



# Mortons Lane Wind Farm Operational Brolga and Bat Monitoring - 2013

FINAL REPORT

Prepared for Mortons Lane Wind Farm Pty Ltd

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## Summary

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Biosis Pty Ltd was commissioned by Mortons Lane Wind Farm Pty Ltd to undertake Brolga utilisation monitoring and Bat utilisation monitoring at the Morton's Lane Wind Farm (MLWF) in south-west Victoria. The MLWF is located on the Victorian Volcanic Plain, approximately 20 km east of Penshurst.

Brolga utilisation was monitored at six points within the MLWF and two reference sites outside the wind farm. Surveys were conducted in mid to late November 2013.

One sub-adult, non-breeding Brolga was observed using the site on several occasions. Fifty-five other native bird species and five introduced bird species were also recorded within the MLWF during the surveys.

Micro-bat activity was monitored using ultrasonic detectors in mid December 2013. Detectors were installed at four turbine locations, with one detector placed on the ground (1 m high) and one mounted on the turbine nacelle.

At least eight bat species were recorded during the bat call survey, only one of which (Gould's Wattled Bat) was recorded by a turbine-mounted detector. No significant species were recorded.

Activity levels were highest during warm conditions. Activity levels were generally higher at ground level, and both ground and turbine-mounted detectors recorded ultrasonic noise from non-bat sources. Although very few shrubs and trees are present within the site, revegetated shelter-belts provide foraging habitat for several bat species which are unlikely to be present in completely cleared areas.

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# 1 Introduction

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## 1.1 Project background

The 13 turbine Mortons Lane Wind Farm (MLWF) located near Woodhouse in south-western Victoria, commenced operation in January 2013. The Bird and Avifauna Management Plan (BAM Plan) (SKM 2011) specifies the monitoring and reporting requirements.

Biosis Pty Ltd was commissioned by Mortons Lane Wind Farm Pty Ltd to undertake the 2013 bird and bat monitoring at MLWF, as specified in the BAM plan. This report presents the results of bird utilisation monitoring in November 2013 and ultrasonic bat monitoring in December 2013.

## 1.2 Scope of assessment

The objectives of this investigation are to:

- Undertake spring Brolga utilisation monitoring
- Undertake December bat utilisation monitoring
- Produce the 2013 annual Brolga and bat monitoring report

## 1.3 Previous studies

Pre-construction bird and bat utilisation studies were conducted at MLWF in 2006 by Biosis (formerly Biosis Research):

- Biosis Research (2006a). Bat Activity Report for the Proposed Morton's Lane Wind Farm, South West Victoria. Report prepared for NewEn Australia, July 2006.
- Biosis Research (2006b). Bird Utilisation Studies at the Proposed Morton's Lane Wind Farm, South West Victoria. Report prepared for NewEn Australia, July 2006.

Biosis also conducted the preliminary flora and fauna assessment of the proposed MLWF (Biosis Research 2005), and undertook a regional survey of Brolga utilisation in the area surrounding MLWF and the proposed Salt Creek Wind farm (Biosis Research 2006c).

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## 2 Methods

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### 2.1 Brolga utilisation survey

The BAM plan specifies a program of monitoring Brolga utilisation, based on the methods applied by Biosis Research (2006b). Although Brolga is the primary species of interest, observations of all bird species were noted and are presented in this report.

#### 2.1.1 Monitoring points

Monitoring was conducted at the same six point locations monitored in the pre-construction surveys (Biosis Research 2006) (Figure 2). Two reference points (RFN and RFS) were also established for the current surveys, as required by the BAM plan. The coordinates of the points are presented in Table 1.

#### 2.1.2 Methods

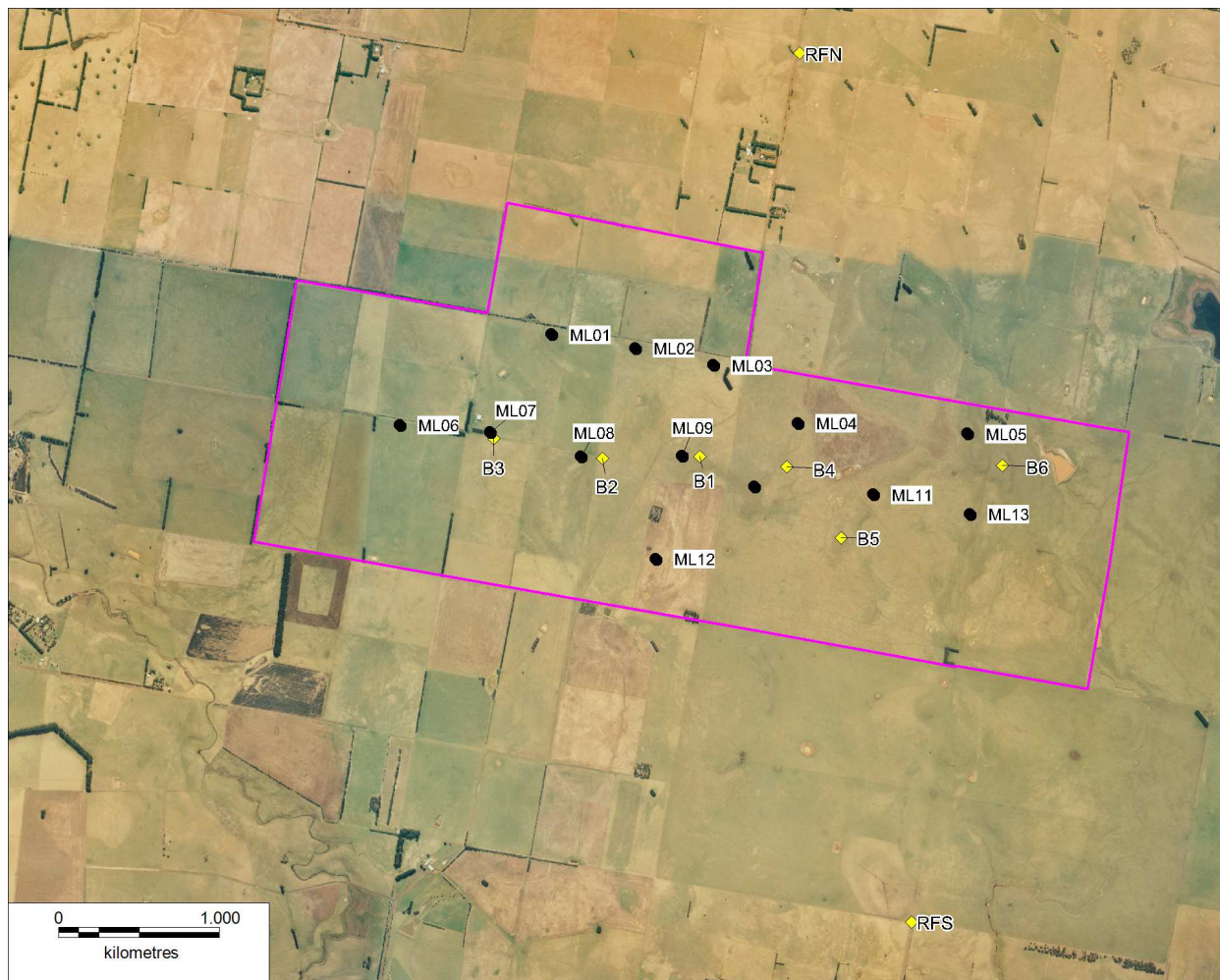
Point count surveys were conducted at the eight monitoring points. Each point was monitored by one stationary observer for a period of 20 minutes. Within this period, the following information was recorded:

- Start time and date
- Weather conditions
- For Brolga, the number of individual birds, height of observation, distance from the observer and behaviour.
- For all other species, the number of individual birds observed.

A copy of the datasheet, which details the classification systems used for weather conditions and bird behaviour is provided in Appendix 1.

**Table 1: Bird utilisation monitoring points**

Point code	Location description	Easting (MGA94)	Northing (MGA94)
<b>RFN</b>	Northern reference site - Mortan's Lane	629399	5813413
<b>RFS</b>	Southern reference site - Estate Road	630030	5807555
<b>B1</b>	Near turbine ML09	628657	5810734
<b>B2</b>	Near turbine ML08	628054	5810721
<b>B3</b>	Near turbine ML07	627378	5810845
<b>B4</b>	Near turbine ML04	629199	5810667
<b>B5</b>	Near turbine ML12	629537	5810229
<b>B6</b>	Near turbine ML05	630541	5810677



**Figure 1: Location of Brolga monitoring points, Morton's Lane Wind Farm, Victoria**



### 2.1.3 Timing and survey intensity

Surveys were conducted over two periods:

- 11/11/2013 – 14/11/2013; and
- 28/11/2013 – 29/11/2013.

The number of surveys conducted at each survey point is summarised in Table 2.

**Table 2: Bird utilisation monitoring points**

Point code	Number of morning surveys	Number of afternoon surveys	Total number of surveys
<b>RFN</b>	4	3	7
<b>RFS</b>	2	3	5
<b>B1</b>	6	10	16
<b>B2</b>	8	7	15
<b>B3</b>	7	8	15
<b>B4</b>	5	11	16
<b>B5</b>	6	10	16
<b>B6</b>	7	10	17
<b>Total</b>	<b>45</b>	<b>62</b>	<b>107</b>

In relation to survey intensity and timing, the BAM Plan specifies that:

*Two observers are to visit each of the eight points separately and carry out a survey twice on a single day. Surveys are to be completed at dawn and late afternoon prior to sunset. Surveys are to be repeated over four days during April (Flocking Season) and four days during October (Breeding Season).*

Our interpretation of this is that each observer should conduct 16 surveys each day over four days, resulting in a total of 128 surveys (16 surveys at each site). In practice, it was not possible for each observer to complete 16 surveys each day for four consecutive days. Additional surveys were conducted by a single observer on the 28<sup>th</sup> and 29<sup>th</sup> November, but the total number of surveys conducted at four sites still fell short of the target. The reference sites, in particular, were time consuming to access, and a decision was made to focus effort on the points within the wind farm to get as close to the target as possible.

Additionally, it was decided not to continue surveys into December, due to the low level of Brolga activity observed during the November surveys. Recommendations for improving the efficiency of the Brolga utilisation surveys are provided in Section 4.

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## 2.2 Bat survey

### 2.2.1 Methods

Microbats were surveyed using ultrasonic detectors. Four detection sites were used, with one detector placed approximately 1 m above the ground and one detector placed on the turbine (82 m) at each location. Turbines were selected to ensure a spread of monitoring points across the site.

Ground detectors were mounted on fence posts, as close as possible to the base of the turbine (Plate 1).



Plate 1. SM2 detector mounted on a fence post.

Turbine height detectors were mounted by Goldwind technicians on the galvanized steel mesh platform on the turbine nacelle (Plate 2). The microphone was aimed to the rear of the turbine.

Detectors were powered using internal D-cell batteries and calls were recorded onto 16GB SD cards. Detectors were configured to record in zero-crossing (ZC) format between 20:00 (8 pm) and 07:00 (7 am) (Table 3).

**Table 3: SM2 configuration settings**

Setting	Value
Sample rate	192000
Channels	Mono-L
File Format	ZC
Division Ratio	16
Location Prefix	MLWF
Start time	07:00
Stop time	20:00



Plate 2. SM2 ultrasonic bat detector mounted on the galvanised mesh platform located on the nacelle of the Goldwind turbines.

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### 2.2.2 Monitoring points and survey timing

Turbines ML02, ML05, ML06 and ML10 were selected for monitoring (Table 4, Figure 2). All ground detectors and the detector mounted on ML05 were deployed on 16/12/2013. The remaining three turbine mounted detectors were deployed the following day.

**Table 4: Locations and timing of ultrasonic bat monitoring**

Turbine	Detector	Date deployed	Date collected	Number of monitoring nights
ML02	Ground	16/12/2013	23/12/2013	7
	Turbine	17/12/2013	23/12/2013	6
ML05	Ground	16/12/2013	23/12/2013	7
	Turbine	16/12/2013	23/12/2013	7
ML06	Ground	16/12/2013	23/12/2013	7
	Turbine	17/12/2013	23/12/2013	6
ML10	Ground	16/12/2013	23/12/2013	7
	Turbine	17/12/2013	23/12/2013	6
Total				45

### 2.2.3 Call identification and analysis

Bat calls were analysed using the automated identification software AnaScheme, developed by the author and widely used in the automated analysis of microbat vocalisations within Victoria. The system allows for development of identification keys based on analysis of reference calls. The key used to analyse bat calls for this project was developed and tested by Lindy Lumsden and Peter Griffioen of Arthur Rylah Institute, Department of Environment and Primary Industries (Key to bats of south-west Victoria, dated 20 June 2011).

The AnaScheme system applies a conservative approach to identifying calls in that only clear, high quality calls are assigned to a species. The system also counts recordings which match the criteria to be considered true bat calls, but may be of insufficient quality to identify to species level. This allows a measure of overall bat activity to be calculated.

Any calls identified by the system as significant or uncommon species are checked manually, by visual comparison with published reference calls by an experienced bat expert, to ensure accurate results.



## 3 Results

### 3.1 Bird utilisation survey

Sixty-one species were recorded within the wind farm during the surveys, five of which were introduced species (Table 5). The most abundant species were the introduced Eurasian Skylark and Common Starling, and the native Australian Raven and Australia Magpie.

Twenty-four of the species recorded are wetland dependent species. Most of these were recorded in the permanent wetland near point 6 or the seasonal wetland near point 4, but many were also recorded flying through the site, particularly the Ibis and Cormorant species.

**Table 5: Bird species recorded**

Family	Common Name	Scientific Name	Status
Acanthizidae	Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>	Native
Acanthizidae	Brown Thornbill	<i>Acanthiza pusilla</i>	Native
Acanthizidae	Striated Fieldwren	<i>Calamanthus fuliginosus</i>	Native
Accipitridae	Brown Goshawk	<i>Accipiter fasciatus</i>	Native
Accipitridae	Wedge-tailed Eagle	<i>Aquila audax</i>	Native
Accipitridae	Swamp Harrier	<i>Circus approximans</i>	Native
Accipitridae	Black-shouldered Kite	<i>Elanus axillaris</i>	Native
Accipitridae	Little Eagle	<i>Hieraaetus morphnoides</i>	Native
Alaudidae	Eurasian Skylark	<i>Alauda arvensis</i>	Native
Anatidae	Grey Teal	<i>Anas gracilis</i>	Native
Anatidae	Pacific Black Duck	<i>Anas superciliosa</i>	Native
Anatidae	Hardhead	<i>Aythya australis</i>	Native – vulnerable (DEPI Advisory List)
Anatidae	Australian Wood Duck	<i>Chenonetta jubata</i>	Native
Anatidae	Black Swan	<i>Cygnus atratus</i>	Native
Anatidae	Pink-eared Duck	<i>Malacorhynchus membranaceus</i>	Native
Anatidae	Australian Shelduck	<i>Tadorna tadornoides</i>	Native
Ardeidae	White-necked Heron	<i>Ardea pacifica</i>	Native
Ardeidae	White-faced Heron	<i>Egretta novaehollandiae</i>	Native
Artamidae	Australian Magpie	<i>Cracticus tibicen</i>	Native
Cacatuidae	Long-billed Corella	<i>Cacatua tenuirostris</i>	Native
Cacatuidae	Yellow-tailed Black-cockatoo	<i>Calyptorhynchus funereus</i>	Native
Cacatuidae	Galah	<i>Eolophus roseicapillus</i>	Native
Charadriidae	Masked Lapwing	<i>Vanellus miles</i>	Native
Corvidae	Australian Raven	<i>Corvus coronoides</i>	Native
Falconidae	Brown Falcon	<i>Falco berigora</i>	Native
Falconidae	Nankeen Kestrel	<i>Falco cenchroides</i>	Native
Fringillidae	European Goldfinch	<i>Carduelis carduelis</i>	Introduced

Family	Common Name	Scientific Name	Status
Fringillidae	Common Greenfinch	<i>Carduelis chloris</i>	Introduced
Gruidae	Brolga	<i>Grus rubicunda</i>	Native
Hirundinidae	Welcome Swallow	<i>Hirundo neoxena</i>	Native
Hirundinidae	Fairy Martin	<i>Petrochelidon ariel</i>	Native
Laridae	Silver Gull	<i>Chroicocephalus novaehollandiae</i>	Native
Maluridae	Superb Fairy-wren	<i>Malurus cyaneus</i>	Native
Megaluridae	Brown Songlark	<i>Cinclorhamphus cruralis</i>	Native
Meliphagidae	Red Wattlebird	<i>Anthochaera carunculata</i>	Native
Meliphagidae	White-fronted Chat	<i>Epthianura albifrons</i>	Native
Meliphagidae	New Holland Honeyeater	<i>Phylidonyris novaehollandiae</i>	Native
Monarchidae	Magpie-lark	<i>Grallina cyanoleuca</i>	Native
Monarchidae	Restless Flycatcher	<i>Myiagra inquieta</i>	Native
Motacilidae	Australasian Pipit	<i>Anthus novaeseelandiae</i>	Native
Muscicapidae	Common Blackbird	<i>Turdus merula</i>	Introduced
Pachycephalidae	Grey Shrike-thrush	<i>Colluricincla harmonica</i>	Native
Pachycephalidae	Crested Pidgeon	<i>Oreoica gutturalis</i>	Native
Passeridae	House Sparrow	<i>Passer domesticus</i>	Introduced
Phalacrocoracidae	Great Cormorant	<i>Phalacrocorax carbo</i>	Native
Phalacrocoracidae	Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>	Native
Phalacrocoracidae	Pied Cormorant	<i>Phalacrocorax varius</i>	Native
Phasianidae	Stubble Quail	<i>Coturnix pectoralis</i>	Native
Podicipedidae	Hoary-headed Grebe	<i>Poliocephalus poliocephalus</i>	Native
Podicipedidae	Australasian Grebe	<i>Tachybaptus novaehollandiae</i>	Native
Rallidae	Eurasian Coot	<i>Fulica atra</i>	Native
Rallidae	Purple Swamphen	<i>Porphyrio porphyrio</i>	Native
Recurvirostridae	Black-winged Stilt	<i>Himantopus himantopus</i>	Native
Rhipiduridae	Grey Fantail	<i>Rhipidura albiscapa</i>	Native
Rhipiduridae	Willie Wagtail	<i>Rhipidura leucophrys</i>	Native
Scolopacidae	Latham's Snipe	<i>Gallinago hardwickii</i>	Native – Migratory species (EPBC Act)
Sturnidae	Common Starling	<i>Sturnus vulgaris</i>	Introduced
Threskiornithidae	Yellow-billed Spoonbill	<i>Platalea flavipes</i>	Native
Threskiornithidae	Australian White Ibis	<i>Threskiornis molucca</i>	Native
Threskiornithidae	Straw-necked Ibis	<i>Threskiornis spinicollis</i>	Native
Timaliidae	Silvereye	<i>Zosterops lateralis</i>	Native

Open country and generalist species were most abundant within the site, but there were also some records of woodland-dependent species at points near planted shrubs and trees, including Grey Shrike-thrush, Red Wattlebird, Superb Fairy-wren, Silvereye, Brown Thornbill, Grey Fantail, New Holland Honeyeater and Restless Flycatcher.

### 3.1.1 Significant species

Three significant species were recorded:

- **Brolga** is considered vulnerable within Victoria (DSE 2013) and is listed under the *Flora and Fauna Guarantee Act 1988*. Observations of Brolga within the site are described in section 3.1.2.
- **Hardhead** is considered vulnerable within Victoria (DSE 2013). This duck species was observed from point 6 during nine of the counts conducted at that point. All observations were of birds on the permanent wetland to the east of point 6. No flights were observed.
- **Latham's Snipe** is an international migratory wetland dependent species which is protected under the *Environment Protection and Biodiversity Conservation Act 1999*. This species was observed once near point 4 and once near point 6.

### 3.1.2 Brolga

One individual sub-adult Brolga was observed within the wind farm on four of the first five days of survey. The bird was observed on 11-13 November and then again on 15 November. It was not recorded during the second survey period (28-29 November).

Most records of this bird were in the Tussock Grass wetland to the north-east of turbine ML04. It was observed flying during one point count, when it flew a short distance (approximately 200 m), at a height of 5 m above ground level, and landed on the north side of the fence, outside of the wind farm. During the other seven point counts when this bird was observed, it was either sitting on the ground or walking around foraging.

As this was a sub-adult, and the wetland was dry at the time of survey, it is not likely that the bird was attempting to breed within the wind farm. No other evidence of recent breeding activity, such as an abandoned nest, was observed in the area.

**Table 6: Brolga records**

Point	Date	Time	Behaviour	Flight observed
B4	11/11/2013	16:04:00	Foraging among tussock grass, near drainage line	-
B4	12/11/2013	13:30:00	Foraging near northern boundary fence	-
B5	12/11/2013	14:39:00	Flew north over wind farm boundary fence	200 m horizontal distance at 5m above ground level.
B4	12/11/2013	17:14:00	Sitting in dry wetland	-
B5	13/11/2013	11:27:00	Foraging among tussock grass, near drainage line	-
B4	13/11/2013	11:57:00	Foraging among tussock grass, near drainage line	-
B4	13/11/2013	15:46:00	Sitting in dry wetland	-
B4	15/11/2013	10:42:00	Sitting in dry wetland	-

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### 3.1.3 Raptors

Six raptor (bird of prey) species were recorded during the surveys. Listed in decreasing order of abundance, these were:

- **Brown Falcons** were recorded on 13 occasions throughout the wind farm. Birds were observed flying at a range of heights, up to approximately 50 m, and perching either on the ground or on power lines.
- The **Nankeen Kestrel** was relatively common within the area, typically observed flying up to 50 m in height.
- The **Swamp Harrier** was recorded during six point counts, typically flying low (< 20 m above the ground) over wetlands or crops and pasture near wetlands.
- The **Wedge-tailed Eagle** was recorded during four point counts, flying at a range of heights between ground level and approximately 100 m above the ground.
- The **Black-shouldered Kite** was recorded during two point counts, hovering between 10 and 50 m above the ground.
- One **Brown Goshawk** was observed on the ground near point 1.
- A Little Eagle was recorded near point 4 during one point count, flying at a height of approximately 20 m.

### 3.2 Bat survey

Six bat species were identified to species level during the ultrasonic survey:

- **Gould's Wattled Bat** *Chalinolobus gouldii*
- **Chocolate Wattled Bat** *Chalinolobus morio*
- **White-striped Freetail Bat** *Tadarida australis*
- **Large Forest Bat** *Vespadelus darlingtoni*
- **Southern Forest Bat** *Vespadelus regulus*
- **Little Forest Bat** *Vespadelus vulturnus*

Two other groups of bats could only be identified to genus (group) level, due to overlapping call characteristics:

- **Freetail Bats** *Mormopterus* sp.  
Calls recorded during this study are most likely to be calls of the Southern Freetail Bat *Mormopterus* sp. 4 (undescribed) (Churchill 2008).
- **Long-eared Bats** *Nyctophilus* sp.  
Ultrasonic calls of the three Victorian Long-eared Bat species cannot be reliably distinguished. Most or all of the calls recorded at Morton's Lane are likely to be from the Lesser Long-eared Bat *Nyctophilus geoffroyi*. Gould's Long-eared Bat *Nyctophilus gouldi* may also be present but this species is less likely to inhabit open habitats. The threatened Greater Long-eared Bat *Nyctophilus corbeni* is limited to north-west Victoria.

The number of recordings of these species and species groups is shown in Table 7, which lists the numbers of calls recorded each night by each detector. A large number of poor-quality calls could



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not be identified to species or species group level. These recordings are clearly bat calls, but are of insufficient duration or quality to allow confident identification.

Minimum and maximum daily temperatures for the survey period from the Hamilton monitoring station are presented in Table 8.

**Table 7: Bat survey results**

Turbine	Detector location	Species	16/12	17/12	18/12	19/12	20/12	21/12	22/12	Total calls
ML02	Ground	<i>Chalinolobus gouldii</i>		2					1	3
		<i>Chalinolobus morio</i>	1	1	2	1				5
		<i>Mormopterus</i> sp.			2	3	1	4	1	11
		<i>Nyctophilus</i> sp.				2				2
		<i>Tadarida australis</i>		1		2		4		7
		<i>Vespadelus darlingtoni</i>		2	4	3		2		11
		<i>Vespadelus regulus</i>		1	5	2		2		10
		<i>Vespadelus vulturnus</i>			1	2				3
		Unident. (poor qual.)	2	2	10	5	3	4	1	27
	Turbine	Unident. (poor qual.)			9		4	3	4	20
ML05	Ground	<i>Chalinolobus gouldii</i>			1	1				2
		<i>Chalinolobus morio</i>						1		1
		<i>Nyctophilus</i> sp.			2	2				4
		<i>Vespadelus darlingtoni</i>	1							1
		<i>Vespadelus regulus</i>						2		2
		<i>Vespadelus vulturnus</i>			2		1	1		4
		Unident. (poor qual.)			10		3	7		20
	Turbine	<i>Chalinolobus gouldii</i>				2				2
		Unident. (poor qual.)				1		1		2
ML06	Ground	<i>Chalinolobus gouldii</i>		1	6					7
		<i>Chalinolobus morio</i>			11	1				12
		<i>Mormopterus</i> sp.			4					4
		<i>Nyctophilus</i> sp.		1	5	1				7
		<i>Tadarida australis</i>				7				7
		<i>Vespadelus darlingtoni</i>		1	24	6				31
		<i>Vespadelus regulus</i>	2	5	25	2				34
		<i>Vespadelus vulturnus</i>			3					3
		Unident. (poor qual.)	4	8	35	62				109
	Turbine	<i>Chalinolobus gouldii</i>							1	1
		Unident. (poor qual.)			7					7
ML10	Ground	<i>Chalinolobus morio</i>			2					2
		<i>Vespadelus darlingtoni</i>			2			1		3
		<i>Vespadelus vulturnus</i>		1	1	2				4
		Unident. (poor qual.)		3	4	7	1	1	1	17
		<i>Mormopterus</i> sp.			1					1
	Turbine	Unident. (poor qual.)		1	3					4

**Table 8: Daily minimum and maximum temperatures for Hamilton, Victoria**

Date	Minimum (°C)	Maximum (°C)
16/12/2013	9.5	23.1
17/12/2013	10.0	26.1
18/12/2013	9.3	33.7
19/12/2013	16.1	39.2
20/12/2013	13.0	23.9
21/12/2013	11.2	20.5
22/12/2013	11.5	26.9
23/12/2013	10.4	18.1

### 3.2.1 Bat activity

Activity levels (number of recordings) was greatest on the nights of the 18<sup>th</sup> and 19<sup>th</sup> December, corresponding with the nights following the two warmest days during the survey period (Table 8). These nights also had the highest overnight minimum temperatures of 16.1°C and 13.0°C respectively. Large numbers of noise (non-bat) calls were also recorded on these nights, which are likely to be due to insect noise.

Bat calls were recorded at all four locations. The ground detector at ML02 recorded the widest range of species, and this may reflect the placement of the detector near a patch of revegetation.

### 3.2.2 Records from turbine-mounted detectors

The turbine mounted detectors successfully recorded bat calls. Although most of these calls were poor quality recordings which could not be identified to species level, clear calls of Gould's Wattled Bat were recorded at two turbines – ML05 and ML06 (see Plate 3 for an example).

Of the species recorded in this survey, the White-striped Freetail bat is generally considered to be the most likely to be recorded at height, and this was the only species recorded at 50 m during the 2006 surveys (Biosis Research 2006a). Although this species was recorded by two of the ground detectors in the current survey, none were recorded by turbine-mounted detectors.

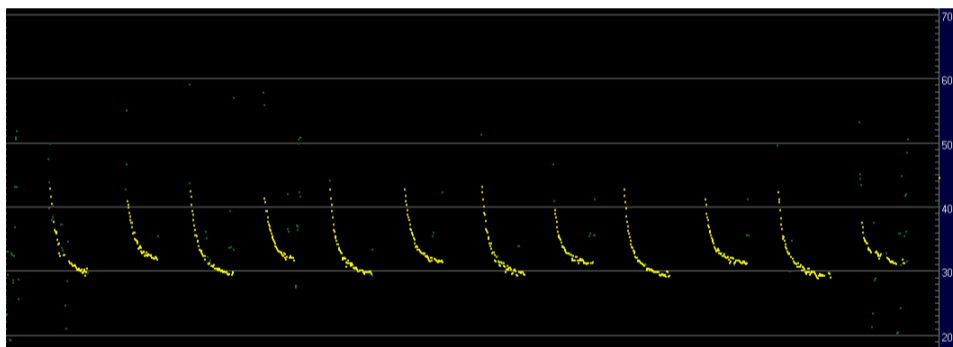


Plate 3. Section of a Gould's Wattled Bat call (frequency vs. time plot) recorded from a turbine-mounted detector. The alternating frequency at the end of pulses is a useful diagnostic character for this species.

## 4 Conclusions and recommendations

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### 4.1 Conclusions

#### 4.1.1 Brolga

A single Brolga was present within the wind farm site during several of the survey days. The bird was generally stationary or foraging on the ground, and only one flight was recorded, when the bird flew a short distance beyond the wind farm boundary, at a height of approximately 5 m above the ground. No Brolga were recorded from reference sites or in other habitats around the perimeter of the wind farm.

#### 4.1.2 Bats

At least eight bat species were recorded during the bat call survey, only one of which (Gould's Wattled Bat) was recorded by a turbine-mounted detector. No significant species were recorded.

Activity levels were highest during warm conditions. Activity levels were generally higher at ground level, although both ground and turbine-mounted detectors recorded high levels of ultrasonic noise from non-bat sources. Although very few shrubs and trees are present within the site, revegetated shelter-belts provide foraging habitat for several species which are unlikely to be present in completely cleared areas.

Bat calls were successfully recorded from turbine-mounted detectors. It is recommended that future monitoring follows a similar approach, using SM2 detectors mounted near the ground and on turbines, to further evaluate the value of the approach, which has been relatively un-tested to date in Australia.

#### 4.1.3 Significant impacts

No bird or bat deaths were recorded during the Brolga and Bat utilisation studies.

### 4.2 Recommendations

The following recommendations are made in relation to the approaches to Brolga and Bat monitoring, for consideration during future reviews of the BAM plan:

- Reduce the duration of the point counts to 10 minutes each. In the November surveys all Brolga and most other species were observed during the first few minutes. Observations within the second half of each point count are generally limited to additional movements of birds already recorded in the first 10 minutes, particularly introduced species and common native species including the European Skylark, Australian Magpie and Australian Raven.
- Consider removing the two reference sites from monitoring. The two reference sites provide very little information of value relating to Brolga utilisation within the surrounding area. It is highly unlikely that sufficient observations of Brolga flights will be recorded from these sites to allow comparison between activity levels within the wind farm and surrounding areas.
- Future surveys of Brolga utilisation should be timed to coincide with the peak of the breeding season and flocking season within the region. Exact timing will vary from year to year, but higher levels of breeding activity are generally noted from September to November and flocking can occur from late summer until May/June. We recommend monitoring known breeding sites in the region to align onsite surveys with other known breeding events. A flocking site which regularly supports up to 300 individuals is located at Blackwood approximately 2 kilometres west of MLWF. This flocking site provides an excellent opportunity to monitor MLWF while flocking activity nearby is highest.



## References

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## Appendices

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