Friday, 22 February 2019

Mr Matt Philpott
Allen Price & Scarratts Pty Ltd
PO Box 73
Nowra
NSW 2541

Delivery via email: mattphilpott@allenprice.com.au

ABN 86139603268
6 John Street
Port Macquarie 2444
Phone: 6593 6178
Mobile: 0431 833 968
Email: jbenvironsw@gmail.com

Dear Matt,

Re: Moss Vale Rd North Urban Release Area Masterplan and Development Control Plan – Spring-Summer Survey Results.

Following completion of the survey, we provide the following report.

1 METHODOLOGY

1.1 Areas

The areas shown in Figure 1 in Appendix 1 were subject to the survey methods specified in 1.2.

1.2 Methods

The table attached in Appendix 2 details methods and effort for fauna.

Targeted survey for threatened orchids in flower at the time of survey were also made in the three E2 zones. These consisted of variable width belt transects to cover the zones.

1.3 Schedule

Survey was primarily undertaken over two weeks: 5-11th December and January 14-19th. Four anabats were set over 4 weeks.

2 RESULTS

2.1 Threatened Species

The following threatened species were recorded – all bats:

Table 1: Recorded threatened species

Species	Listing	Survey technique	Location	Comments
Grey-headed Flying Fox	V-BCA, V-EPBCA	Stagwatching, spotlighting	Scattered trees and clumps	Observed flying over from camp in Bomaderry every night. Few flowering trees. Observed feeding on mistletoe.
Long-eared Pied Bat (*Chalinobus dwyeri*)	V-TSCA, V-EPBCA	Anabat	Abernathy's Creek	Confident call identification on 3 nights, between 7/12/2018-8/1/2019. This is a species credit species.
Southern Myotis (*Myotis macropus*)	V-TSCA	Anabat	Abernathy's Creek	Only a single 'possible' call. Not detected by harp trapping. Possible call fragment from *Myotis macropus*/*Nyctophilus geoffroyi*/*Nyctophilus gouldii* species group. This is a species credit species.

2.2 General observations

A generally low diversity and abundance of fauna was noted. Notwithstanding the prevailing dry conditions, the condition and limited extent of the site vegetation combined with the poor connectivity to extensive habitat on Cambewarra Mountain is demonstrably a key limitation. Those fauna present are species consistently recorded in modified agricultural woodland habitats in the region.

2.2.1 Frogs

The following frogs were recorded:

- Southern Brown Tree Frog (*Litoria ewingii*)
- Peron's Tree Frog (*Litoria peronii*)
- Striped Marsh Frog (*Limnodynastes peronii*)
- Dwarf Green Tree Frog (*Litoria fallax*)
- Bleating Tree Frog (*Litoria dentata*).

Frogs were most diverse and abundant in the dam just off-site in southeast of Lot 4 DP268209 with all 5 species record here, but only 2-3 in other areas.

Dams noted to be dry in the original survey were noted to contain water and macrophytes indicating more rain had occurred this season.

Frogs were absent from the small patch of remnant freshwater wetland in the 2nd order drainage line on Lot 7 DP618693, which was very dry despite other water in other dams. Peron's Tree Frog were heard calling from the dam on Lot 1 DP1191186 upstream of this habitat in good numbers despite the poor water quality and lack of any aquatic vegetation, and were the only frog found in the dam downstream on Lot 2 DP1134376. This result strongly indicates the remnant wetland habitat in this drainage line is not likely to support any threatened frog.

Frog diversity along Abernathy's Creek was also low, and around the large dam on Lot 4 DP268209. Only Peron's Tree Frog, Striped Marsh Frog and Dwarf Green Tree Frog were found in these habitats, with these frogs being most common in the portion of the dam where it connects to a drainage line in the southeast corner.

2.2.2 Reptiles

Only three reptile species were recorded:

- Red-bellied Black Snake (*Pseudechis porphyriacus*):
- Eastern Water Skink (*Eulamprus quoyii*)
- Common Grass Skink (*Lampropholis guichenoti*)

2.2.3 Mammals

Mammals were low in diversity and abundance:

- Short-beaked Echidna (*Tachyglossus aculeatus*)
- Common Wombat (*Vombatus ursinus*)
- Eastern Grey Kangaroo (*Macropus giganteus*)
- Brushtail Possum (*Trichosurus vulpecula*)
- Sugar Glider (*Petaurus breviceps*)
- European Hare (**Lepus capensis*)
- Black Rat (**Rattus rattus*)

The Black Rat was the only mammal recorded in the Elliot A traps, as a single individual. This indicated a lack of antechinus and native rodents.

2.2.4 Bats

As noted above, the Large-eared Pied Bat was confirmed as present along Abernathy's Creek by Anabat on three nights. Only a 'possible' call was identified of the Southern Myotis. The bat specialist call identification report is provided in Appendix 3.

Harp traps captured 11 bats (5 in one trap on one night at the location shown in Photo 1). Most were caught in Abernathy's Creek, with a single *Vespadelus vulturnus* caught near the dam just adjacent to the southeast of the site on Lot 4 DP268209 where the trap was set in a flyway leading down to the dam. The other species trapped were:

- Chocolate Wattled Bat (*Chalinobus morio*)
- Gould's Wattled Bat (*Chalinobus gouldii*).

2.2.5 Birds

Bird diversity was relatively low, with medium and large passerines dominating ie. Noisy Miners, Indian Mynas, White Cockatoo, Corellas, Magpie and Kookaburra.

A pair of Boobooks (*Ninox boobook*) appear to include the site as part of their territory, recording calling from the E2 zones and seen roosting in the E2 zones and near the small clump of forest in the road reserve near Lot 2 DP1191186. Boobooks were also heard calling from Cambewarra Mountain.

Photo 1: Harp trap and anabat location where most bats were recorded on Abernathy's Creek

2.3 Orchid survey

No orchids of any species were detected.

While conditions were prevailing dry, other native species had regenerated in the E2 zone in the west of Abernathy's Creek with lack of cattle, and the filling of previous dry dams plus water in the creek indicated some rainfall has occurred in preceding months.

Cattle have been destocked from the E2 zone on Lot 4 DP708356, allowing extensive regeneration of the groundcover. Some common natives also sensitive to dry conditions (eg. *Arthropodium milleflorum*) were noted, mainly in the E2 zone on Lot 4.

The failure to detect any threatened species strongly reaffirms the low likelihood of such species occurring given the disturbance history.

Yours faithfully,

J. Berrigan

Jason Berrigan.
Director, JBEnviro
B. Nat. Res. (Hons). Grad. Cert. (Fish.).
MECANSW, MRZSNSW, MABS, MAHS, MAPCN

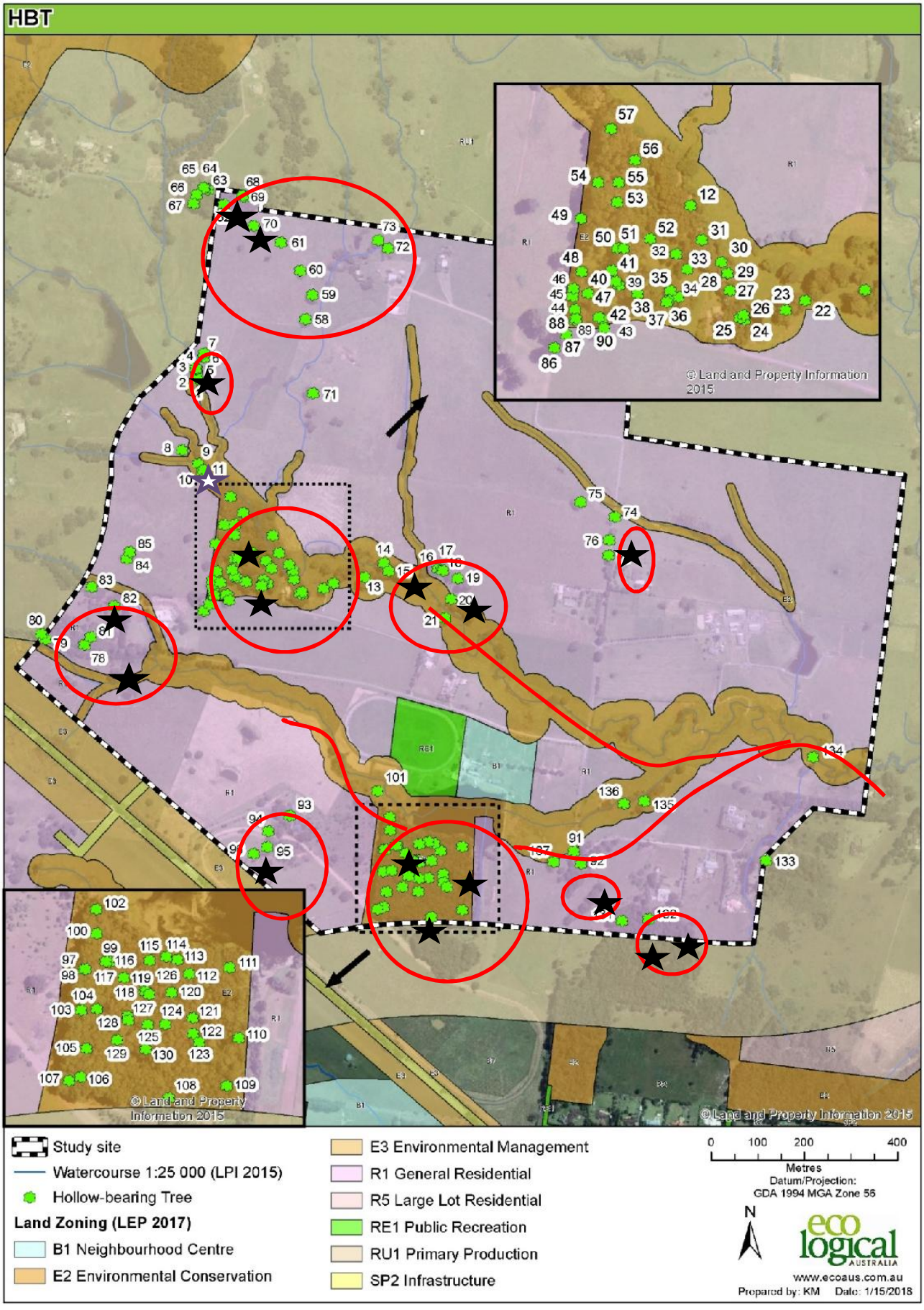
APPENDIX 1: SURVEY AREAS

In circled areas:

- PIR cameras (stars)
- Microbat call detection
- Stagwatching
- Spotlighting
- Call detection and playback
- Elliot A traps (two E2 zones)

Frog surveys:

- Along Abernathy's Creek as shown as red line
- In the 'oasis' in the northeast drainage line.
- All dams on site.
- Call playback and detection
- Diurnal and nocturnal searches for adult Green and Golden Bell Frog


HBT
© Land and Property Information 2015
Study site
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Hollow-bearing Tree
Land Zoning (LEP 2017)
B1 Neighbourhood Centre
E2 Environmental Conservation
E3 Environmental Management
R1 General Residential
R5 Large Lot Residential
RE1 Public Recreation
RU1 Primary Production
SP2 Infrastructure
0 100 200 400
Metres
Datum/Projection:
GDA 1994 MGA Zone 56
N
eco logical AUSTRALIA
www.ecoaus.com.au
Prepared by: KM Date: 1/15/2018

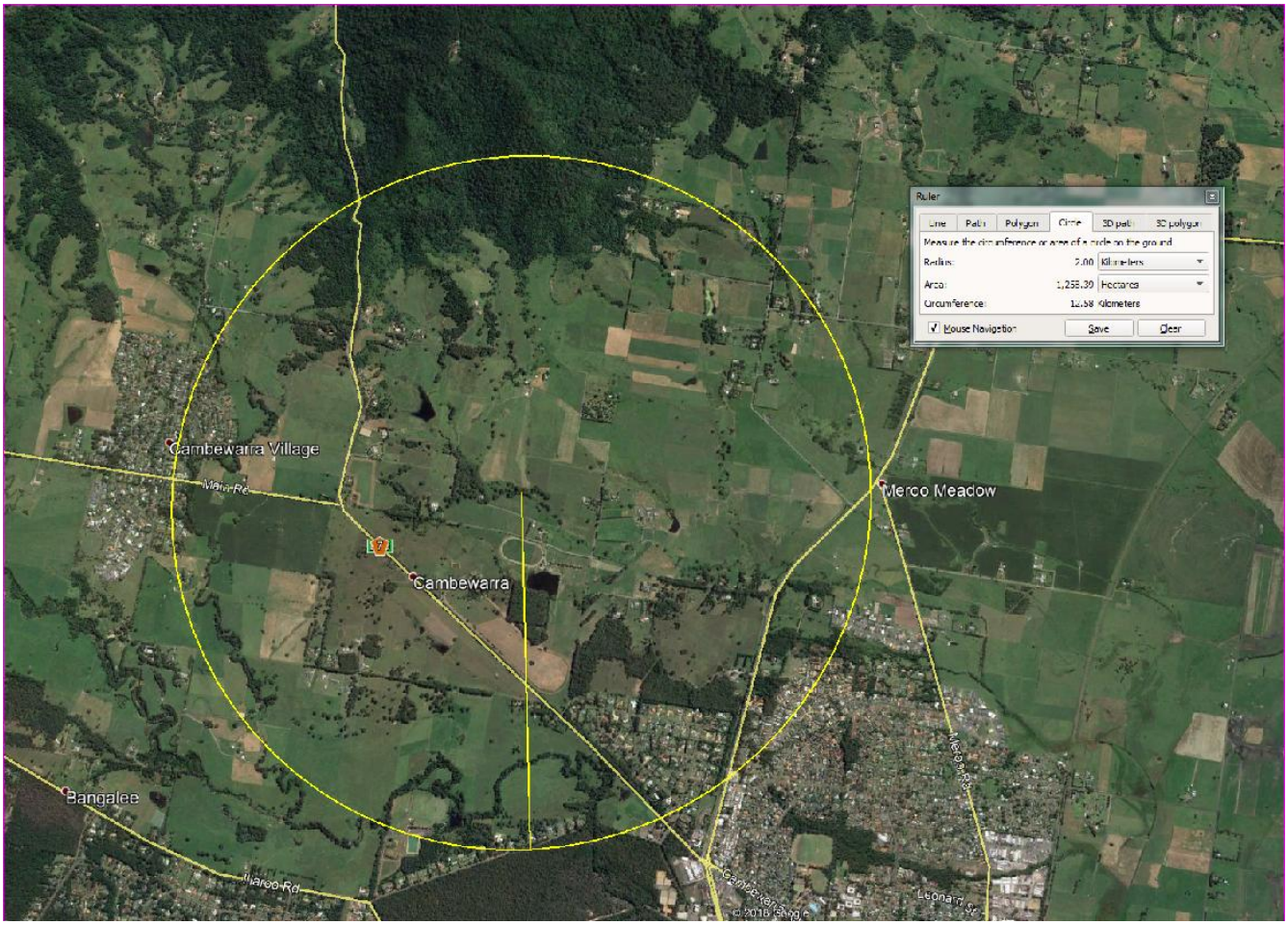
APPENDIX 2: SURVEY EFFORT AND TECHNIQUES

Table 2: Survey effort – spring-summer 2018 fauna survey

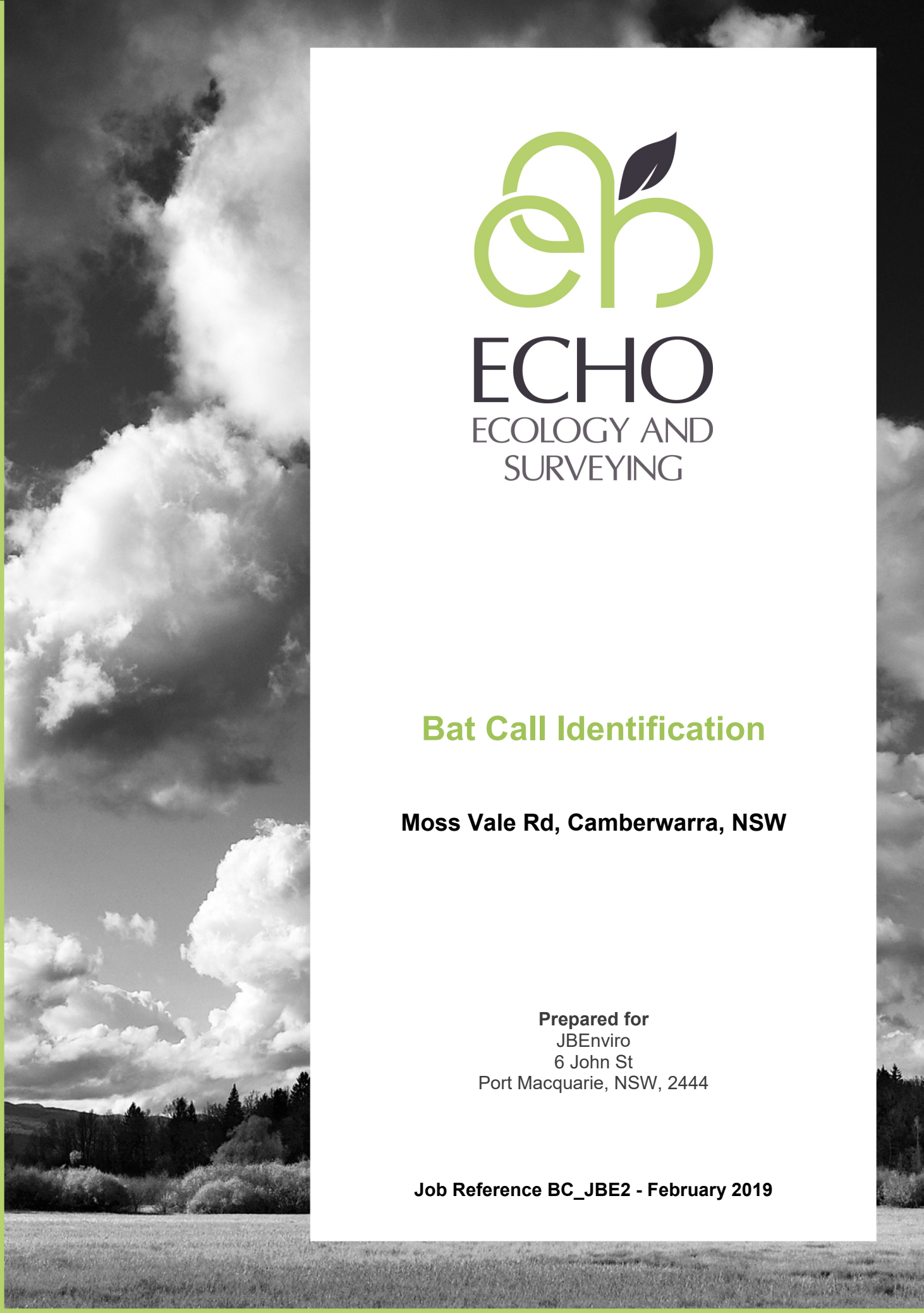
Method	Habitat (ha)	Stratification units	Total effort	Target species
Arboreal Elliot A	<50ha	1	17 PIR cameras set for 4 weeks (min. total effort of 476 trap nights)	Squirrel Glider, Brushtailed Phascogale,
Arboreal Elliot B	<50ha	1		
Arboreal hair tubes	<50ha	1		
Terrestrial Elliot A	<50ha	1	240 trap nights (60 traps x 4 nights)	Small terrestrial mammals
Terrestrial Elliot B	4 PIR cameras used for general survey. 112 trap nights.			
Cage traps	Habitat considered too disturbed or otherwise unsuitable for target species, but 4 terrestrial PIR traps set to record general terrestrial fauna. 112 trap nights.			
Terrestrial hair tubes	4 PIR cameras used for general survey. 112 trap nights.			
Nestboxes	<50ha	1	Not used – Eastern Pygmy Possum not a potential occurrence. PIR cameras will detect this species if it were present.	Eastern Pygmy Possum
Area search (birds)	<50ha	1	Incidental only during other survey	Ecosystem credit species, diurnal raptors, Glossy Black Cockatoo, Gang-gang
Call playback – birds and mammals	<50ha	1	12hrs with two sites per night.	Powerful Owl, Masked Owl, Barking Owl, Bush-stone Curlew, Koala, Yellow-bellied Glider
Call playback – frogs	<50ha	1	3hrs	Green and Golden Bell Frog
Call recording (Anabat)	<50ha	1	896hrs (24 nights @8hrs/night x 4 units)	Southern Myotis, Bent-wing Bats, East-coast Freetail Bat, Dwyer's Bat, Eastern False Pipistrelle
Harp trapping	<50ha	1	4 traps set for 4 nights in second survey period (16 trap nights).	Southern Myotis, Bent-wing Bats, East-coast Freetail Bat, Dwyer's Bat, Eastern False Pipistrelle
Mist netting	Not used as Golden-tipped Bat not likely potential occurrence, and harp traps used for Southern Myotis if confirmed present by acoustic detection.			
Pitfall traps with drift net	Not used as habitat too disturbed or otherwise unsuitable for target species.			

Method	Habitat (ha)	Stratification units	Total effort	Target species
Sand plots	Not used as habitat too disturbed or otherwise unsuitable for target species; and terrestrial PIR cameras used.			
Search for scats and signs	<50ha	1	Incidental under base of stagwatch trees	Glossy Black Cockatoo, Powerful Owl, Masked Owl, Barking Owl
Spotlighting from vehicle	Paddock trees only – included in spotlighting on foot as no trails through forest.			
Spotlighting on foot	<50ha	1	Min. 3hrs per night over 8 nights over two separate weeks: 36hrs	Powerful Owl, Masked Owl, Barking Owl, Koala, Yellow-bellied Glider, Greater Glider, Squirrel Glider, Brushtailed Phascogale, Spotted-tail Quoll, Ecosystem credit species
Stag-watching	<50ha	1	18hrs over two weeks	Glossy Black Cockatoo, Powerful Owl, Masked Owl, Barking Owl, Yellow-bellied Glider, Greater Glider, Squirrel Glider, Brushtailed Phascogale, Spotted-tail Quoll, Ecosystem credit species
Watercourse search (nocturnal)	1km	1	12hrs	Green and Golden Bell Frog
Wetland census (nocturnal)	<1ha	1		
Wetland census (diurnal)	<1ha	1	4hrs	Ecosystem credit species, Green and Golden Bell Frog

Appendix 3: 2km radius of bat detections



APPENDIX 4: BAT CALL IDENTIFICATION REPORT



ECHO
ECOLOGY AND SURVEYING

Bat Call Identification

Moss Vale Rd, Camberwarra, NSW

Prepared for
JBEnviro
6 John St
Port Macquarie, NSW, 2444

Job Reference BC_JBE2 - February 2019

Echo Ecology and Surveying • PO Box 4132 Crescent Head
Ecology - 0423 801 779 • **Surveying -** 0418 604 460 • **E:** info@echoecology.com.au • **W:** echoecology.com.au

This report has been prepared to document the analysis of digital ultrasonic bat echolocation calls received from a third party. The data was not collected by the author and as such no responsibility is taken for the quality of data collection or for the suitability of its subsequent use.

This report was authored by

Dr Anna McConville
PhD, B.Env.Sc.

Contents

List of Tables

List of Figures

1.0 INTRODUCTION

This report has been commissioned by JBEnviro to analyse bat echolocation call data (Anabat, Titley Electronics) targeting *Myotis macropus*, collected from Moss Vale Rd, Camberwarra, NSW. Data was provided electronically to the author. This report documents the methods involved in analysing bat call data and the results obtained only.

2.0 METHODS

The identification of bat echolocation calls recorded during surveys was undertaken using AnalookW (Chris Corben, Version 4.4a) software. The calls were recorded in zero crossings format using Data Division Ratio 8. The identification of calls was undertaken with reference to Pennay et al. (2004) and through the comparison of recorded reference calls from the Sydney Basin. Reference calls were obtained from the NSW database and from the authors personal collection.

For this project, bat call identification targeted *Myotis macropus* and only call sequences that could've been this species were closely examined. Some easily recognisable calls of threatened species were identified opportunistically while scanning for *Myotis macropus* calls. These are marked as presence only ('X') in the results table.

Each call sequence ('pass') was assigned to one of five categories, according to the confidence with which an identification could be made, being:

- Definite - Pass identified to species level and unlikely to be confused with another species
- Probable - Pass identified to species level and there is a low chance of confusion with another species
- Possible - Pass identified to species level but short duration or poor quality of the pass increases the chance of confusion with another species
- Species group - Pass could not be identified to species level and could belong to one of two or more species. Occurs more frequently when passes are short or of poor quality
- Unknown – Either:
    - Noise - background 'noise' files; or

- Unknown - passes by bats which are too short and/or of poor quality to confidently identify; or
- Unidentified - files that were confirmed to be bat calls but were of non-target species and so no attempt at identification was made.

Call sequences that were less than three pulses in length were not analysed and were assigned to 'Unknown' and only search phase calls were analysed. Furthermore, some species are difficult to differentiate using bat call analysis due to overlapping call frequencies and similar shape of plotted calls and in these cases calls were assigned to species groups.

The total number of passes (call sequences) per unit per night was tallied to give an index of activity.

It should be noted that the activity levels recorded at different sites may not be readily able to be compared. Activity levels should not be compared among species as different species have different detectability due to factors such as call loudness, foraging strategy and call identifying features. Activity comparisons among sites are dependent on many variables which need to be carefully controlled during data collection and statistically analysed. Influential variables include wind, rain, temperature, duration of recording, season, detector and microphone sensitivity, detector placement, weather protection devices etc.

Nomenclature follows the Australian Chiroptera taxonomic list described by Reardon et al. (2015).

2.1 Characteristics Used to Differentiate Species

Myotis macropus was differentiated from *Nyctophilus* spp. by calls with pulse intervals < 75 ms, initial slope > 400 OPS and often with a central kink and varying slopes among pulses.

Chalinolobus dwyeri, was differentiated from other bat species on the basis of characteristic frequency.

3.0 RESULTS

A total of 17,621 call sequences were recorded from 16 full nights of sampling and two partial nights (Anabat 4, 6/12/18 and Anabat 3, 4/12/18), of which 7,771 bat call sequences were recorded (those classified as 'unidentified', 'definite', 'probable', 'possible' and 'species groups'). Of the bat calls, one possible *Myotis macropus* sequence was identified, 23

sequences were identified as the *Myotis macropus / Nyctophilus gouldii / Nyctophilus geoffroyi* species group and three sequences as *Nyctophilus gouldii / Nyctophilus geoffroyi* species group (Table 3-1). *Chalinolobus dwyeri* was also recorded opportunistically as being present within the site.

It should be noted that bat detectors alone should not be relied on to determine presence / absence of *Myotis macropus* from a site as it overlaps in call characteristics with other species. Bat detectors are best used in conjunction with other survey methods such as targeted harp and mist netting surveys.

Table 3-1 below summarises the results of the bat call analysis.

Table 3-1: Results of bat call analysis (number of passes per site per night)

IDENTIFICATION	Anabat 3 7/12/2018	Anabat 3 8/12/2018	Anabat 3 9/12/2018	Anabat 3 3/01/2019	Anabat 4 6/12/2018	Anabat 4 8/12/2018	Anabat 4 9/12/2018	Anabat 4 3/01/2019	Anabat 4 4/01/2019	Swift 1 6/12/2018	Swift 1 7/12/2018	Swift 1 3/01/2019	Swift 1 4/01/2019	Swift 1 6/01/2019	Swift 1 7/01/2019	Swift 1 8/01/2019	Swift 1 9/01/2019	Swift 1 10/01/2019
DEFINITE																		
Chalinolobus dwyeri	-	-	-	-	-	X	-	X	-	-	X	-	-	-	-	-	-	-
POSSIBLE																		
Myotis macropus	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
SPECIES GROUPS																		
Myotis macropus / Nyctophilus geoffroyi / Nyctophilus gouldi	2	-	-	-	-	-	2	1	-	2	2	1	4	2	3	2	-	2
Nyctophilus geoffroyi / Nyctophilus gouldi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
UNKNOWN																		
'Noise' files	22	21	31	13	30	24	1070	49	168	1274	1464	273	1194	588	1355	65	432	1776
Unidentified	837	569	730	294	101	1217	195	188	54	319	545	414	575	590	559	290	1	266
TOTAL	**861**	**590**	**761**	**307**	**131**	**1241**	**1267**	**238**	**222**	**1596**	**2011**	**688**	**1773**	**1180**	**1917**	**357**	**433**	**2047**

4.0 SAMPLE CALLS

A sample of the calls actually identified from the site for each species is given below.

Figure 4-1: *Chalinolobus dwyeri* definite call

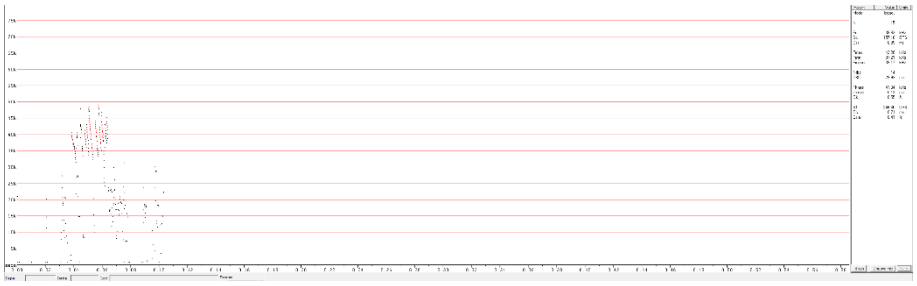


Figure 4-2: *Myotis macropus* possible call

Figure 4-3: *Nyctophilus* sp. species group

5.0 REFERENCES

Adams, M. D., Law, B.S., French, K.O. (2009). "Vegetation structure influences the vertical stratification of open- and edge-space aerial-foraging bats in harvested forests." Forest Ecology and Management 258(9): 2090-2100.

Adams, M. D., Law, B.S., French, K.O. (2010). Reliable automation of bat call identification for eastern New South Wales, Australia, using classification trees and AnaScheme software. *Acta Chiropterologica* 12(1): 231-245.

Australasian Bat Society Incorporated (undated) *Standards for reporting bat detector surveys*, http://batcall.csu.edu.au/abs/issues/ABS_Anabat_survey_standards.pdf

Churchill, S. (2008). *Australian Bats.* Second Edition Allen & Unwin; Crows Nest, NSW.

Law, B.S., Reinhold, L. and Pennay, M. (2002). Geographic variation in the echolocation calls of Vespadelus spp. (Vespertilionidae) from New South Wale and Queensland, Australia. *Acta Chiropterologica* 4: 201-215.

Pennay, M., Law, B. and Reinhold, L. (2004). *Bat calls of New South Wales: Region based guide to the echolocation calls of Microchiropteran bats*. NSW Department of Environment and Conservation, Hurstville.

Reardon, T., Armstrong, K., Jackson, S. (2015). *A current taxonomic list of Australian Chiroptera*, Australasian Bat Society, Inc. Version 2015-05-15.

Reinhold, L., Law, B., Ford, G. and Pennay, M. (2001a). *Key to the bat calls of south-east Queensland and north-east New South Wales*. Queensland Department of Natural Resources and Mines, State Forests of New South Wales, University of Southern Queensland, and New South Wales National Parks and Wildlife Service, Australia.

Reinhold, L., Herr, A., Lumsden, L., Reardon, T., Corben, C., Law, B., Prevett, P., Ford, G., Conole, L., Kutt, A., Milne, D. and Hoye, G. (2001b). Geographic variation in the echolocation calls of Gould's wattled bat *Chalinolobus gouldii*. *Australian Zoologist* 31: 618-624.

Van Dyck, S. and Strahan, R. (Eds.) (2008). *The Mammals of Australia: Third Edition*. New Holland; Sydney.