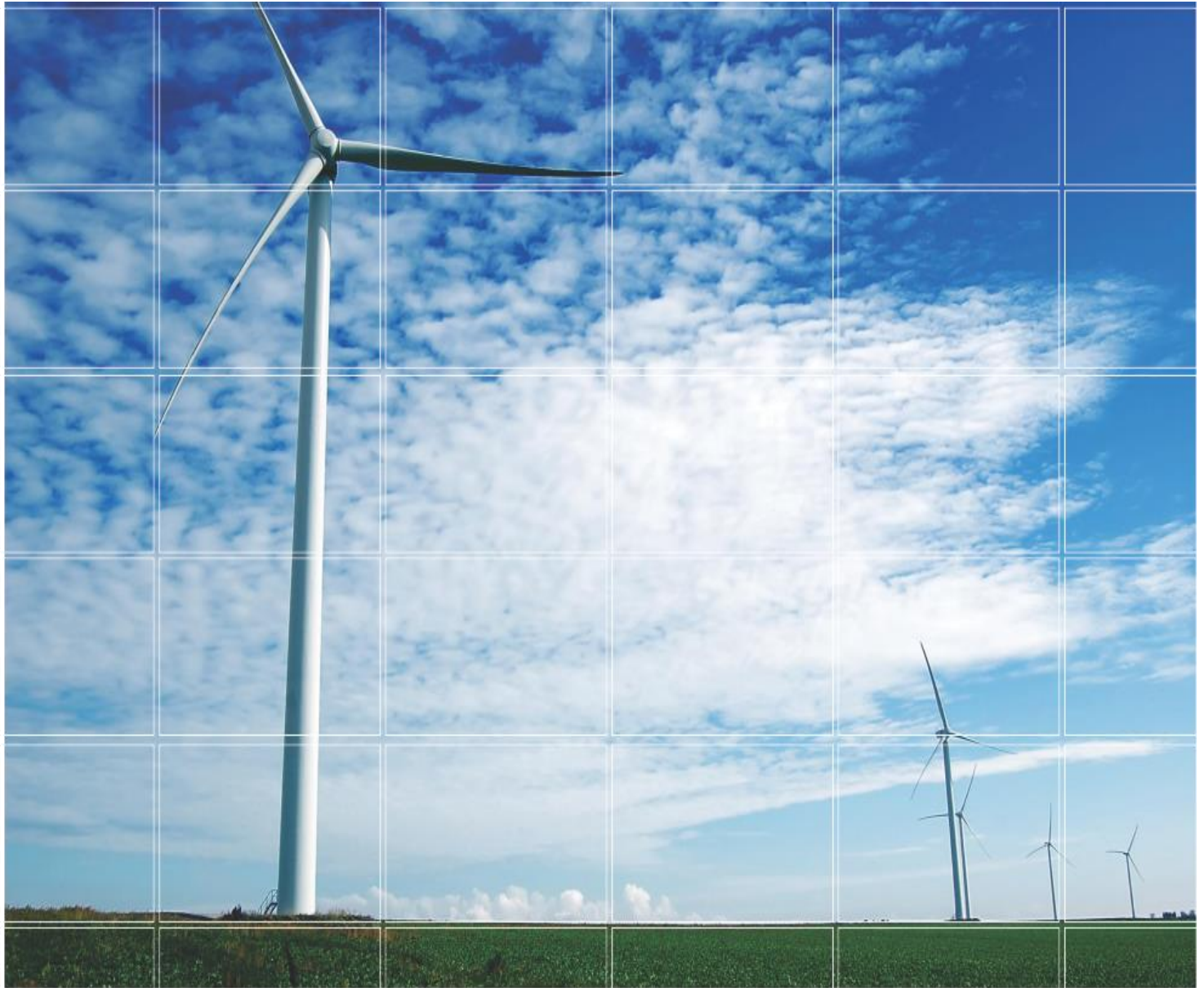


Annex E

Bat Data Analysis and Updated impact Assessment



Biala Wind Farm EIS Addendum to Biodiversity Impact Assessment

Bat Data Analysis and Updated Impact Assessment

Report prepared for Newtricity

February 2016

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Biala Wind Farm

Ecology Impact Assessment

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Newtricity (the Proponent) is seeking approval for the construction and operation of the Biala Wind Farm, situated near the locality of Biala in the Southern Tablelands region of New South Wales (NSW) (the Project). An Ecological Impact Assessment (EIA) (ERM, June 2015) was prepared for the Project, and included as Annex F to the Environmental Impact Assessment (EIS) that was submitted to NSW Department of Planning and Environment (DP&E) in July 2015.

This report is an addendum to the EIA, and will be provided as Annex E within the 'Response to Submissions' Report (RtS). The RtS has been prepared to provide considered responses to the issues raised during the public exhibition period of the EIS in accordance with Section 79C (1) of the *Environmental Planning and Assessment Act, 1979* (EP&A Act). The RtS report will be submitted to DP&E so that the Development Application lodged by Newtricity can be further assessed and determined.

The scope of this report is limited to the ecological assessment of bats within the Project Area (PA). The EIS contained some results and impact assessment of the Project with respect to bats using desktop research, data collected from ground-level monitoring units and habitat based assessments. However, since submission of the EIS, data analysis has been ongoing using data from the mast-mounted recording device during the period from 24 July 2014 to 11 May 2015. This report updates the bat results and impact assessment from the EIS with this recently available data, and should be considered to supersede all bat-related results and impact assessments in the EIA. The avoidance and mitigation measures described in the EIS (*Section 6.2.1*) are still considered current and therefore have not been updated in this addendum.

A desk based assessment was undertaken to identify ecological values that have the potential to occur in the PA. Databases and mapping products reviewed are presented in *Section 4.1* of the EIA.

Bats species were targeted using electronic units which record the echolocation calls of bats. Two different types of units were used throughout the field surveys, SongMeter® (SM2Bat) and AnaBat™ SD2.

Field surveys for fauna were undertaken across the PA between October 2012 and March 2014. Bat calls were recorded on the mast-mounted unit until May 2015 (refer to *Section 2.2*). All data collected during the 2012 survey period was forwarded to a specialist subcontractor (Narawan Williams, Clarence Town, NSW) for analysis. The data captured between 2013 and 2015 was analysed by ERM. Calls were identified at three confidence levels:

- **Definite** - the call can be assigned to a species with certainty;
- **Probable** - it is most likely that the call can be assigned to one species, however there is a minority proportion of call signature overlap with other species; or
- **Possible** –the call cannot be differentiated from another species.

Definite records were considered positive identification of the species. Probable records were considered positive identification of the species when the species distribution and habitat requirements also indicated that the species could occur within the PA. Possible identifications were considered too unreliable to confirm the presence of a species alone, and the species' likelihood of occurrence was assessed based on the habitat preferences for the species, desktop records and known distribution.

A species was accepted as occurring with certainty where it was assigned at least one **Definite** call. Where a species was assigned **Probable** calls, analysis was conducted of ancillary data such as the species' distribution and habitat requirements. If these coincided with the PA the species was considered as occurring in the PA. Where a species was only assigned **Possible** calls, these data could not be used and the species' likelihood of occurrence was based on its habitat preferences, location of desktop records and known distribution.

2.1

GROUND LEVEL UNITS

Ground level units were used to sample bats within a variety of habitats within the PA. Four SongMeter® (SM2Bat) echolocation call detectors (SM-01 to SM-04) were deployed at suitable locations across the PA, including potential flight paths and foraging areas (refer to *Table 2.1* and *Figure 3.1*) for a total of five nights in Spring 2012. An additional three AnaBat™ SD2 detectors were deployed over three consecutive nights in Spring 2013, with a handheld mobile detector used during spotlighting.

Table 2.1 **Ground Level Unit Effort and Locations**

Start Date	End Date	Unit	Description
5/11/2012	7/11/2012	SM-01	Adjacent and aimed over dam/water body
5/11/2012	7/11/2012	SM-02	Edge of woodland, potential flyway
5/11/2012	7/11/2012	SM-03	Edge of woodland, potential flyway
5/11/2012	7/11/2012	SM-04	Edge of woodland, potential flyway
7/11/2012	9/11/2012	SM-01b	In woodland potential flyway and utilisation area
7/11/2012	9/11/2012	SM-02b	Edge of woodland, potential flyway
7/11/2012	9/11/2012	SM-03b	Elevated area, edge of woodland patch
7/11/2012	9/11/2012	SM-04b	Over creek line in a gully
15/10/2013	18/10/2013	SYD01	At RS-01 site. Set on hill in Blakely's Red Gum.
15/10/2013	18/10/2013	SYD02	At RS-02 site, set on hill.
15/10/2013	18/10/2013	HV1	Active during spotlighting.
15/10/2013	18/10/2013	HV2	At RS-03 site, set on hill.

2.2 **MAST-MOUNTED UNIT**

The mast-mounted unit provides important information on species that are likely to fly at height and therefore may be susceptible to impacts of WTGs (such as rotor strike and barotrauma).

One SongMeter® was installed on the monitoring mast at approximately 50 m high on 25 July 2014 and continually recorded until 11 May 2015. The monitoring mast was located on a ridge in open pasture habitat, not immediately adjacent to woodland. It is therefore considered to be representative of the situational characteristics of the proposed Wind Turbine Generator (WTG) (refer to *Figure 3.1*). The data was collected periodically to ensure the device data storage capacity was not reached and that the recording unit was functional. The data provides a period of close to a full year of bat data recorded flying at Rotor Swept Area (RSA) height, in a situational location similar to the proposed WTGs, which can therefore be used as a reference during ongoing monitoring during operation of the Project.

2.3 **RISK AND IMPACT ASSESSMENT**

A combination of desktop information and field survey results has been used to provide information for the impact assessment and to provide baseline dataset to inform the bird and bat monitoring plan. The approach for the risk and impact assessment for ecological values is provided in *Section 4.4* of the EIA.

The likelihood of occurrence table has been used to provide an assessment of likely presence or absence for threatened bat species. Several species were included in the likelihood of occurrence table as a conservative approach, despite not being able to confirm a species as present by their call signatures.

Section 5A of the EP&A Act sets out seven factors to be considered during the Assessment of Significance (7-part test) when determining whether a proposed action will, or is likely to, have a significant effect on a threatened species, endangered populations or endangered ecological communities listed under the schedules of the *Threatened Species Conservation Act, 1995* (TSC Act), these are detailed in *Section 4.2*.

Up to 16 bat species were recorded, of which, 10 individual species were assigned 'Definite' calls. The genus *Nyctophilus* (Long-eared Bats) were also given an 'Either or Both' confidence as the genus can be identified from the calls, but not individual species. Based on the known distribution and habitat preferences for *Nyctophilus* species, the calls are likely to be from either the Gould's Long-eared Bat (*N. gouldi*) and Lesser Long-eared Bat (*N. geoffroyi*), or both species may have been recorded.

The remaining species were recorded with Possible or Probable confidence. **Table 3.1** *Error! Reference source not found.* details the confidence of each species, and the height at which the detection unit was located (i.e. at ground level or mast height).

Table 3.1 *Bat Species Recorded within the PA*

Scientific Name	Common Name	TSC Act ¹	EPBC Act ²	Ground Level ³	Mast Height ³
<i>Austronomus australis</i>	White-striped Freetail Bat			def	def
<i>Chalinolobus gouldi</i>	Gould's Wattled Bat			def	def
<i>Chalinolobus morio</i>	Chocolate Wattled Bat			def	def
<i>Falsistrellus tasmaniensis</i>	Eastern Falsistrelle	V		def	prob
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bent-wing Bat	V		prob	prob
<i>Mormopterus species 2</i>	Sheathtail Bat Species 2			prob	def
<i>Mormopterus species 4</i>	Sheathtail Bat Species 4			pos	def
<i>Nyctophilus sp. (N. gouldi or N. geoffroyi)</i>	Gould's Long-eared Bat/Lesser Long-eared Bat			either or both	either or both
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat	V		-	def
<i>Scotorepens balstoni</i>	Western Broad-nosed Bat			pos	def
<i>Scotorepens greyii</i>	Little Broad-nosed Bat			pos	pos
<i>Scotorepens orion</i>	Eastern Broad-nosed Bat			prob	prob
<i>Vespadelus darlingtoni</i>	Large Forest Bat			def	def
<i>Vespadelus regulus</i>	Southern Forest Bat			prob	prob
<i>Vespadelus vulturnus</i>	Little Forest Bat			def	-

1. TSC Act = Threatened Species Conservation Act, 1995 (TSC Act) Status: V – Vulnerable

2. EPBC Act – Environmental Protection and Biodiversity Conservation Act, 1999

3. Confidence Rating: def – Definite; prob – Probable; pos – Possible.

3.1

NON-THREATENED SPECIES

Up to 13 non-threatened bats were recorded within the PA. Ten species were either given Definite or Probable confidence and are considered to occur within the PA. The bat calls most frequently recorded were from the White-striped Freetail Bat (*Austronomus australis*), Gould's Wattled Bat (*Chalinolobus gouldi*) and Large Forest Bat (*Vespadelus darlingtoni*).

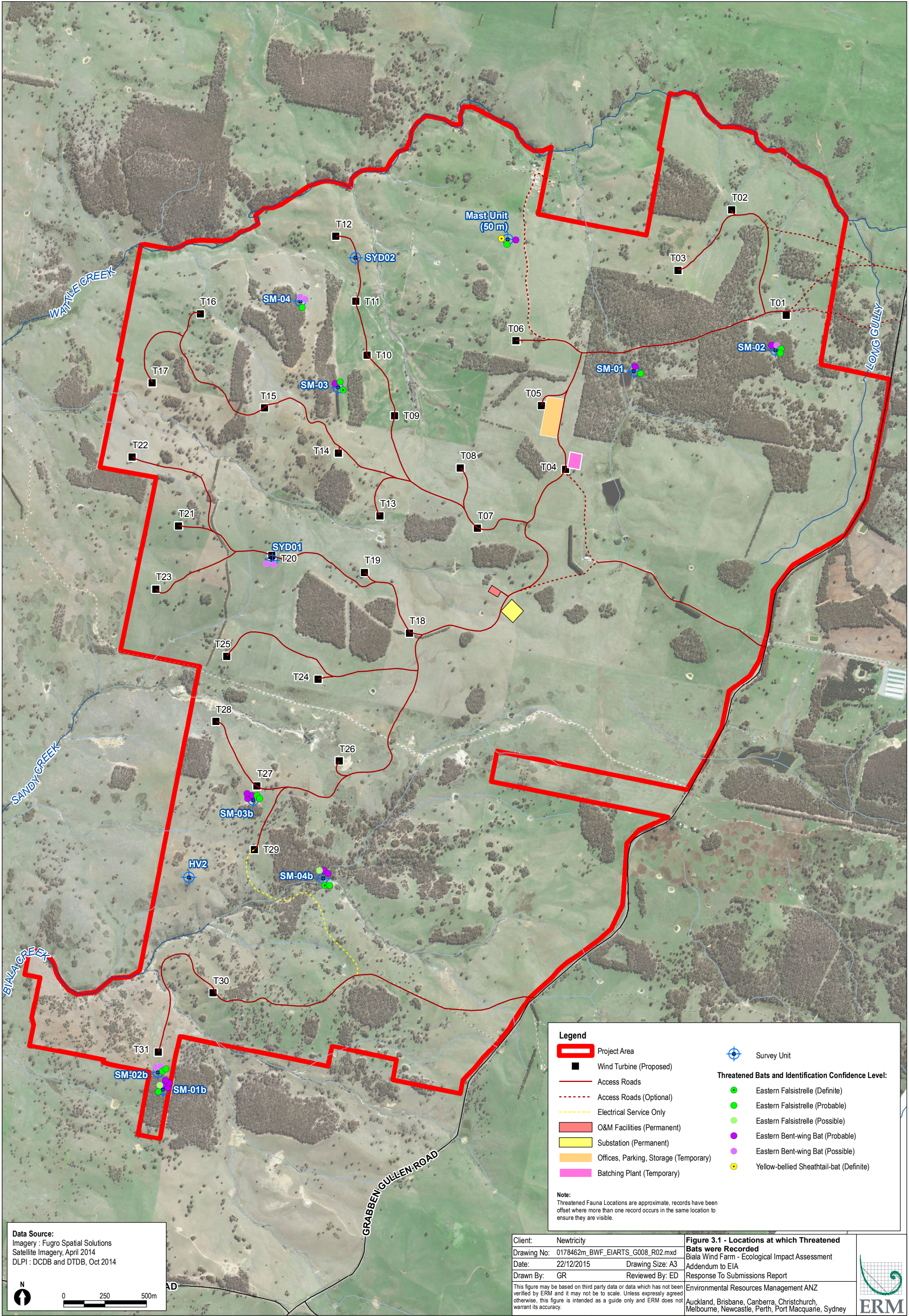
The Little Broad-nosed Bat (*Scotorepens greyii*) was considered 'Possible' as the calls can be confused with other species with similar frequency. Few calls from this species were recorded.

Two Long-eared Bat species have the potential to occur within the PA; Gould's Long-eared Bat (*Nyctophilus gouldi*) and the Lesser Long-eared Bat (*N. geoffroyi*). Calls between these species cannot be differentiated and either or both of these species may occur within the PA, based on the calls identified to genus level.

3.2

THREATENED SPECIES

Table 3.1 demonstrates that calls of three threatened species were recorded (two assigned Definite confidence and one assigned Probable confidence), all of which are listed as Vulnerable under the TSC Act. No EPBC Act listed species were recorded. The locations of the threatened species recorded are shown in Figure 3.1.



3.2.1

Threatened Species Recorded on the Mast-mounted Unit

Figure 3.2 displays seasonal variation in the number of calls attributed to threatened species for the mast-mounted units throughout the monitoring period. The calls were grouped in one-week periods in order to reduce the relative impact of daily variation and to demonstrate abundance trends over time. There were few bat calls recorded during the winter months, with no threatened species recorded during August and early September. Mast-mounted recordings identified one additional threatened species, the Yellow-bellied Sheath-tail-bat, which was not recorded on the ground based units.

Two of the species were recorded infrequently and in low numbers: the Eastern Falsistrelle and the Eastern Bent-wing Bat. The recordings of these species did not show any seasonal trends in abundance. The Yellow-bellied Sheath-tail-bat in contrast, was recorded regularly and in much higher abundances than the other threatened species. The Yellow-bellied Sheath-tail-bat was most abundant throughout spring, with a maximum of 40 calls recorded within a single week during early October. The number of calls dropped during the summer months, and then returned to relatively high abundances during late summer and autumn. The species was not recorded from April to August.

Figure 3.2 Number of Bat Calls Recorded per Week by Threatened Species (Mast-mounted Units)

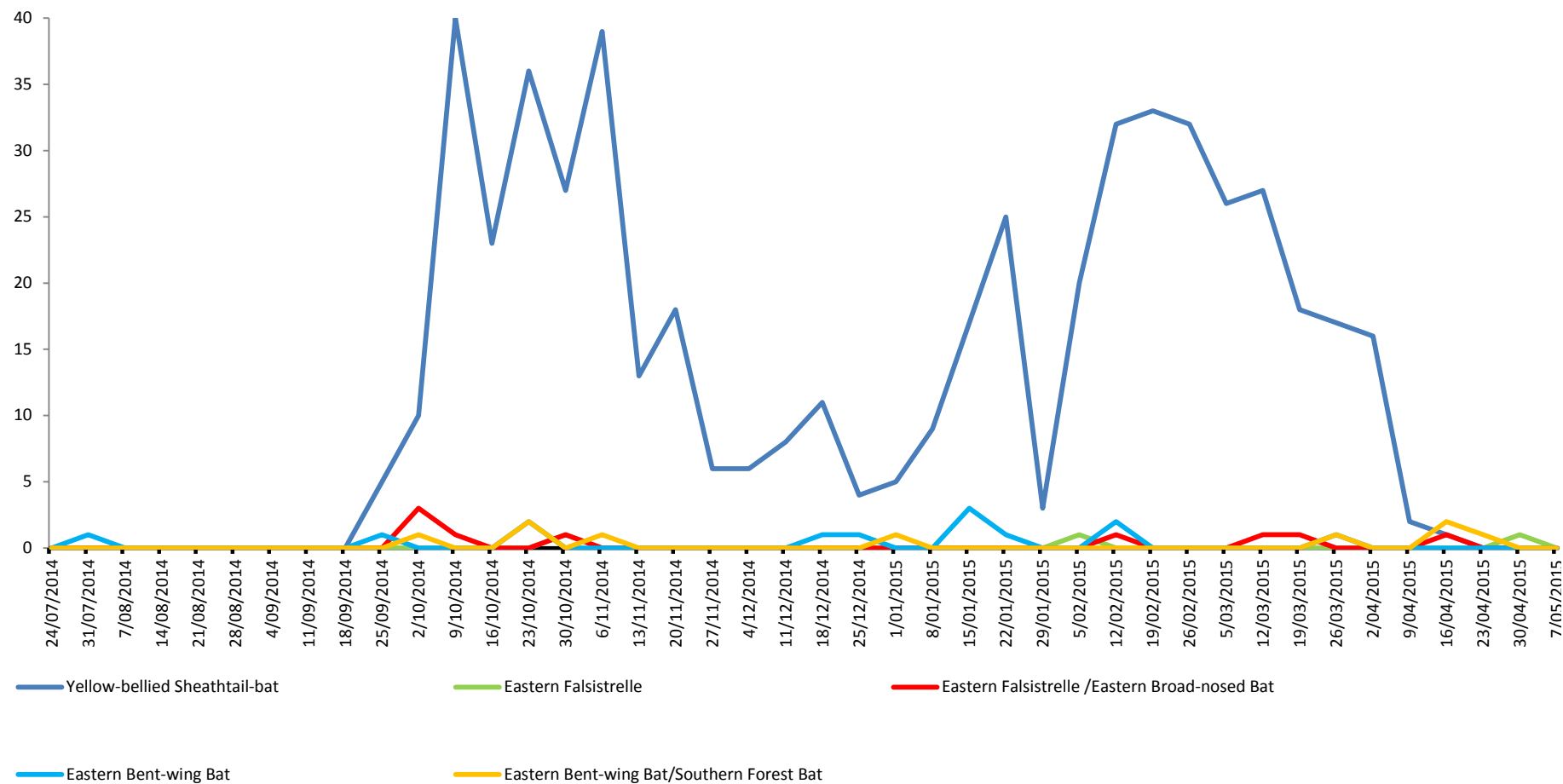


Table 3.2 Likelihood of Occurrence for Threatened Bat Species within the PA.

Scientific Name Common Name	TSC Act Status	EPBC Act Status	Species and Habitat Information	Likelihood of occurrence
<i>Falsistrellus tasmaniensis</i> Eastern Falsistrelle	V	-	This species is found in tall, mature, wet forest. It generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. The species hunts beetles, moths, weevils and other flying insects above or just below the tree canopy (OEH 2015).	Known - One Definite record of this species was recorded from a ground based unit deployed in a woodland patch in the north west of the PA (refer to <i>Figure 3.1</i>). A further 11 'Probable' and two 'Possible' records were made from woodland patches across the PA from ground based units. The species was also recorded as 'Probable' on two occasions on the mast-mounted unit and up to a further eight occasions as 'Possible', however these calls could not be differentiated between this species and the Eastern Broad-nosed Bat. This species' calls were intermittently recorded in very low numbers and thus no seasonal trends were observed. <i>This species is discussed further in Section 4.3 and an Assessment of Significance has been conducted (refer to Section 4.2.1).</i>
<i>Miniopterus schreibersii oceanensis</i> Eastern Bentwing-bat	V	-	This species hunts in forested areas, catching moths and other flying insects above the tree tops. Caves are the primary roosting habitat, but it also uses derelict mines, stormwater tunnels, buildings and other man-made structures (OEH 2015). This species forms discrete populations centred on a maternity cave with specific temperature and humidity regimes that is used annually in spring and summer for the birth and rearing of young. At other times of the year, populations disperse within about 300 km range of maternity caves (OEH 2015).	Known -A small number of recordings on the ground level units were attributed to the Eastern Bentwing-bat with 'Probable' confidence. The mast-mounted unit recorded 13 calls with 'Probable' confidence. Several of the calls recorded showed characteristics that are indicative of this species rather than the Southern Forest Bat (a species with overlapping call characteristics). A further nine calls were assigned a 'Possible' confidence given that they could not be distinguished between the Eastern Bent-wing Bat and the similar calls of the Southern Forest Bat. The calls recorded on the mast-mounted units were comparatively few given the long-term deployment of the unit. There were no trends that could be identified over the monitoring period with the species detected intermittently in low numbers. Although the calls were not definitively attributed to the Eastern Bent-wing Bat, woodland/forest habitat in the PA is considered to provide potential foraging habitat for this species, and a conservative approach has been taken to assume the presence of the species. The species may roost in built structures within the PA, but no natural roosting features are present. <i>This species is discussed further in Section 4.3 and an Assessment of Significance has been conducted (refer to Section 4.2.2).</i>
<i>Myotis macropus</i> Southern Myotis	V	-	This species generally roost in groups of 10 – 15, close to water in caves, mine shafts, hollow-bearing trees, and storm water channels, buildings, under bridges and in dense foliage. They forage over streams and pools catching insects and small fish by raking	Unlikely - Given that the PA is greater than 130 km from the coast, and there is a lack of any major rivers, it is considered unlikely that the species is present in the PA. Furthermore, there are no prior records within the locality. The Southern Myotis and <i>Nyctophilus</i> species can be difficult to distinguish from call analysis alone. Bat calls that show a similar signature to this species are likely to be from <i>Nyctophilus</i> species.

Scientific Name Common Name	TSC Act Status	EPBC Act Status	Species and Habitat Information	Likelihood of occurrence
			their feet across the water surface. They occur in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. They are rarely found more than 100 km inland, except along major rivers (OEH, 2015).	<i>No further assessment is required for this species as it not likely to occur within the PA.</i>
<i>Nyctophilus corbeni</i> Corben's Long-eared Bat	V	V	The species inhabits a variety of vegetation types, including mallee, Bulloke (<i>Allocasuarina leuhmanni</i>) and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. Roosts in tree hollows, crevices, and under loose bark. It is a slow flying agile bat, utilising the understorey to hunt non-flying prey - especially caterpillars and beetles - and will even hunt on the ground. Mating takes place in autumn with one or two young born in late spring to early summer (OEH, 2015).	Unlikely - Long-eared Bat (<i>Nyctophilus</i>) species cannot be reliably differentiated by call analysis alone. Several calls were recorded on both the ground based units and mast units that could be attributed to this species, however the PA is considered outside of the known distribution for this species and without suitable habitat types present to support the species. <i>No further assessment is required for this species as it not likely to occur within the PA.</i>
<i>Saccolaimus flaviventris</i> Yellow-bellied Sheath-tail-bat	V		The species is a wide-ranging species found across northern and eastern Australia. In south-western NSW it is a rare visitor in late summer and autumn. It roosts singly or in groups of up to six, in tree hollows and buildings. When foraging for insects the species flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. Breeding has been recorded from December to mid-	Known - This species was regularly recorded on the mast-mounted unit from late October 2014 until late April 2015 (refer to <i>Figure 3.1</i>). Activity level was highest during spring and late summer to early autumn. The species was not recorded on the ground based units or on the mast-mounted unit between May to September (winter period). <i>This species is discussed further in Section 4.3 and an Assessment of Significance has been conducted (refer to Section 4.2.3).</i>

Scientific Name Common Name	TSC Act Status	EPBC Act Status	Species and Habitat Information	Likelihood of occurrence
			March, when a single young is born. Seasonal movements are unknown; there is speculation about a migration to southern Australia in late summer and autumn (OEH, 2015).	
<i>Scoteanax rueppellii</i> Greater Broad-nosed Bat	V	-	The species utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species. The Greater Broad-nosed Bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. The species is only known from a relatively narrow coastal strip in southern NSW, occurring below 500 m above sea level (OEH 2015). The species is also associated in regions with mild winters (Churchill 2008)	Unlikely –Review of the habitat requirements and distribution for this species indicates that this species is unlikely to occur within the PA. The mean altitude, above 800 m above sea level, is considered too high for this species to occur. The PA also experiences regular frosts during the winter months and this species is typically known from areas with mild winters. There are no records of this species within the locality. Several calls were recorded which are similar to those emitted by this species, however the frequency of the species' calls overlaps with <i>Falsistrellus tasmaniensis</i> and <i>Scotorepens orion</i> , and therefore its presence or absence so cannot be definitively assessed on its calls alone . <i>No further assessment is required for this species as it not likely to occur within the PA.</i>

Potential impacts from the Project on biodiversity during the construction and operation phases are discussed within the EIA. *Section 4.1* of this report specifically discusses impacts that are likely to affect bat species present within the PA, including common species. *Section 4.2* provides further discussion of the specific impacts to the three threatened bat species known to occur within the PA.

4.1 *IMPACT EVALUATION FOR BAT SPECIES*

4.1.1 *Habitat Loss*

The Development Footprint is the area of land that will be subject to permanent and temporary alteration as a result of installation and operation of Project infrastructure. This will occupy a total area of approximately 42.37 ha. The majority of this Development Footprint is grassland (both native and non-native). Several species forage in open areas including the threatened Yellow-bellied Sheath-tail Bat, although bat diversity and abundance is typically lower than habitats with more complexity such as forest. Wooded and forested habitat typically provide more diverse bat assemblages and also increase the foraging potential of adjacent open areas, with several species foraging along the margins of woodlands and forest. The amount of wooded and forested habitat which will be lost as a result of the Project is approximately 1.25 ha, which is 1 % of the total woodland/forest area within the PA. This amount of habitat loss is considered negligible and bat species diversity and abundance is not likely to suffer significant negative impacts from this land clearing.

Tree hollows provide roosting habitat for several bat species recorded within the PA. Most bat species use a multitude of different hollows, changing on a nightly basis. A small number of hollow bearing trees are likely to be removed as part of the Project, however this will represent a small proportion of those that will be retained within the PA. As a result, no significant effect is anticipated as a result of the proposed hollow-bearing tree clearance.

4.1.2 *Habitat Alienation*

There is potential for wind farms to lead to avoidance of habitat surrounding WTGs, thereby alienating some areas of retained habitat. If the Project does result in habitat alienation in the area surrounding the WTGs, this would have a positive influence for bats by further reducing the risk of WTG collision.

There is limited research into changes in habitat use resulting from wind energy developments in Australia. The findings of a 10 year monitoring program for two wind farms in Tasmania showed a general reduction in biodiversity across the survey period within both the wind farm site and reference sites, with the decline commencing prior to construction (Hull n.d.).

4.1.3

Bat Mortality due to WTG Collision and Barotrauma

Operational wind farm rotors pose risks to bats that include:

- WTG Collision: a collision risk to bats exists in that they can be struck by a moving rotor, which can cause injury and/or death. Lighting on WTGs may also increase the likelihood of WTG collision to microbat species by attracting insects within the RSA causing bats to forage within this area and interact with the moving rotors; and
- Barotrauma: bats approaching near to the moving rotors are at risk of tissue damage to air-containing structures in their lungs caused by rapid or excessive pressure changes (Baerwald *et al.* 2008). As with any airfoil, moving wind- turbine blades create zones of low pressure as the air flows over them. Animals entering these low pressure areas may suffer barotrauma (Baerwald *et al.* 2008). Species most at risk of barotrauma within the PA are species of microbats.

The amount of mortality attributed to rotor strike and barotrauma is reported in the range from 1.6 bats per WTG per year to over 90 bats per WTG per year (ABS, n.d). This data cannot be directly applied to this study however given that this data is largely collected from global studies which are likely to have a wide variety of WTG designs and does not take into account the ecology of the local bat species. One long-term study has been conducted in Australia at two Tasmanian wind farms, which found a mortality rate equivalent to approximately 0.13 bats per WTG per year (Hull and Cawthen 2012). The data provides an indication of the scale of potential mortality rates from the combination of barotrauma and collision, although the rates are considered indicative because the site characteristics of the locations in which these studies were conducted vary from the Project, and the studies did not account for undetected carcasses.

It is anticipated that there will be some mortality of bats due to WTG impacts, including both direct rotor strike and barotrauma. The amount of mortality is poorly studied and therefore a reliable estimate of mortality rates cannot be achieved for individual species or on a per WTG basis. It is anticipated that the majority of bat species recorded within the PA will fly below RSA for the majority of time and this will reduce their exposure to rotor based impacts.

4.2

THREATENED SPECIES IMPACT ASSESSMENT

Three threatened bat species were recorded on the mast-mounted unit: the Eastern Falsistrelle, Yellow-bellied Sheath-tail-bat and the Eastern Bent-wing Bat. The literature also supports this observation as all of these species have been reported to fly in open areas at height. Therefore, all three have the potential to be affected by rotor impacts in addition to habitat based impacts. The impact to the species and local populations are discussed below with Assessments of Significance also provided for each species.

4.2.1

Eastern Falsistrelle – Vulnerable (TSC Act)

This species was recorded infrequently, in low abundances, within the PA both at ground level and the unit mounted at height. This species habitat preference is tall wet forest with trees taller than 20 m, where the understory is dense. The species also stated as being absent from small patches of remnant forest, preferring continuous forest (Churchill, 2008). The habitat within the PA is considered sub-optimal for the species given its heavily fragmented nature and the lack of large areas of tall wet forest. Given that few calls were recorded and that sub-optimal habitat present, it is anticipated that this species occurs in the PA in low abundances.

The clearance of woodland/forest habitats and hollow-bearing trees has the potential to impact the species, however the amount of habitat being impacted is considered negligible and will not cause a significant impact for the species.

The Eastern Falsistrelle typically hunts beetles, moths, weevils and other flying insects above or just below the tree canopy (OEH 2015). It can therefore be inferred that for the majority of the time the species is not flying within open areas, at height, and therefore the risk of rotor strike is non-existent whilst exhibiting these foraging traits. Notwithstanding, the species is also stated as capable of moving through cleared landscapes and foraging in open areas (Churchill, 2008), which is supported by the species being occasionally detected on the mast-mounted bat recorded mounted at 50 m. This behaviour trait increased the risk of rotor impacts.

A risk of rotor impacts, including rotor strike and barotrauma exist for this species, however, few individuals are likely to be affected considering that the species is unlikely to spend the majority of its lifecycle flying in open areas. Furthermore only a small number of individuals are likely to be affected given the low abundances predicted within the PA.

Eastern Falsistrelle Assessment of Significance

(a)	<i>in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,</i>
Reduction of foraging area, loss of roosting hollows and mortality of breeding individuals has potential to disrupt the lifecycle of the Eastern Falsistrelle. Reduction of foraging area is limited to approximately 1.25 ha (less than 1% of available foraging habitat in the PA) and this is unlikely to affect survival of breeding individuals, juveniles or other adults. Loss of potential roosting hollows is limited to a small proportion of the hollow bearing trees within the PA. There is a low rate of WTG impacts expected for this species as the species typically forages in forested habitat and is occasionally occur in open areas. Due to the small scale of disturbance to habitat, and the expected low rate of WTG collision, the Project is unlikely to adversely affect the lifecycle of the species to the extent that is would place the local population at risk of extinction.	
(b)	<i>in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,</i>
Not applicable.	
(c)	<i>in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</i>
<i>(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or</i>	
Not applicable.	
<i>(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,</i>	
Not applicable.	
(d)	<i>in relation to the habitat of a threatened species, population or ecological community:</i>
<i>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and</i>	
The total area of woodland/forest habitat to be removed is approximately 1.25 ha, equivalent to <1% of the total woodland/forest habitat within the PA. A small number of hollows will be removed for the Project, however hollows are abundant in woodland/forest habitat in the PA, and only a small proportion of these will be removed within the PA. The habitat modification is considered negligible and will not significantly affect this species, furthermore, micrositeing undertaken with involvement from an ecologist prior to clearing, will aim to further reduce the number of hollows removed.	
<i>(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and</i>	
Clearing of woodland/forest habitat proposed for the Project is limited to approximately 1.25 ha, configured in corridors with a maximum width of 10 m. This width is unlikely to fragment or isolated areas of habitat such that it would inhibit the movement or dispersal of the Eastern Falsistrelle.	
<i>(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,</i>	
The small area of habitat to be removed for the Project (1% of the PA) is not unique in its value to this species. It is consistent with the habitats observed outside the Development Footprint.	

(e)	<i>whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),</i>
	Not applicable.
	<i>whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,</i>
	Not applicable.
(g)	<i>whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.</i>
	The Project will directly result in two key threatening processes' which have the potential to affect the species: the 'clearing of native vegetation' and 'loss of hollow bearing trees'. Given the minimal amount of vegetation clearance and the large proportion of retained hollow bearing trees, the Project is not anticipated to significantly increase the impact of the key threatening processes. Where Possible, micro-siting of infrastructure will further reduce the clearance of any hollow bearing trees.
	<i>Conclusion</i>
	The Project is unlikely to have a significant impact on the Eastern Falsistrelle. Only a relatively small area of potential Eastern Falsistrelle habitat in the PA will be removed for the Project, and the foraging behaviour of the Eastern False Pipistrelle (foraging above or just below the canopy) indicates it will be largely separated from the location of the WTGs (as they are located in the open areas) and a small proportion of the population present may interact with the WTGs and therefore be at risk of collision.

4.2.2 *Eastern Bent-Wing Bat- Vulnerable (TSC Act)*

This species was recorded infrequently, in low abundances, within the PA both at ground level and the unit mounted at height. The exact number of calls remain uncertain, owing to the call overlap in frequency with several species, particularly, the Southern Forest Bat. The Eastern Bent-wing Bat typically forages above the canopy of wooded and forested habitat but also is known to occur in open areas. Habitat for this species exists within the Study Area, however it is sub-optimal with relatively small patches of forest within a highly fragmented and cleared landscape. This is a cave roosting species and there are no natural roosting features present, any roosting habitat within the PA is limited to the built structures outside of the Development Footprint.

This species has specific breeding ecology, forming discrete populations centred on a maternity cave with specific temperature and humidity regimes that is used annually in spring and summer for the birth and rearing of young. At other times of the year, populations disperse within about 300 km range of maternity caves (OEH 2015). There are two key maternity caves known within the NSW Southern Tablelands, Bungonia Caves and Wee Jasper Caves. Bungonia Cave system is approximately 63 km south east and Wee Jasper 80 km south west of the PA. The Colong Caves, 85 km north east of the PA, is also believed to be an important site for the species, with large aggregations roosting there (DECC 2007). There are no known maternity colonies in the Lachlan Catchment Management Area (OEH 2015). The Project is not anticipated to occur within any key migratory pathways for this species given that the PA is not between any important foraging habitats or breeding

resources for the species. Direct migration between coastal areas and the breeding caves would not pass directly over or through the PA.

It is anticipated that the PA does not provide important habitat for the species owing to the reasons outlined above. This is supported by data analysis of the records indicating very few records of the species within the locality and very few records inland of the PA. A review of the Atlas of Living Australia database indicates the majority of the records of this species are coastal or associated with larger areas of more continuous forest. The records indicate that the PA is close to the western periphery of the species' occurrence.

This species is at risk of rotor strike given that it is known to cross large open area. The species may also occasionally forage at rotor swept height. Mortality may occur during the operation phase of the Project, however it is anticipated to affect a small number of individuals given the low number of bats anticipated to occur within the area. Any impacts to life cycle of this species are likely to affect individuals only, not causing any population level effects and therefore no risk of extinction for the local population is anticipated. A small amount of foraging habitat (woodland/forest) will be lost as a result of the Project; however this will be negligible given the much larger proportions of these habitats that will be retained within the PA.

Eastern Bent-wing Bat Assessment of Significance

(a)	<i>in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,</i>
The PA is located in a fragmented landscape, with no breeding habitat for this species and very few records of the species within the locality. There is no evidence to suggest that the PA is important to the species or that large aggregations are likely to occur. The species not anticipated to occur in high numbers within the PA which is supported by field studies which detected a small number of individuals within the PA. Furthermore the PA is not anticipated to occur within any key migratory pathways for this species given that the known breeding caves are 63 km south east and 80 km south west of the PA and the species is known to migrate between the maternity caves after overwintering in coastal areas. Migration between coastal areas and the breeding caves would not pass over or through the PA. Any impacts to life cycle of this species are likely to affect individuals only, not causing any population level effects and therefore no risk of extinction for the local population is likely due to the Project.	
(b)	<i>in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,</i>
Not applicable.	
(c)	<i>in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</i>
(i) <i>is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or</i>	
Not applicable.	
(ii) <i>is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,</i>	

Not applicable.

(d)	<i>in relation to the habitat of a threatened species, population or ecological community:</i>
	<i>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and</i>
	The total area of woodland/forest foraging habitat to be removed is approximately 1.25 ha, equivalent to <1% of the total woodland/forest habitat within the PA. This amount of clearance is considered negligible and unlikely to significantly impact the species.
	<i>(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and</i>
	Clearing of woodland/forest habitat proposed for the Project is limited to approximately 1.25 ha, configured in corridors with a maximum width of 10 m. This width is unlikely to fragment or isolated areas of habitat such that it would inhibit the movement or dispersal of the Eastern Bent-wing Bat.
	<i>(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,</i>
	The small area of habitat to be removed is considered sub-optimal foraging habitat that is not unique in its habitat characteristics in the PA and is not of particular importance to the species. The habitat does not contain maternity caves, or any naturally occurring roosting habitat (with potential roosting habitat restricted to buildings).
	<i>(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),</i>
	Not applicable.
	<i>whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,</i>
	Not applicable.
	<i>(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.</i>
	The Project will directly result in one key threatening process which has the potential to affect the species, which is the 'clearing of native vegetation'. The total area of woodland/forest foraging habitat to be removed is 1.25 ha, equivalent to <1% of the total woodland/forest habitat within the PA. Given the significant amount of vegetation retained, the Project is not anticipated to significantly contribute to the KTP.
	<i>Conclusion</i>
	No significant impact is anticipated for this species given that large aggregations of the species are unlikely to occur within the PA. Impacts are likely to be restricted to a small number of individuals and considered insufficient to cause population scale impacts.

4.2.3

Yellow-Bellied Sheathtail-Bat- Vulnerable (TSC Act)

There are no significant impacts anticipated for the species as a result of habitat clearance, owing to the vast range that this species occupies and the general habitat requirements of the species. The amount of habitat clearance is negligible and is not likely to cause any declines in the species abundance

Yellow-bellied Sheathtail is a large bat which flies high and fast over the forest canopy, but is known to fly lower in more open country. Despite flying lower

in open areas the species is still likely to remain susceptible to rotor strike and barotrauma given the high relative proportion of time spent flying and foraging in open habitat. This is supported by the regular recordings of the species flying at height on the mast-mounted unit. It should be noted that this species is easily detected by recording devices as the relatively low frequency and loud call carries well in open areas and can be captured at a further distances than many other bat species.

The number of bats which are likely to be exposed to rotor strike and barotrauma remain unknown for this species given that the calls recorded may be from one individual calling multiple times or several individuals. It is anticipated that the PA would support a very small fraction of the species population at any one time given that the species occurs and disperses over much of the Australian mainland. The habitat for this species within the PA is not of a uniquely higher quality than the surrounding locality and the PA does not occur in any landform or vegetation corridor which could funnel aggregations of the species through the area. For this reason it is anticipated that while a number of individuals may experience mortality due to rotor strike and barotrauma, the overall impact would not extend to population level effects, and therefore impacts are not considered significant.

Yellow-bellied Sheathtail Bat Assessment of Significance

(a)	<i>in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,</i>
	Reduction of foraging area, loss of roosting hollows and mortality of breeding individuals has potential to disrupt the lifecycle of this species. Reduction of foraging area is limited to 1.25 ha (less than 1% of available foraging habitat in the PA) and this is unlikely to affect survival of breeding individuals, juveniles or other adults. A small number of potential roosting hollows may be lost as a result of the Project, however this is considered negligible given that the majority of hollow bearing trees will be retained within the PA. Furthermore, micrositeing undertaken with involvement from an ecologist prior to clearing will aim to further reduce the number of hollows removed. This species is not anticipated to occur in large aggregations within the PA, and although may be susceptible to WTG strike and barotrauma, it is unanticipated that only a small number of individuals will be impacted. The Project is unlikely to adversely affect the lifecycle of the species to the extent that it would place the local population at risk of extinction.
(b)	<i>in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,</i>
	Not applicable.
(c)	<i>in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</i>
	<i>(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or</i>
	Not applicable.

	<i>(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,</i>
	Not applicable.
<i>(d)</i>	<i>in relation to the habitat of a threatened species, population or ecological community:</i>
	<i>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and</i>
	The total area of woodland/forest habitat to be removed is approximately 1.25 ha, equivalent to <1% of the total woodland/forest habitat within the PA. A small number of hollows will be removed for the Project, however hollows are abundant in woodland/forest habitat in the PA, and a small proportion will be removed. Micro-siting undertaken with involvement from an ecologist prior to clearing will aim to further reduce the number of hollows removed.
	<i>(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and</i>
	Clearing of woodland/forest habitat proposed for the Project is limited to 1.25 ha, configured in corridors with a maximum width of 10 m. This width is unlikely to fragment or isolated areas of habitat such that it would inhibit the movement or dispersal of the Yellow-bellied Sheathtail-bat, which occurs within open areas and has the ability to migrate over long distances.
	<i>(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,</i>
	The entire PA is considered habitat for this species, as it has very broad habitat requirements. The habitat to be removed is not unique or particular importance to the species with large areas of similar habitat in PA and wider locality.
<i>(e)</i>	<i>whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),</i>
	Not applicable.
	<i>whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,</i>
	Not applicable.
<i>(g)</i>	<i>whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.</i>
	The Project will directly result in two key threatening processes' which have the potential to affect the species: the 'clearing of native vegetation' and 'loss of hollow bearing trees'. Given the minimal amount of vegetation clearance and the large proportion of retained hollow bearing trees, the Project is not anticipated to significantly increase the impact of the key threatening processes.
	<i>Conclusion</i>
	The Project is unlikely to have a significant impact on the Yellow-bellied Sheathtail-bat owing to the negligible amount of habitat loss relative to that remaining in the PA. The rotor impacts are expected to affect a small proportion of the species given its very broad distribution.

The three Assessments of Significance conducted for the Eastern Falsistrelle, Eastern Bent-wing Bat and Yellow-bellied Sheathtail Bat, all concluded, no significant impact as a result of the Project.

4.3 *AVOIDANCE AND MITIGATION MEASURES*

4.3.1 *Avoidance*

Infrastructure has been sited to avoid native vegetation where possible, with WTCs sited outside of woodland/forest habitat where possible. This is discussed further in *Section 6.2.1* of the EIA.

4.3.2 *Mitigation Measures*

Mitigation measures for fauna are discussed in detail within *Section 6.2.2* of the EIA, and these remain unchanged as a result of this assessment. The measures and recommendations outlined in the EIA will further reduce the impact of the Project on Bat species. The measures include the requirement of a Bird and Bat Monitoring Plan which will have the objective of minimising the impacts to Bat species.

The Project will result in the loss of a small amount of habitat used by bats, however this is considered a negligible impact, considering the large proportion of forested and wooded habitat retained. There remains a residual risk of rotor strike and barotrauma for bats and some individual mortality is likely to occur. It is anticipated that the mortality will not be of sufficient magnitude to cause any significant effects to any common or threatened species, given that the PA is unlikely to support high abundances or aggregations of any threatened bat species.

A Bird and Bat Monitoring Plan will be developed, as discussed in the *Section 5* of the EIS, which will have the objective of minimising the impacts of the operational wind farm. It will also include monitoring of bat carcasses in order to estimate the impact during operation.

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