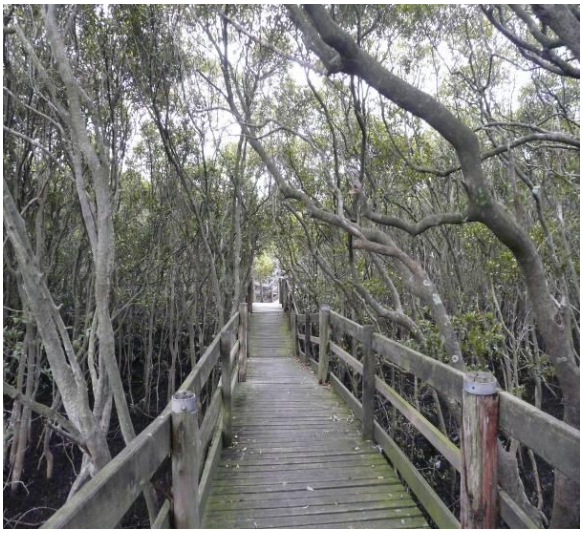
MICROBAT MONITORING REPORT

Woolooware Bay Town Centre

Prepared for
Bluestone Property Solutions Pty Ltd

25 January 2013



DOCUMENT TRACKING

ITEM	DETAIL
Project Name	Woolooware Bay Town Centre Microbat Monitoring Report
Project Number	12SUTECO-80
Project Manager	Beth Medway 02 8536 8612 PO Box 12 Sutherland NSW 1499
Prepared by	Rebecca Dwyer
Approved by	
Status	Final
Version Number	1
Last saved on	25 January 2013
Cover photos	Hollow suitable for microbat roosting within mangroves, viewing platform looking north, drainage channel in mangroves looking south, drainage channel looking north

This report should be cited as 'Eco Logical Australia 2013. *Woolooware Bay Town Centre Microbat Monitoring Report*. Prepared for Bluestone Property Solutions Pty Ltd.'

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Abbreviations

ABBREVIATION	DESCRIPTION
BPS	Bluestone Property Solutions Pty Ltd
DA	Development Application
DEC	Former NSW Department of Environment and Conservation
DECC	Former NSW Department of Environment and Climate Change
DoPI	Department of Planning and Infrastructure
ELA	Eco Logical Australia
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
ha	hectares
LGA	Local Government Area
m	metres
OEH	NSW Office of Environment and Heritage
TSC Act	NSW *Threatened Species Conservation Act 1995*
VMP	Vegetation Management Plan

Executive summary

In response to items raised in the Concept Plan Approval for Woolooware Bay Town Centre, Bluestone Property Solutions commissioned Eco Logical Australia to conduct detailed surveys for *Myotis macropus* (Large-footed Myotis) within the mangrove vegetation community adjacent to the proposed development. The Large-footed Myotis is listed as vulnerable under the NSW *Threatened Species Conservation Act 1995*.

Two microbat species were identified from Anabat recordings over the three survey nights: the Large-footed Myotis and *Chalinolobus gouldii* (Gould's Wattle Bat). Gould's Wattle Bat is not listed as a threatened species.

The habitat within the study area provides suitable foraging, roosting and potential maternity sites for the Large-footed Myotis.

Management strategies recommended to avoid or minimise impacting this threatened species and other microbats include:

- Preservation of native vegetation within the Estuarine Mangrove Forest (primarily mangroves)
- Provision of vegetated riparian buffer zones as per the approved concept design and vegetation management plan
- Design, construction and operation of landscaping features and buildings to minimise impacts associated with noise and light spill

1 Introduction

1.1 STUDY OBJECTIVES

This report has been prepared by Eco Logical Australia (ELA) at the request of Bluestone Property Solutions (BPS). The objectives of this study were to:

- Conduct a detailed survey in accordance with relevant guidelines to determine the presence of micro-chiropteran bat (microbat) species within the mangrove vegetation community adjacent to the proposed Woolooware Bay Town Centre development
- Determine if the *Myotis macropus* (Large-footed Myotis, also known as the Southern Myotis) is present – this species is listed as vulnerable under the NSW *Threatened Species Conservation Act 1995*
- Identify and describe the microbat habitats present in the study area and their condition
- Assess the impacts of the proposal on microbats and their habitat as a result of the proposed action
- Make recommendations regarding any environmental management and impact mitigation/amelioration measures

1.2 DESCRIPTION OF THE SUBJECT SITE AND STUDY AREA

The *subject site* is the area to be developed as the Woolooware Bay Town Centre and is defined as 461 Captain Cook Drive, Woolooware (Lot 11 DP 526492, Lot 20 DP 529644, Lot 21 DP 529644, Lot 1DP 711486 and Lot 1 DP 501920). The *study area* comprises the subject site as well as vegetation surrounding the subject site extending to Woolooware Bay to the north. (Refer to **Figure 1** and **Figure** 2.)

Two ecological communities, Swamp Oak Floodplain Forest and Estuarine Mangrove Forest, occur to the north of the subject site and within the drainage channel. Weeds and rubbish are prominent throughout the study area, although some native vegetation remains.

1.3 PLANNING CONTEXT

Concept Approval has been given for the proposed Woolooware Bay Town Centre in accordance with the NSW *Environmental Planning and Assessment Act 1979*. Clause 8 Schedule 5 of the Concept Approval requires the proponent (BPS) to undertake detailed survey for the Large-footed Myotis. If the species is present, specific management plans need to be developed and implemented to prevent adverse impacts that could result from the proposed Town Centre (e.g. associated with habitat disturbance or light spill).

The detailed fauna survey needs to be conducted in accordance with the OEH guidelines (*Draft Threatened Species Survey and Assessment Guidelines* DEC 2004). The guidelines suggest ultrasonic call recording in the period October-March with 'two sound activated recording devices utilised for the entire night staring at dusk for two nights'.

Figure 1: Regional context

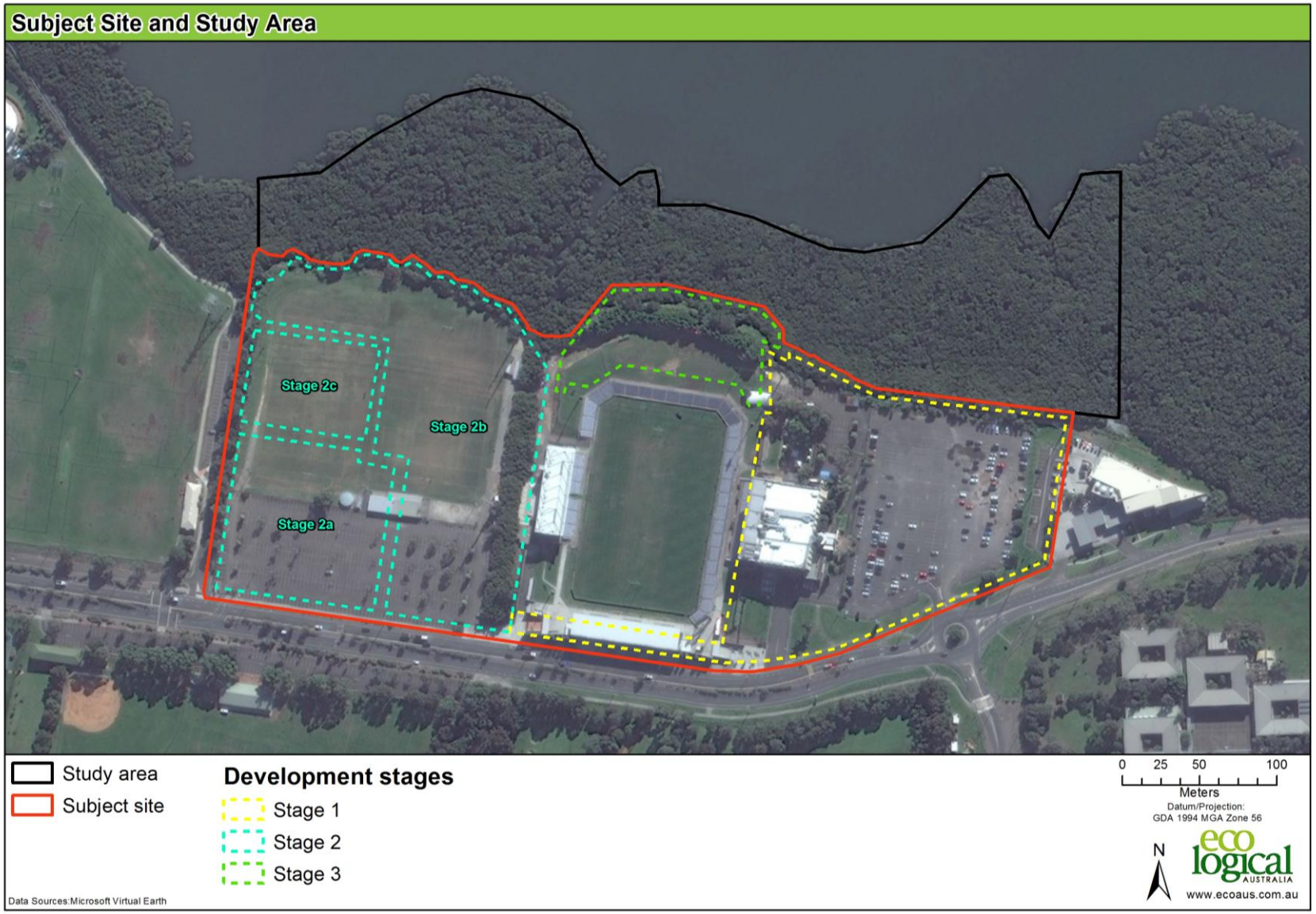

Figure 2: Subject site and study area

2 Methodology

2.1 SURVEY DATES, SURVEY TEAM AND CONDITIONS DURING SURVEY

The field survey was undertaken by Ecologist Rebecca Dwyer and Senior Consultant Beth Medway on 26 - 28 November 2012 for approximately seven person hours. Temperature ranged from 18.6°C – 25°C during the survey period and conditions were generally fine with little wind or cloud cover, except for a storm on the night of the 27 November. See **Table 1** for weather details.

Table 1: Weather conditions during field survey

DATE (2012)	MINIMUM DAILY TEMPERATURE (°C)	MAXIMUM DAILY TEMPERATURE (°C)	DAILY RAINFALL (MM)	TIME OF SUNSET (24HRS)
26 November	20.1	25	0	19:47
27 November	19.4	23.9	3.6	19:48
28 November	18.6	23.4	10.2	19:49

Source: Bureau of Meteorology (BoM): http://www.bom.gov.au/climate/data/index.shtml Sydney Airport Weather Station 066037.

2.2 SURVEY METHODS

Survey for microchiropteran bat species (microbats) involved the use of ultrasonic Anabat detectors, visual inspection and stag watches.

Except where specifically noted, the field survey was undertaken using hand-held GPS units, which were used to take GPS point locations of flora and fauna observed in the field. It is noted that these units can have errors in the accuracy of the locations taken of approximately 20m (subject to availability of satellites on the day).

2.2.1 Anabat detectors

Microbats were surveyed using two Anabat detectors equipped with ZCAIM recording devices. Anabat detectors were placed in four locations for three nights (as shown in **Figure 3**, AB1 and AB2 during the first night, then moved to AB3 and AB4 for the second and third nights). On each night of survey the Anabats were turned on between 1630 hours and 1800 hours and then turned off the following morning between 0730 hours and 0900 hours. Anabat calls were downloaded in the office and analysed by Alicia Lyon (Ecologist).

2.2.2 Call analysis

Bat calls were analysed using the program AnalookW (Version 3.3q 03 October 2006, written by Chris Corben, www.hoarybat.com). Call identifications were made using regional based guides to the echolocation calls of microbats in New South Wales (Pennay et al. 2004); and south-east Queensland and north-east New South Wales (Reinhold et al. 2001) and the accompanying reference library of over 200 calls from north-eastern NSW (http://www.forest.nsw.gov.au/research/bats/default.asp).

Bat calls are analysed using species-specific parameters of the call profile such as call shape, characteristic frequency, initial slope and time between calls (Reinhold et al. 2001). To ensure reliable and accurate results the following protocols (adapted from Lloyd et. al. 2006) were followed:

- Recordings containing less than three pulses were not analysed (Law et al. 1999)
- Only search phase calls were analysed (McKenzie et al. 2002)
- Four categories of confidence in species identification were used (Mills et al. 1996):
    - definite – identity not in doubt
    - probable – low probability of confusion with species of similar calls
    - possible – medium to high probability of confusion with species with similar calls
    - unidentifiable – calls made by bats which cannot be identified to even a species group
- *Nyctophilus* species are difficult to identify confidently from their calls and no attempt was made to identify this genus to species level (Pennay et al. 2004)

2.2.3 Visual inspection

Visual inspection of the mangroves occurred during the first survey night on 26 November 2012. It involved walking the foreshore to the north of the subject site and inspecting cracks and crevices observed in the mangroves for roosting bats. Headlamps on the lowest intensity settings and hand-held spotlights were used to illuminate the mangroves during inspection. Attempts were made to reduce any disturbance to roosting bats by minimising noise and by avoiding any direct contact (from spotlights) to the bats observed. Visual inspection of the mangroves totalled approximately two person hours.

2.2.4 Stag watches

Stag watches were conducted during the first survey night on 26 November 2012. Stag watches were conducted at the boardwalk (**Figure 3**). Bats were counted simultaneously by one observer between approximately 19:20 hours and 20:20 hours (sunset times in **Table 1**).

Figure 3: Field survey effort

3 Results

The inspection of hollows within the mangroves detected microbat activity and the stag watch survey observed microbats emerging from the hollows (i.e. microbats are roosting in the study area).

The Anabats recorded 369 sequences for the study period 26-28 November. Only 1% of sequences were able to be identified to species level with the remainder being too short or of low quality preventing positive identification of species (note that this is typical of Anabat analyses). General microbat activity was low with calls recorded less often than every ten minutes throughout the evening. Feeding buzzes and foraging activity were not recorded, with microbat activity restricted to commuting.

There were two species identified (**Table 2**). The call profiles of the two species recorded by Anabat are presented in **Appendix A**.

Table 2: Pooled Anabat results 26-28 November 2012

SPECIES NAME	COMMON NAME	NO. OF CALLS	DEFINITE	PROBABLE	POSSIBLE
Chalinolobus gouldii	Gould's Wattled Bat	2	1	2	
Myotis macropus	Large-footed Myotis	2		2	
Indistinguishable		2			
Low		347			
Short		13			
Total sequences		366			
Total sequences identified		6			
% identified		1%			

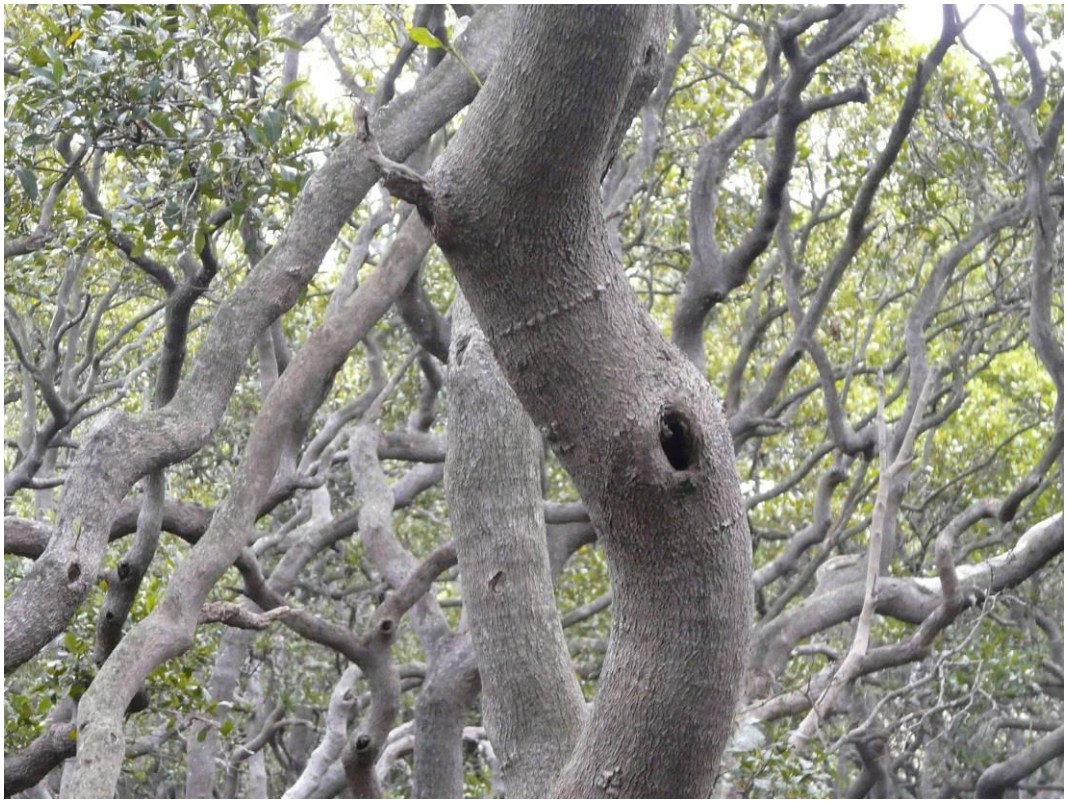

Figure 4: Potential roosting or maternity hollow in a Grey Mangrove

Figure 5: Estuarine Mangrove Forest – note weed invasion and rubbish

4 Management recommendations

4.1 PROFILE OF THE LARGE-FOOTED MYOTIS

The following description of the Large-footed Myotis is from the OEH website (http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10549).

The Large-footed Myotis (also referred to as the Southern Myotis) has disproportionately large feet; more than 8 mm long, with widely-spaced toes which are distinctly hairy and with long, curved claws. It has dark-grey to reddish brown fur above and is paler below. It weighs up to 15 grams and has a wingspan of about 28 cm.

It generally roosts in groups of 10-15 close to water in caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage. They forage for insects and small fish by raking their feet across the water surface. In NSW, females have one young each year usually in November or December.

The species is threatened by:

- Loss or disturbance of roosting sites
- Clearing adjacent to foraging areas
- Application of pesticides in or adjacent to foraging areas
- Reduction in stream water quality affecting food resources

Activities that can assist recover the species in NSW include:

- Retain native vegetation along streams and rivers and around other waterbodies
- Minimise the use of pesticides adjacent to foraging areas
- Protect roosts from damage or disturbance

4.2 SUMMARY OF IMPACTS AND MITIGATION MEASURES

The study area provides suitable foraging in the mangroves to the north of the subject site and within the drainage line off Woolooware Bay. Potential roosting and maternity habitat are available within hollows of *Avicennia marina* subsp*. austalasica* (Grey Mangrove) within the Estuarine Mangrove Forest and adjacent Swamp Oak Floodplain Forest (**Figure** 6).

Direct and indirect impacts associated with development of Woolooware Bay Town Centre could include loss or disturbance of microbat habitat through vegetation clearing, noise or artificial lighting. Water quality may also be affected, although current water quality in the drainage channel and immediately adjacent the foreshore is likely to be poor (based on visual interpretation because there is no data available).

Table 3 describes possible impacts and recommended mitigation measures, many of which will be addressed through the VMP and detailed design/construction planning. To mitigate potential impacts the management actions have been proposed which includes recommendations of architectural design and management strategies. These focus on the Large-footed Myotis and should be used in conjunction with those provided in the flora and fauna assessment (ELA 2011).

Figure 6: Vegetation communities

Table 3: Impact assessment and mitigation measures

ISSUE	IMPACT	MITIGATION
Artificial lighting	There is limited information available on the biology and behaviour of the Large-footed Myotis or the impacts of artificial lighting on Australian microbats. There is potential that artificial lighting may impact on the foraging behaviour and emergence of microbats. Emergence of microbats is dependent upon a number of variables including the availability of light. Research of urban bats in Adelaide City parklands suggests that some species of microbats may utilise artificial lighting for foraging (Scanlon and Petit 2008), however, an international study of *Myotis daubentonii* identified this species preferred foraging in dark environments due to risk of predation and thus emerged later in the night when compared with other species (Shirley et al. 2001). Another experiment on artificial lighting identified that Myotis and *Rhinolophus* sp. were negatively impacted and displayed avoidance to lighting when commuting between habitats (Stone et al. 2009). One plausible explanation is that both species are slow fliers (Stone et al 2012) and thus vulnerable to predation especially for *Myotis* sp in open habitats. Artificial street lighting and additional lighting used during night markets may reduce the foraging habitat available for this species if the light penetrates into the mangrove habitat. This could have the potential to fragment habitats.	Management options to mitigate impacts include the following: • Avoid artificial lighting within native vegetation communities or pointing towards potential microbat habitats (i.e. mangroves and waterways) • Reduce the intensity of artificial lighting where possible or increase the spacing between lights • Restrict access into the Estuarine Mangrove Forest and Swamp Oak Floodplain Forest • Avoid night construction works • Turn lights off where possible • Use native plantings to provide a buffer to the Estuarine Mangrove Forest
Noise	The study area is currently subject to significant and frequent noise from aircraft, boats, vehicle traffic/parking and sporting activities (ELA 2011). An increase in noise is predicted as part of the proposed construction and due to anticipated increase in human activity in the subject site. Additional significant noise adjacent habitat is likely to deter Large-footed Myotis from roosting.	Construction noise can be mitigated as per DECCW noise level criteria in the ecological assessment of the concept plan (ELA 2011). Other considerations include: • Provide a vegetated buffer between proposed infrastructure (e.g. paths, seating, buildings) and Estuarine Mangrove Forest

ISSUE	IMPACT	MITIGATION
	If excessive noise occurs during October to January this may impact on breeding cycles.	• Schedule the timing and location of works to minimise noise impacts in areas within 50 m of Estuarine Mangrove Forest, especially during October to January when mothers have young
Habitat	Habitat loss by removal of mangroves should be avoided where possible by constructing bridges/paths in previously disturbed areas. There is potential to improve the quality and extent of habitat by removal of rubbish and weeds, and through establishment of vegetated buffers – this will be achieved in accordance with a Vegetation Management Plan (VMP)	Management options include: • Prepare and implement a VMP to maintain/improve existing native vegetation within the Estuarine Mangrove Forest and Swamp Oak Floodplain Forest and provide vegetated riparian buffers in accordance with approved Concept Plan • Ongoing maintenance to address potential weed and rubbish problems • Monitor health of vegetation communities
Water quality	The Large-footed Myotis is highly dependent on water influenced habitats for foraging, roosting and breeding. There is potential that the water quality will be affected as a result of the development and proposed stormwater works. However, it is uncertain if this will be a positive or negative impact. (According to Sutherland Shire Council's strategic water monitoring program 2011-12, water quality in the mangrove channel is 'fair to poor'.) An increase in nutrients such as phosphorus, decline in salinity and turbidity, or increase in pesticides/herbicides or other chemicals in the water would adversely impact the Large-footed Myotis (Law and Anderson 1999). The use of pesticide and herbicide within the adjacent terrestrial environments has the potential to leach into the aquatic environment or	Management options include: • Minimise the use of pesticides and herbicides within the study area • Contract qualified bush regenerators to implement the VMP including appropriate chemical treatments near aquatic environments • Consider stormwater treatments to reduce pollutants entering waterways • Encourage Council/agencies to educate the community about water pollution – including in the upper catchment • Conduct water quality testing to inform management

ISSUE	IMPACT	MITIGATION
	through stormwater outlets. This may reduce the availability of prey or cause a decline in mangrove health (Environment Australia 1999).	
Introduced species	Weeds have invaded the margins of estuarine habitat in the study area. These include environmental weeds and perennial grasses from the surrounding sporting fields. Weeds reduce the extent and condition of estuarine habitat available (as well as adversely impacting amenity). This would have a flow-on effect to the Large-footed Myotis by reducing the amount of foraging, breeding and roosting habitat available. Additionally, the proposed works may encourage exotic fauna species within the terrestrial and aquatic habitats. These species may be translocated from infested habitats during construction works. The establishment of these species may reduce the availability of prey for the Large-footed Myotis. Predation by the *Rattus rattus* (Black Rat) is a risk to Myotis while roosting. Evidence of significant predation by Black Rat is responsible for a decline *Corynorhinus townsendii* (Townsend big-eared bat) a rare microbat in California (Fellers 2000).	Management options include: • Implement weeds treatment as per the VMP • Use local provenance species or non-invasive horticultural species, for landscaping • Reduce foraging habitat for exotic fauna species such as the Black Rat (e.g. through appropriate waste management practices) • Monitor population of exotic fauna and consider a pest management plan
Anthropogenic disturbances	Human disturbance has impacted on the Estuarine Mangrove Forest by the accumulation of rubbish within the foreshores, trampling of pneumatophores and the removal of mangroves for access to the waterway. The proposal is likely to increase the number of people accessing the study area, and will require ongoing management.	Management options include: • Install interpretive signage of the significance of the threatened vegetation community and threatened fauna habitat • Reduce access within the mangroves i.e. install permanent fencing and provide clearly designated walkways (paths/boardwalks) • Provide appropriate waste and recycling disposal facilities

ISSUE	IMPACT	MITIGATION
		• Consider how plantings can provide a barrier to anthropogenic disturbances • Install and maintain gross pollutant traps at stormwater outlets • Implement suitable erosion and sedimentation plan prior to construction

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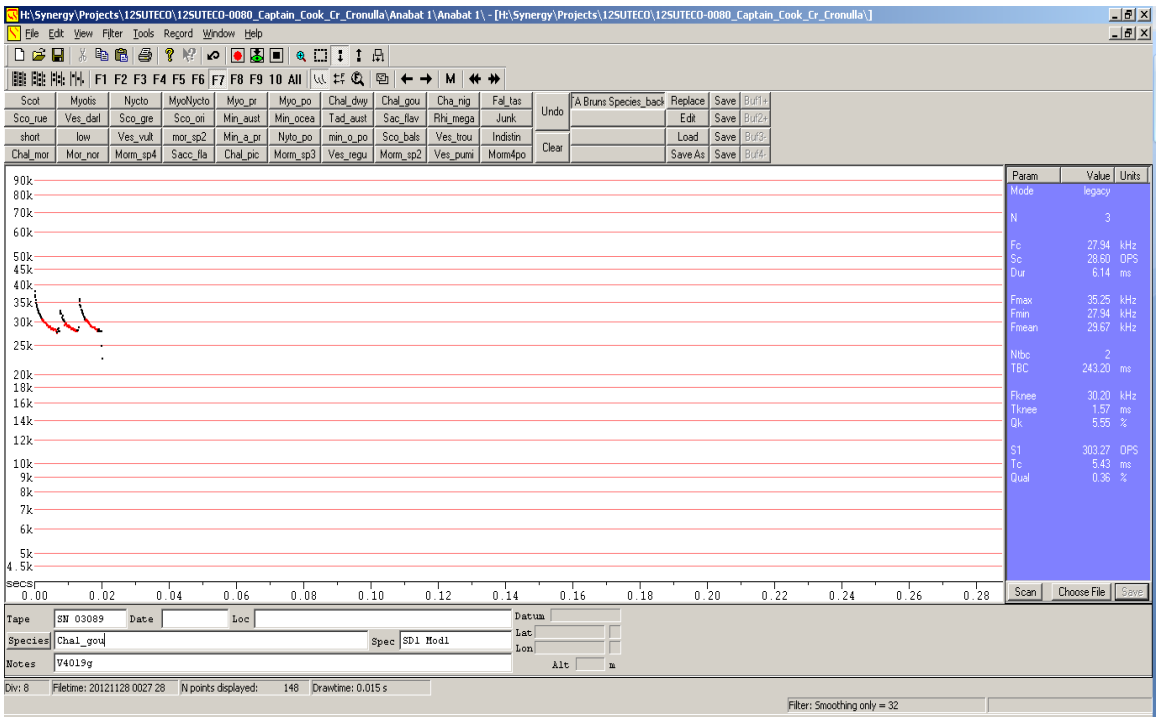
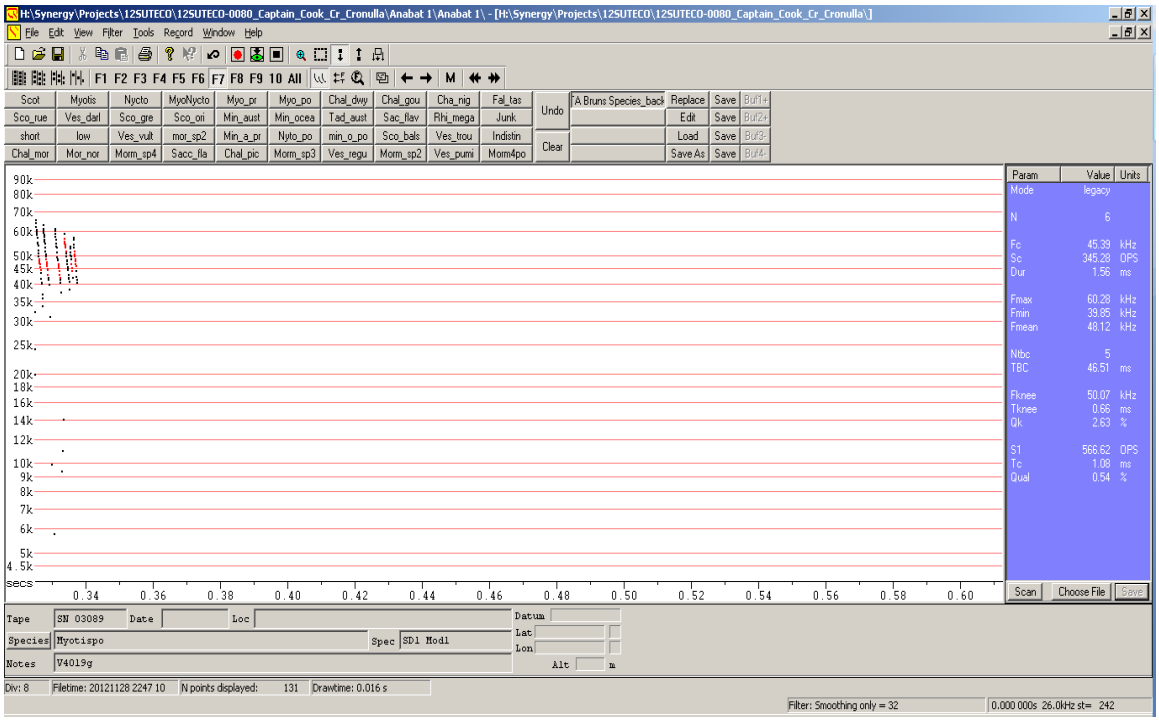
Appendix A: Anabat results



Call profile for *Chalinolobus gouldii* recorded at Captain Cook Drive, Cronulla at 00:27 on 28 November 2012



Call profile for *Myotis macropus* recorded at Captain Cook Drive, Cronulla at 22:47 on 28 November 2012

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Newcastle NSW 2300
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Narooma NSW 2546
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Coffs Harbour Jetty NSW 2450
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F 02 6651 6890

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