golden Sun Moth *Synemon plana*. Action Statement prepared under section 19 of the *Flora and Fauna Guarantee Act 1988* under delegation from the Secretary, Department of Natural Resources and Environment, July 2000.
- Olsen, J., and Olsen, P. 1980. Alleviating the impact of human disturbance on the breeding Peregrine falcon II: Public and recreational lands. *Corella* 4: 54–57.
- Organ, A. 2002. 'Survey for the Warty Bell Frog *Litoria raniformis*, at the Western Treatment Plant, Werribee, Victoria'. Biosis Research, Port Melbourne.
- Percival, S.M. 1998. Birds and Wind Turbines: managing potential planning issues. Proc. Of the 20th British Wind Energy Association Conference, Univ. of Sutherland, UK.
- Percival, S.M. 2003. Birds and Windfarms in Ireland: A review of potential issues and impact assessment. Consultant Report, Durham, UK.
- Peterson, G. 2000. 'Distribution and Conservation Status of the Corangamite Water Skink (*Eulamprus tympanum marnieae*) on the Victorian Volcanic Plain', Final Report to the Research Advisory Group of the Grassy Ecosystem Reference Group, La Trobe University, Bundoora.
- Short, P.S. 1999 Leucochrysum, In Walsh. N.G. & Entwisle, T.J. (eds) *Flora of Victoria: Dicotyledons, Cornaceae to Asteraceae*, V.4, Inkata Press, Melbourne, pp. 789-793.
- Smith, W. and Robertson, P. 1999. National Recovery Plan for the Striped Legless Lizard (*Delma impar*) 1999-2003. Unpublished report to Environment Australia, Canberra.

- Strickland, D. 2004. Overview of Non-Collision Related Impacts from Wind Projects. In: American Wind Energy Association and American Bird Conservancy. Proc. Wind Energy and Birds/Bats Workshop. Washington, DC, May 18–19, 2004.
- Sustainable Energy Authority of Victoria 2003. 'Policy and Planning Guidelines for Wind Energy Developments in Victoria.' SEAV, Melbourne.
- Sutherland, W J; Newton, I; Green, R. 2004. 'Bird Ecology and Conservation: A Handbook of Techniques' Oxford University Press, Oxford.
- United States Department of Fish and Wildlife Services 2003. Interim Guidance on avoiding and minimizing wildlife impacts from wind turbines. Washington, DC, May 2003.
- Walsh, N.G. 1994 Poaceae, In Walsh, N.G. and Entwisle, T.J. (eds) Flora of Victoria: Ferns and Allied Plants, Conifers and Monocotyledons, V.2, Inkata Press, Melbourne, pp 356-627.
- Walsh, N.G. 1996 Amaranthaceae, In Walsh, N.G. & Entwisle, T.J. (eds) Flora of Victoria: Dicotyledons, Winteraceae to Myrtaceae, V.3, Inkata Press, Melbourne, pp. 199-215.
- Walsh, N.G. 1999a Senecio, In Walsh, N.G. and Entwisle, T.J. (eds) Flora of Victoria: Dicotyledons, Cornaceae to Asteraceae, V.4, Inkata Press, Melbourne, pp 941-965.
- Walsh, N.G. 1999b Polygalaceae, In Walsh, N.G. and Entwisle, T.J. (eds) Flora of Victoria: Dicotyledons, Cornaceae to Asteraceae, V.4, Inkata Press Melbourne, pp 131-137.
- Weber, J.Z. and Entwisle, T.J. 1994 Thelymitra, In Walsh, N.G. and Entwisle, T.J. (eds) Flora of Victoria: Ferns and Allied Plants, Conifers and Monocotyledons, V.2, Inkata Press, Melbourne, pp 840-854.
- Webster, A., Fallu, R. and Preece, K. (1992), 'Flora and Fauna Guarantee Act Action statement No. 17: Striped Legless Lizard *Delma impar*', Department of Conservation and Environment, East Melbourne.
- Wilson, K.L. 1994 Cyperaceae, In Walsh, N.G. and Entwisle, T.J. (eds) Flora of Victoria: Ferns and Allied Plants, Conifers and Monocotyledons, V.2, Inkata Press, Melbourne, pp 238-356.

Appendix 1: Plant species recorded in the Berrybank study area

Origin	Common Name	Scientific Name	Family Name	Conservation Status			Recorded
				FFG	EPBC	DSE	
	Tall Sundew	<i>Drosera peltata subs. Peltata</i>	Droseraceae				X
*	African Box-thorn	<i>Lycium ferocissimum</i>	Solanaceae				X
	Australian Sweet-grass	<i>Glyceria australis</i>	Poaceae				X
	Black-anther Flax-lily	<i>Dianella revoluta s.l.</i>	Phormiaceae				X
	Blackwood	<i>Acacia melanoxylon</i>	Mimosaceae				X
	Blue Devil	<i>Eryngium ovinum</i>	Apiaceae				X
*	Cat's Ear	<i>Hypochoeris radicata</i>	Asteraceae				X
*	Clover	<i>Trifolium sp.</i>	Fabaceae				X
	Cock's Foot	<i>Dactylis glomeratus</i>	Poaceae				X
	Common Everlasting	<i>Chrysocephalum apiculatum</i>	Asteraceae				X
	Common Reed	<i>Phragmites australis</i>	Poaceae				X
	Common Spike-sedge	<i>Eleocharis acuta</i>	Cyperaceae				X
	Common Tussock-grass	<i>Poa labillardierei</i>	Poaceae				X
	Common Woodruff	<i>Asperula conferta</i>	Rubiaceae				X
	Cranesbill	<i>Geranium sp.</i>	Geraniaceae				X
	Kangaroo Grass	<i>Themeda triandra</i>	Poaceae				X
	Large Quaking-grass	<i>Briza maxima</i>	Poaceae				X
	Lemon Beauty-heads	<i>Calocephalus citreus</i>	Asteraceae				X
*	Oat	<i>Avena spp.</i>	Poaceae				X
*	Radiata Pine	<i>Pinus radiata</i>	Pinaceae				X
	Scaly Buttons	<i>Leptorhynchus squamatus</i>	Asteraceae				X

Origin	Common Name	Scientific Name	Family Name	Conservation Status			Recorded
				FFG	EPBC	DSE	
	Sheep's Burr	<i>Acaena echinata</i>	Rosaceae				X
	Small Spike-sedge	<i>Eleocharis pusilla</i>	Cyperaceae				X
	Spear Grass	<i>Austrostipa spp.</i>	Poaceae				X
	Spiny Rice-flower	<i>Pimelea spinescens subsp. spinescens</i>	Thymelaeaceae	f	C	e	X
*	Sugar Gum	<i>Eucalyptus cladocalyx</i>	Myrtaceae				X
	Tall Spike-sedge	<i>Eleocharis sphacelata</i>	Cyperaceae				X
*	Toowoomba Canary-grass	<i>Phalaris aquatica</i>	Poaceae				X
	Vanilla Lily	<i>Arthropodium milleflorum</i>	Anthericaceae				X
	Wallaby Grass	<i>Austrodanthonia spp.</i>	Poaceae				X
	Water Ribbons	<i>Triglochin procera s.l.</i>	Juncaginaceae				X
*	Willow	<i>Salix sp.</i>	Salicaceae				X
	Windmill Grass	<i>Chloris truncata</i>	Poaceae				X
	Wood Sorrel	<i>Oxalis spp.</i>	Oxalidaceae				X
*	Yorkshire Fog	<i>Holcus lanatus</i>	Poaceae				X

* = introduced species; # = native species occurring outside of natural range; **FFG (f)** = Listed as threatened under FFG Act; **EPBC** = Status under EPBC Act; **DSE** = Status in DSE Advisory List; **C** = critically endangered; **E, e** = endangered; **V, v** = vulnerable; **R, r** = rare; **k** = insufficiently known

Appendix 2: Fauna species that occur or are likely to occur in the Berrybank study area.

Origin	Common Name	Scientific Name	Conservation status			Recorded
			EPBC	DSE	FFG	
Birds						
	Australasian Grebe	<i>Tachybaptus novaehollandiae</i>				
	Australasian Shoveler	<i>Anas rhynchotis</i>		VU		
	Australian Hobby	<i>Falco longipennis</i>				X
	Australian Magpie	<i>Gymnorhina tibicen</i>				X
	Australian Pelican	<i>Pelecanus conspicillatus</i>				
	Australian Raven	<i>Corvus coronoides</i>				
	Australian Shelduck	<i>Tadorna tadornoides</i>				
	Australian White Ibis	<i>Threskiornis molucca</i>				
	Australian Wood Duck	<i>Chenonetta jubata</i>				X
	Banded Lapwing	<i>Vanellus tricolor</i>				X
	Barn Owl	<i>Tyto alba</i>				
	Black Swan	<i>Cygnus atratus</i>				
	Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>				
	Black-fronted Dotterel	<i>Euseyornis melanops</i>				
	Black-shouldered Kite	<i>Elanus axillaris</i>				
	Black-tailed Native-hen	<i>Gallinula ventralis</i>				
	Black-winged Stilt	<i>Himantopus himantopus</i>				
	Blue-winged Parrot	<i>Neophema chrysostoma</i>				X
	Brolga	<i>Grus rubicunda</i>		VU	L	
	Brown Falcon	<i>Falco berigora</i>				X
	Brown Goshawk	<i>Accipiter fasciatus</i>				X

Origin	Common Name	Scientific Name	Conservation status			Recorded
			EPBC	DSE	FFG	
	Brown Songlark	<i>Cincloramphus cruralis</i>				X
	Cape Barren Goose	<i>Cereopsis novaehollandiae</i>		NT		
	Cattle Egret	<i>Ardea ibis</i>				
	Chestnut Teal	<i>Anas castanea</i>				
	Clamorous Reed Warbler	<i>Acrocephalus stentoreus</i>				
*	Common Blackbird	<i>Turdus merula</i>				X
	Common Greenshank	<i>Tringa nebularia</i>				
*	Common Starling	<i>Sturnus vulgaris</i>				X
	Curlew Sandpiper	<i>Calidris ferruginea</i>				
	Dusky Moorhen	<i>Gallinula tenebrosa</i>				
	Dusky Woodswallow	<i>Artamus cyanopterus</i>				
	Eastern Rosella	<i>Platycercus eximius</i>				X
	Eurasian Coot	<i>Fulica atra</i>				
*	European Goldfinch	<i>Carduelis carduelis</i>				X
*	European Greenfinch	<i>Carduelis chloris</i>				X
	Fairy Martin	<i>Hirundo ariel</i>				
	Flame Robin	<i>Petroica phoenicea</i>				
	Galah	<i>Cacatua roseicapilla</i>				X
	Glossy Ibis	<i>Plegadis falcinellus</i>		NT		
	Golden Whistler	<i>Pachycephala pectoralis</i>				
	Golden-headed Cisticola	<i>Cisticola exilis</i>				
	Great Cormorant	<i>Phalacrocorax carbo</i>				
	Great Egret	<i>Ardea alba</i>		VU	L	
	Grey Currawong	<i>Strepera versicolor</i>				

Origin	Common Name	Scientific Name	Conservation status			Recorded
			EPBC	DSE	FFG	
	Grey Fantail	<i>Rhipidura fuliginosa</i>				
	Grey Shrike-thrush	<i>Colluricincla harmonica</i>				
	Grey Teal	<i>Anas gracilis</i>				X
	Gull-billed Tern	<i>Sterna nilotica</i>		EN	L	
	Hardhead	<i>Aythya australis</i>		VU		
	Hoary-headed Grebe	<i>Poliiocephalus poliocephalus</i>				
	Horsfield's Bronze-Cuckoo	<i>Chrysococcyx basalis</i>				
*	House Sparrow	<i>Passer domesticus</i>				X
	Latham's Snipe	<i>Gallinago hardwickii</i>		NT		
	Laughing Kookaburra	<i>Dacelo novaeguineae</i>				
	Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>				
	Little Grassbird	<i>Megalurus gramineus</i>				
	Little Pied Cormorant	<i>Phalacrocorax melanoleucos</i>				
	Little Raven	<i>Corvus mellori</i>				X
	Long-billed Corella	<i>Cacatua tenuirostris</i>				X
	Magpie-lark	<i>Grallina cyanoleuca</i>				X
	Masked Lapwing	<i>Vanellus miles</i>				X
	Nankeen Kestrel	<i>Falco cenchroides</i>				
	Noisy Miner	<i>Manorina melanocephala</i>				X
	Pacific Black Duck	<i>Anas superciliosa</i>				X
	Pallid Cuckoo	<i>Cuculus pallidus</i>				
	Pink-eared Duck	<i>Malacorhynchus membranaceus</i>				
	Purple Swamphen	<i>Porphyrio porphyrio</i>				
	Purple-crowned Lorikeet	<i>Glossopsitta porphyrocephala</i>				

Origin	Common Name	Scientific Name	Conservation status			Recorded
			EPBC	DSE	FFG	
	Red Wattlebird	<i>Anthochaera carunculata</i>				X
	Red-kneed Dotterel	<i>Erythronyctes alpinus</i>				
	Red-necked Stint	<i>Calidris ruficollis</i>				
	Red-rumped Parrot	<i>Psephotus haematonotus</i>				X
	Restless Flycatcher	<i>Myiagra inquieta</i>				
	Richard's Pipit	<i>Anthus novaeseelandiae</i>				X
	Sharp-tailed Sandpiper	<i>Calidris acuminata</i>				
	Silver Gull	<i>Larus novaehollandiae</i>				
*	Skylark	<i>Alauda arvensis</i>				X
	Straw-necked Ibis	<i>Threskiornis spinicollis</i>				X
	Striated Pardalote	<i>Pardalotus striatus</i>				
	Sulphur-crested Cockatoo	<i>Cacatua galerita</i>				
	Swamp Harrier	<i>Circus approximans</i>				
	Tawny Frogmouth	<i>Podargus strigoides</i>				
	Tree Martin	<i>Hirundo nigricans</i>				
	Wedge-tailed Eagle	<i>Aquila audax</i>				
	Welcome Swallow	<i>Hirundo neoxena</i>				X
	Whiskered Tern	<i>Chlidonias hybridus</i>		NT		
	Whistling Kite	<i>Haliastur sphenurus</i>				
	White-faced Heron	<i>Egretta novaehollandiae</i>				X
	White-fronted Chat	<i>Epthianura albifrons</i>				X
	White-necked Heron	<i>Ardea pacifica</i>				X
	White-plumed Honeyeater	<i>Lichenostomus penicillatus</i>				X
	Willie Wagtail	<i>Rhipidura leucophrys</i>				X

Origin	Common Name	Scientific Name	Conservation status			Recorded
			EPBC	DSE	FFG	
	Yellow-billed Spoonbill	<i>Platalea flavipes</i>				
	Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>				
Mammals						
*	Brown Hare	<i>Lepus capensis</i>				
*	Cat (feral)	<i>Felis catus</i>				
	Common Brushtail Possum	<i>Trichosurus vulpecula</i>				
	Eastern Grey Kangaroo	<i>Macropus giganteus</i>				
*	European Rabbit	<i>Oryctolagus cuniculus</i>				X
	Koala	<i>Phascolarctos cinereus</i>				
	Lesser Long-eared Bat	<i>Nyctophilus geoffroyi</i>				
*	Red Fox	<i>Canis vulpes</i>				
	Short-beaked Echidna	<i>Tachyglossus aculeatus</i>				
	Water Rat	<i>Hydromys chrysogaster</i>				
Reptiles						
	Blotched Blue-tongued Lizard	<i>Tiliqua nigrolutea</i>				
	Common Blue-tongued Lizard	<i>Tiliqua scincoides</i>				
	Eastern Brown Snake	<i>Pseudonaja textilis</i>				
	Lowland Copperhead	<i>Austrelaps superbus</i>				
	Striped Legless Lizard	<i>Delma impar</i>	VU	EN	L	
	unidentified grass skink	<i>Pseudemoia sp.</i>				
Frogs						
	Common Froglet	<i>Crinia signifera</i>				X
	Common Spadefoot Toad	<i>Neobatrachus sudelli</i>				
	Growling Grass Frog	<i>Litoria raniformis</i>	VU	EN	L	

Origin	Common Name	Scientific Name	Conservation status			Recorded
			EPBC	DSE	FFG	
	Southern Brown Tree Frog	<i>Litoria ewingii</i>				
	Southern Bullfrog	<i>Limnodynastes dumerilii</i>				
	Spotted Marsh Frog	<i>Limnodynastes tasmaniensis</i>				X
Other fauna						
	Golden Sun Moth	<i>Synemon plana</i>	CR	EN	L	

Notes:

- EPBC – Status under EPBC Act
- TSC – Listed under TSC Act
- DSE – Status from DSE (2007)
- FFG – Listed under FFG Act
- * - Introduced species
- X – Recorded in the study area
- EN – Endangered
- VU – Vulnerable
- NT – Lower risk near threatened
- DD – Insufficiently known but presumed to be threatened
- L – Listed as threatened under FFG Act.