Flora and Fauna Assessment

Lot 1 DP 1019113, 98 Coachwood Drive, Medowie

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Document Status

Version	Purpose of Document	Orig	Review	Review Date
Draft	Draft for Client Review	BS	ZA, IM	3/09/2013
Final	Final of Submission	BS	ZA	10/09/2013

Approval for Issue

Name	Signature	Date
Ziggy Andersons		10/09/2013

Summary

RPS Australia East Pty Ltd (RPS) was engaged by Carman Surveyors Pty Ltd to provide a Flora and Fauna Assessment for a proposed land rezoning and subsequent residential development of a 61.9 hectare parcel of land in Medowie, NSW. The parcel is known specifically as Lot 1 in DP 1019113, 98 Coachwood Drive, Medowie and lies adjacent and to the east of existing residential developments on Coachwood Drive.

The objective of this assessment was to provide a description of the terrestrial habitats available on site for both flora and fauna, determine the likelihood of occurrence of threatened species and their habitats as well as assessing the likelihood of the proposal to have a significant impact on any threatened species, populations or ecological communities listed within the Threatened Species Conservation Act 1995 (TSC Act) and/or Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). Recommendations with regard to minimisation and mitigation of impacts are provided for any ecologically significant values on site. The report recognises the relevant requirements of the Environmental Planning and Assessment Act 1979 (EP&A Act) as amended by the Environmental Planning and Assessment Amendment Act 1997 (EP&AA Act) as well as specific requirements of the Port Stephens Council (PSC) Comprehensive Koala Plan of Management (CKPoM) (2002).

Database searches were undertaken to identify existing records of threatened species, populations and endangered ecological communities occurring within the site and the surrounding locality. Flora and fauna surveys were undertaken across the site during May 2013.

No threatened plant species listed under the EPBC Act or TSC Act were recorded in the site during field surveys.

Four vegetation communities are present on site:

- MU 30 Coastal Plains Smooth-barked Apple Woodland;
- MU 37 Swamp Mahogany – Paperbark Forest;
- MU 42 Riparian Melaleuca Swamp Woodland; and
- MU 44 Coastal Wet Sand Cyperoid Heath.

Swamp Mahogany – Paperbark Forest and Riparian Melaleuca Swamp Woodland are commensurate with 'Swamp sclerophyll forest on coastal floodplains of the NSW north coast, Sydney Basin bioregion and South East Corner bioregions' which is listed as an Endangered Ecological Community under the TSC Act.

Terrestrial fauna surveys across the site identified three threatened fauna species, namely the Glossy Black-Cockatoo (*Calyptorhynchus lathami*), Grey-headed Flying-fox (*Pteropus poliocephalus*), and Little Bentwing-bat (*Miniopterus australis*) as occurring on the site. Preferred Koala Habitat, Habitat Buffers, and Habitat Linking Areas as mapped in the PSC Koala Habitat Planning Map – Medowie/Tilligerry (2006) are present within the site, and ground-truthing during this survey confirmed the presence of these habitats on site, albeit not exactly as mapped by PSC.

The habitat within the majority of the site is diverse both structurally and floristically. Canopy trees include important winter flowering species such as *Eucalyptus robusta* (Swamp Mahogany) that provide foraging opportunities for birds and arboreal mammals. The understory is varied and often dense. Dense ground cover vegetation, leaf litter, and frequent occurrence of fallen logs and woody debris provides abundant shelter for terrestrial mammals, reptiles, and frogs. The age class of canopy trees is varied, though generally lacking in very large mature trees that might form hollows. The frequency of hollow-bearing trees across the site was generally low, with the highest numbers being found in the upland areas of Coastal Plains Smooth-barked Apple Woodland to the west. Towards the east of the site, the ground becomes increasingly swampy

transitioning through moist riparian vegetation into permanently inundated wetlands with a dense groundcover of sedges.

It was determined that 23 threatened fauna species and two flora species listed under the TSC Act and five threatened fauna species and two threatened flora listed under the EPBC Act may possibly occur within the impact areas. Assessments of Significance (see **Appendix 1**) concluded that the proposal was unlikely to significantly impact on any of these threatened species.

The Port Stephens Council Comprehensive Koala Plan of Management supersedes SEPP44 in the Port Stephens Local Government Area. Assessment under the CKPoM found that Preferred Koala Habitat, Habitat Buffers, and Habitat Linking Areas occur on site

Mitigation measures have been recommended where impacts cannot be avoided, and the implementation of these measures should reduce adverse impacts on ecological values of the site. Concept plans for the proposed urban development have been designed to minimise the impact to EECs and Preferred Koala Habitat where possible.

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1.0 Introduction

RPS Australia East Pty Ltd (RPS) was engaged by Carman Surveyors Pty Ltd to provide a Flora and Fauna assessment for a proposed land rezoning and residential development of a 61.93 hectare parcel of land located in Medowie, NSW (see **Figure 1**). The parcel is known specifically as Lot 1 in DP 1019113, 98 Coachwood Drive, Medowie and lies adjacent and to the east of existing residential developments on Coachwood Drive, herewith referred to as the 'site'. The site is currently zoned as 7a Environment Protection zoning under Port Stephens LEP 2000 which is to become E2 Zoning under Draft Port Stephens LEP 2013.

It is proposed that the site is to be rezoned to a combination of R2 Low Density Residential and E1 National Parks and Nature Reserves zoning as defined by the Draft Port Stephens LEP 2013. The proposed activity includes the rezoning of 35.34 hectares for residential housing and drainage reserves, herewith referred to as the 'urban areas', as well as a 26.58 hectares of conservation area where native vegetation will be preserved, herewith referred to as the 'conservation area'. This assessment is based on the rezoning area and the potential clearing of land within it associated with a proposed residential development for the site. The proposed rezoning is displayed in **Figure 2**.

This assessment aims to examine the likelihood of the proposal to have a significant impact on any threatened species, populations or ecological communities listed within the *Threatened Species Conservation Act 1995* (TSC Act). The report recognises the relevant requirements of the *Environmental Planning and Assessment Act 1979* (EP&A Act) as amended by the *Environmental Planning and Assessment Amendment Act 1997* (EP&AA Act). Assessment is also made with regard to those threatened entities listed federally under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

1.1 Site Particulars

Locality – Medowie, NSW

LGA – Port Stephens Council.

Area – The site is 61.93ha in total.

Zoning – 7a Environment Protection (Port Stephens LEP 2000): Proposed to rezoned to a combination of R2 Low Density Residential and E1 National Parks and Nature Reserves (as defined by the Draft Port Stephens LEP 2013).

Boundaries – The site lies in the centre of the Port Stephens Council LGA, on the eastern edge of the suburb of Medowie and represents an extension of the 'Kindlebark Estate' urban development. A residential development along Coachwood Drive borders the site to the west and south and native bushland within Medowie State Forest borders to the northwest. To the east, a large unbroken tract of native bushland within Salt Ash Air Weapons Range extends from the site to Twelve Mile Creek and the coast of Port Stephens. The eastern border of the site also includes the northern end of Moffats Swamp Nature Reserve. To the southeast, a decommissioned Hunter Water Corporation development with eight small ponds lies between residential areas and Moffats Swamp.

Current Land Use – The entire site consists of native bushland bordering an existing residential development and contiguous with the Salt Ash Air Weapons Range. A few unpaved tracks run from the residential development to the edge of Moffats Swamp and parallel to the associated low swampy areas.

Topography – The site slopes from an elevation of approximately 30m AHD near residential developments in the northwest down to approximately 10m AHD in Moffats Swamp in the southeast. The general

topography of the site is a gentle west to east decline from residential developments in the west down to swampland in the east.

Hydrology- A shallow, sandy ephemeral drainage line runs from north to south along the site's eastern border and into Moffats Swamp. A small ephemeral west to east flowing drainage line runs across the southern end of the site from existing residential developments, through a constructed storm water management dam, and into Moffats Swamp. An additional small storm water management dam is also found near the centre of the site.

Vegetation – The vegetation on site is unfragmented native bushland which is contiguous with an extensive tract to the north and east of the site. Vegetation intergrades from east to west through coastal plains woodland (31.41 ha), riparian woodland (22.22 ha), and swampy rushland (4.04 ha).

1.2 Description of the Proposal

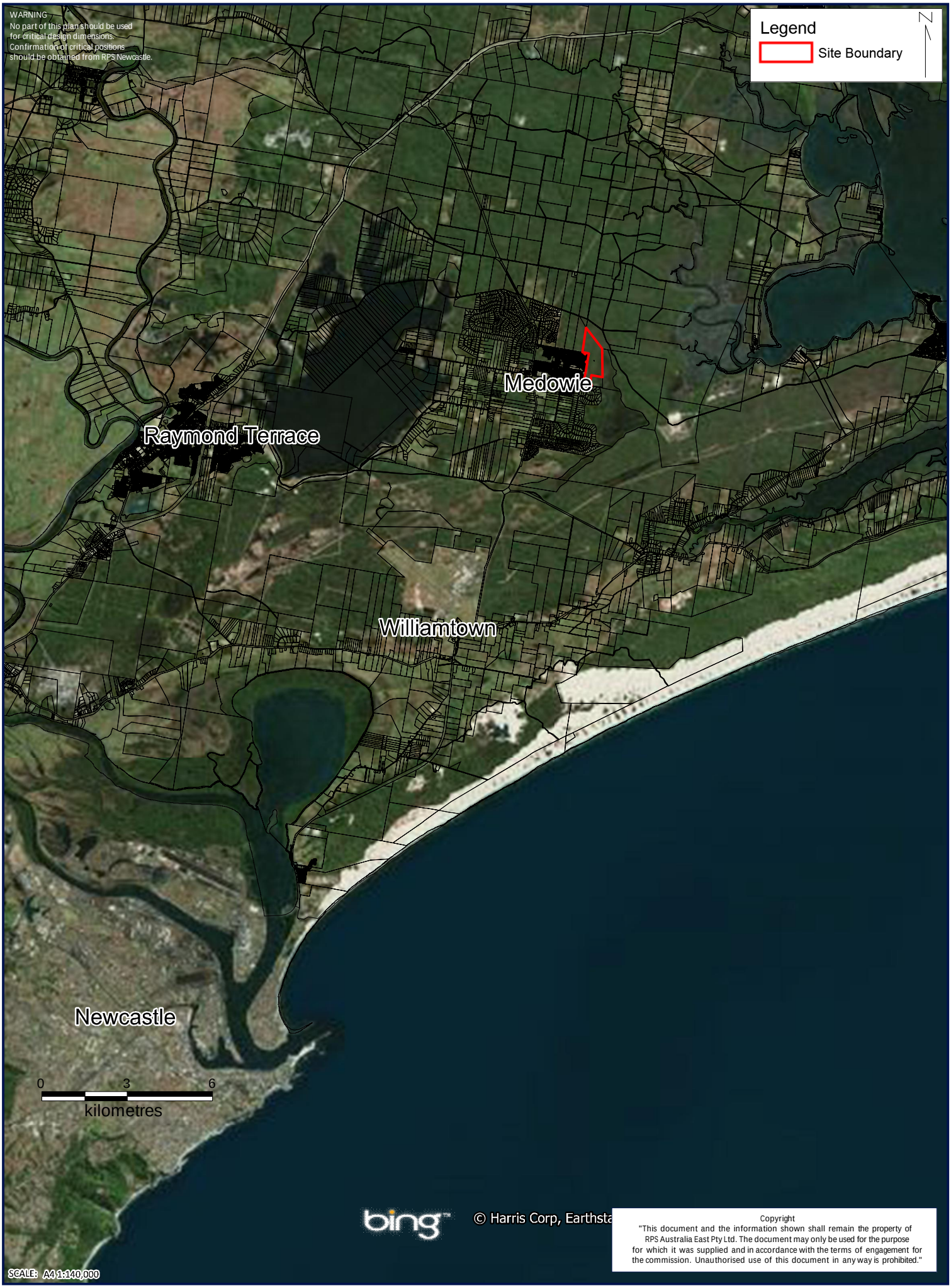
The proposal involves the request to modify the land zoning from 7a Environment Protection zoning to a combination of R2 Low Density Residential and E1 National Parks and Nature Reserve zoning. The proposed R2 Low Density Residential land use zoning covers an area of 35.34 hectares with 32.23 hectares being native vegetation. Within that area a concept masterplan (dated 17/07/2013 Carman Surveyors ref: 2165-7C) has been prepared which will potentially require 26.90 hectares of native vegetation to be removed. An area of 26.58 hectares of ecological significant land will be retained and maintained in perpetuity within the proposed E1 National Parks and Nature Reserve zoning as a result of the proposal.

1.3 Scope of the Study

The scope of this flora and fauna assessment is to:

- identify vascular plant species occurring within the site, including any threatened species listed under the TSC Act or EPBC Act;
- identify and map the extent of vegetation communities within the site, including any Endangered Ecological Communities listed under the TSC Act or EPBC Act;
- identify any fauna species, including threatened and migratory species, and populations or their habitats, which occur within the site and are known to occur in the wider locality;
- assess the level of utilisation of the site by Koalas and verify the habitat mapping within the Port Stephens Council's Comprehensive Koala Plan of Management (CKPoM)
- assess the potential of the proposed development to have a significant impact on any threatened species, populations or ecological communities (or their habitats) identified from the site; and
- recommend measures that could be implemented to avoid, minimise, manage or monitor potential impacts of the proposal.

In addition to the survey work conducted within the site boundary and its immediate surrounds, consideration has been afforded to habitats within 10km of the site in order to appreciate the environmental context of the site. This assessment has included assessment of potential indirect impacts.



TITLE:	FIGURE 1: SITE LOCATION	LOCATION:	LOT 1 COACHWOOD DRV MEDOWIE	DATUM:	GDA 94	DATE:	12/07/2013
				PROJECTION:	MGA ZONE 56	PURPOSE:	REPORT FIGURE

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1.4 Legislation and Policy

1.4.1 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, defined in the EPBC Act as matters of National Environmental Significance (NES). Matters of NES identified in the Act include:

- World heritage properties;
- National heritage places;
- Wetlands of international importance (listed under the Ramsar Convention);
- Threatened species and communities;
- Migratory species protected under international agreements;
- Commonwealth marine areas; and
- The Great Barrier Reef Marine Park.

Under the EPBC Act, actions that have, or are likely to have, a significant impact on a matter of NES require approval from the Australian Government Minister for Sustainability, Environment, Water, Population and Communities (the Minister).

1.4.2 NSW Threatened Species Conservation Act 1995

The NSW *Threatened Species Conservation Act 1995* (TSC Act) provides for the protection and management of threatened species, populations and ecological communities listed under the schedules 1, 1A and 2 of the Act. The purpose of the TSC Act is to:

- Conserve biological diversity and promote ecologically sustainable development;
- Prevent the extinction and promote the recovery of threatened species, populations and ecological communities;
- Protect the critical habitat of those species, populations and ecological communities that are endangered;
- Eliminate or manage certain processes that threaten the survival or evolutionary development of threatened species, populations and ecological communities;
- Ensure that the impact of any action affecting threatened species, populations and ecological communities is properly assessed; and
- Encourage the conservation of threatened species, populations and ecological communities through co-operative management.

1.4.3 NSW Environmental Planning and Assessment Act 1979

The proposal will be submitted (subsequent to approval of the rezoning) for approval under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), which provides the framework for assessing developments in NSW.

1.4.4 Noxious Weeds Act 1993

The *NSW Noxious Weeds Act 1993* provides for the identification and classification for noxious weeds in each New South Wales Local Government Area (LGA). The Act imposes obligations on occupiers of land to control noxious weeds declared for their LGA.

1.4.5 Port Stephens Council (PSC) Comprehensive Koala Plan of Management (CKPoM) (2002)

The Port Stephens Council CKPoM has been prepared in accordance with State Environmental Planning Policy No. 44 - Koala Habitat Protection (SEPP 44). *Schedule 2 of State Environmental Planning Policy (SEPP) No. 44 – 'Koala Habitat Protection'* aims to encourage the conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range, and to reverse the current state trend of koala population decline. The Port Stephens Council CKPoM intends to supersede the requirements of SEPP 44 for the investigation of potential and core koala habitat within Port Stephens Council Local Government Area.

1.4.6 Water management Act 2000

Controlled activities carried out in, on or under waterfront land are regulated by the *Water Management Act 2000* (WM Act). The NSW Office of Water administers the WM Act and is required to assess the impact of any proposed controlled activity to ensure that no more than minimal harm will be done to waterfront land as a consequence of carrying out the controlled activity

1.5 Qualifications and Licensing

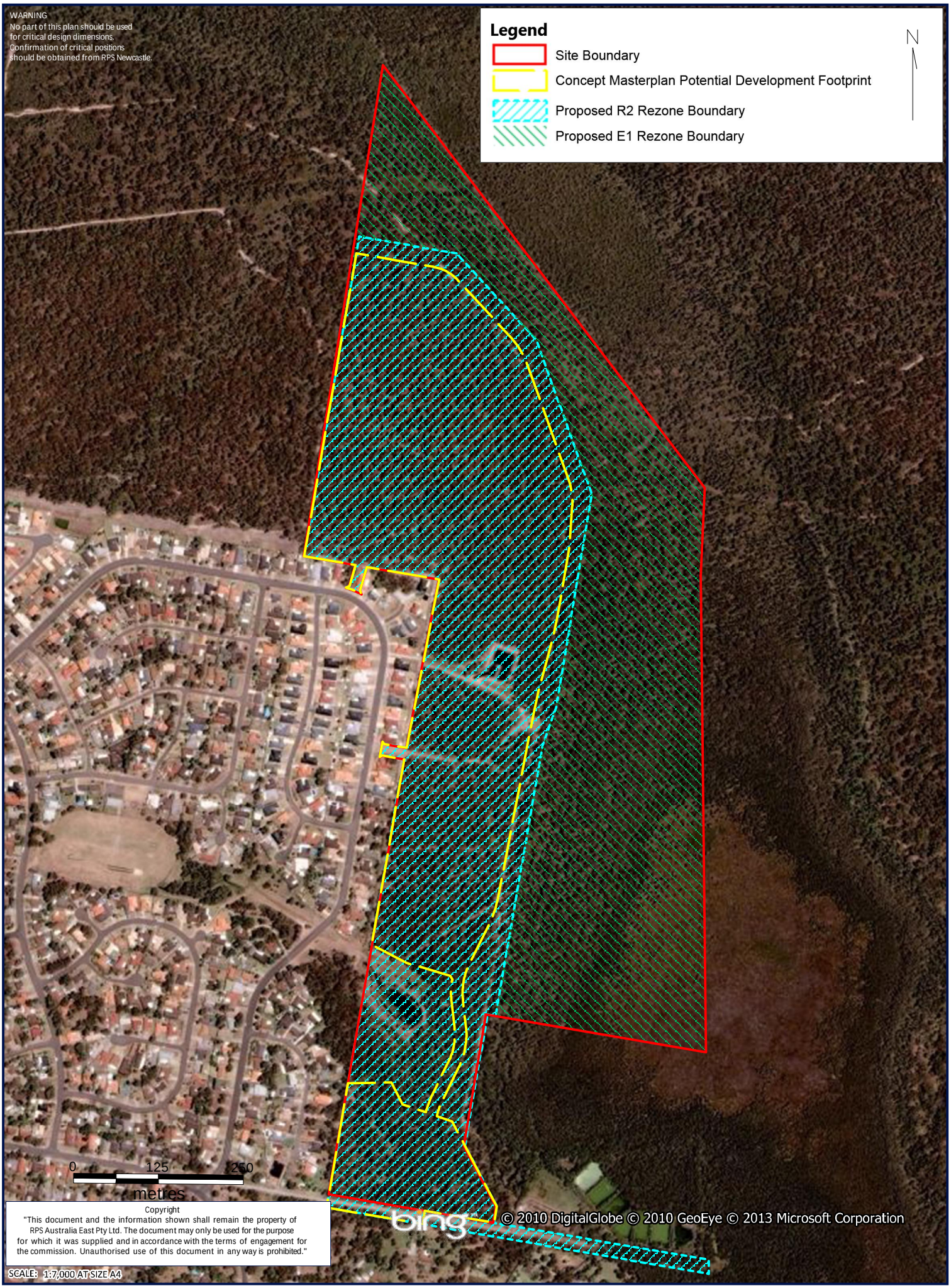
Qualifications

This report was written by Bret Stewart BSc and reviewed by Ziggy Andersons BSc of RPS. The academic qualifications and professional experience of all RPS consultants involved in the project are documented in **Appendix 6**.

Licensing

Research was conducted under the following licences:

- NSW National Parks and Wildlife Service Scientific Investigation Licence S100536 (Valid 31 December 2013);
- Animal Research Authority (Trim File No: 01/1142) issued by NSW Agriculture (Valid 12 March 2014);
- Animal Care and Ethics Committee Certificate of Approval (Trim File No: 01/1142) issued by NSW Agriculture (Valid 12 March 2016); and
- Certificate of Accreditation of a Corporation as an Animal Research Establishment (Trim File No: 01/1522 & Ref No: AW2001/014) issued by NSW Agriculture (Valid 22 May 2014).



TITLE: FIGURE 2: SITE LAYOUT

LOCATION: LOT 1 COACHWOOD DRV MEDOWIE

DATUM: GDA 94
PROJECTION: MGA ZONE 56

DATE: 3/09/2013
PURPOSE: REPORT FIGURE

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2.0 Methodology

A variety of field survey techniques were employed over the course of fieldwork for this assessment to record the ecological characteristics inherent across the site.

2.1 Desktop Assessment

2.1.1 Literature Review

A review of relevant information was undertaken to provide an understanding of ecological values occurring or potentially occurring on the site and locality (i.e. within 10km of the site). Previous reports prepared for the site have been reviewed for the purpose of assessing the likelihood of threatened species or ecological communities occurring within the site. Information sources reviewed included:

- Review of fauna and flora records contained in the Office of Environment and Heritage (OEH) Atlas of NSW Wildlife within a 10 km radius of the site;
- Review of fauna and flora records contained in the Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) Protected Matters Search within a 10 km radius of the site;
- Review of other ecological surveys undertaken within the site - Little, Greg (2010) Preliminary Vegetation Mapping and Habitat Assessment; Lot 1, DP 1019113, 98 Coachwood Drive, Medowie, NSW.

The following sections provide additional detail on the methods employed for this survey.

2.1.2 Existing Vegetation Mapping

Desktop analysis of regional mapping of the site and its surrounds was informed by large-scale vegetation mapping projects and aerial photography, including:

- Preliminary consultation of the Lower Hunter & Central Coast Regional Environmental Management Strategy (LHCCREMS) Extant Vegetation of the Lower Hunter and Central Coast Map (NPWS 2003) to determine the broad categorisation of the site;
- Aerial Photograph Interpretation (API) and consultation of topographic map (Scale1:25000) of the site.
- Literature review of previous fieldwork carried out within the site or surrounds including:

  Little, Greg (2010) Preliminary Vegetation Mapping and Habitat Assessment; Lot 1, DP 1019113, 98 Coachwood Drive, Medowie, NSW.

2.2 Baseline Flora Survey

A baseline flora survey was undertaken utilising transects and quadrats to inventory native flora across the site. Within each 0.04 hectare quadrat (typical quadrat dimension = 20m X 20m), all vascular plant species present were recorded and given an abundance rating, based on a modified Braun-Blanquet scale. Physical attributes of the site within the quadrat (vegetation structure, soil type, elevation, slope, aspect, physiographical position) were also recorded, and photographs taken of the site for later reference. Plant specimens of unknown or significant status are collected for later identification or lodgement with the National Herbarium in Sydney. All field data were recorded on RPS proforma.

An inventory of plant species recorded on site was compiled and is included in **Appendix 2**.

2.3 Vegetation Mapping

Ground-truthing of the vegetation mapping produced by NPWS (2003) (LHCREMMS) for the site was undertaken via a total of 35 Rapid Data Points (RDP). The RDP methodology (as originally devised per Bell 2006) involves identification at each RDP site of:

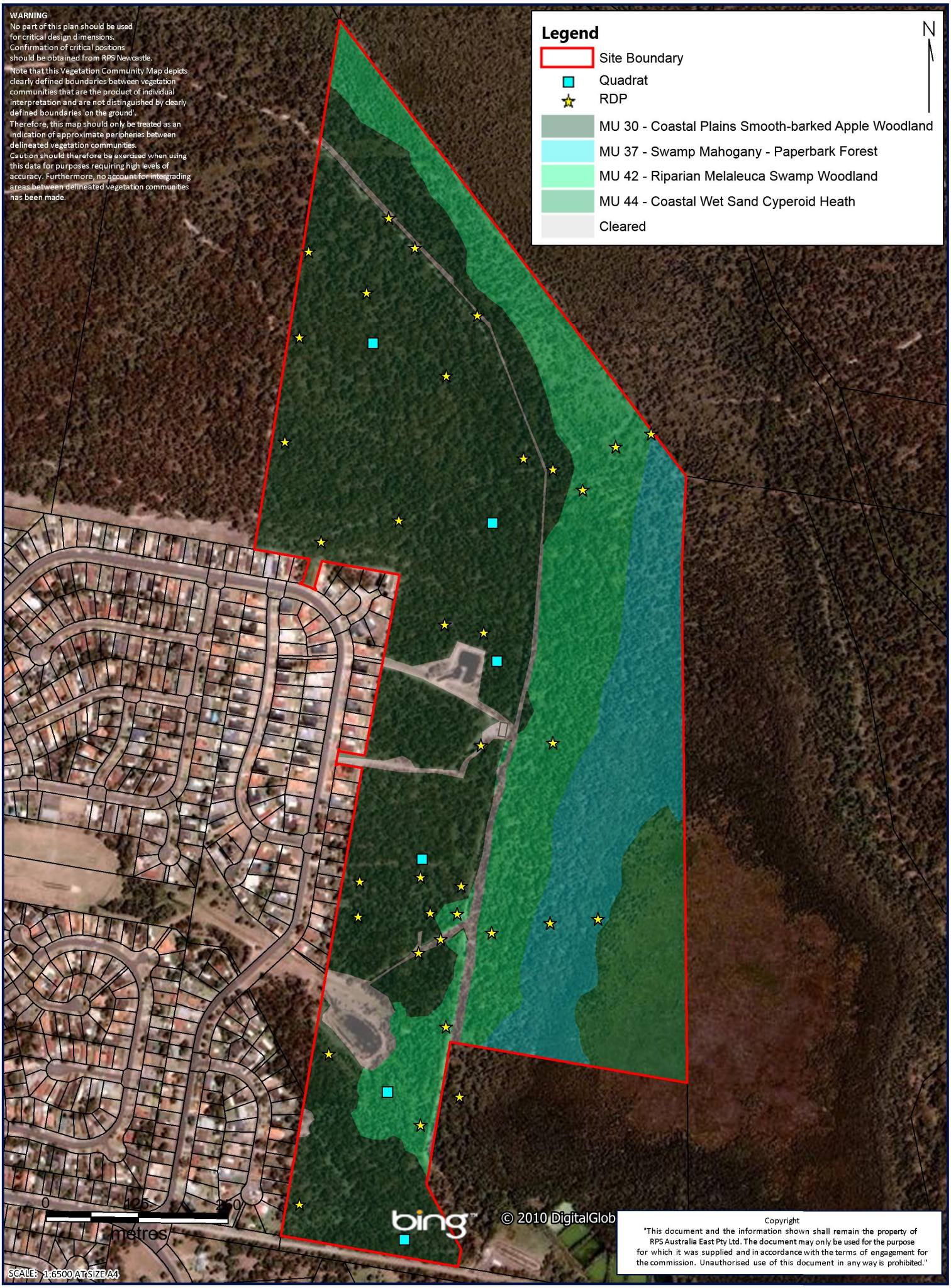
- All dominant species within the canopy, shrub and ground layer; and
- Site location, topography and soil type.

Analysis of quadrat and RDP data in conjunction with interpretation of digital aerial imagery resulted in a refinement of the vegetation mapping for the site.

2.3.1 Threatened Flora Survey

A list of potentially occurring significant flora species from the locality (10km radius) was compiled, which included threatened species (Endangered or Vulnerable) and EEC's listed under the TSC Act and/or the EPBC Act.

Targeted flora searches were conducted during two days of field surveys (8-9 May 2013) using the "Random Meander Technique" described by Cropper (1993). A series of Random Meander transects undertaken in suitable habitats across the site are shown in **Figure 3**.



TITLE:	FIGURE 3: FLORA SURVEY EFFORT	LOCATION:	LOT 1 COACHWOOD DRV MEDOWIE	DATUM:	GDA 94	DATE:	3/09/2013
				PROJECTION:	MGA ZONE 56	PURPOSE:	REPORT FIGURE

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2.3.2 Fauna Survey

A desktop assessment of the potential use of the site by threatened fauna species (as listed under the TSC Act and EPBC Act) identified from the vicinity of the site was undertaken prior to the commencement of field surveys.

The presence of fauna within the site was determined through a variety of survey techniques including Elliot traps, hair tubes, cage traps, spotlighting, call playback, harp trapping, Anabat recordings and opportunistic sightings. These methodologies are described in further detail below. Survey effort is provided in **Table 1** below:

Table 1 Total Survey Effort

Terrestrial Elliot A	Terrestrial Elliot B	Arboreal Elliot B	Cage Traps	Hair Tubes	Harp Trap	Anabat	Spot lighting	Flora Quadrats	Flora RDPs
Trap Nights						Hours			
200	200	48	48	160	8	176	8	6	31

2.3.3 Avifauna

The presence of avifauna within the site was assessed via opportunistic observations during all days of fieldwork. Birds were identified by direct observation or by recognition of calls or distinctive features such as nests, feathers and owl regurgitation pellets.

Nocturnal surveys (see **sections 3.4.9** and **3.4.10**) were undertaken to detect nocturnal bird species on site.

2.3.4 Arboreal Mammal Trapping

Arboreal trapping was undertaken using tree mounted Elliott B size traps. Traps were mounted on brackets set at approximately 2 m in height on trees with a DBH greater than 30 cm. Traps were baited with a rolled oats, peanut butter and honey mixture and the tree trunks were sprayed liberally with a brown sugar and water mix each day in the late afternoon. Traps were checked early each morning. Arboreal traps targeted arboreal mammals such as the threatened Squirrel Glider (*Petaurus norfolcensis*) which has been previously recorded from the surrounding area.

A total of two trapping transects, containing six Elliott B size arboreal traps were installed. Trapping was undertaken over four nights, resulting in 48 arboreal trap nights within the site. The location of each trap line is shown in **Figure 3**.

2.3.5 Terrestrial Mammal Trapping

Terrestrial trapping was undertaken using Elliott A, Elliott B and cage traps. Elliott traps were baited with a mixture of rolled oats, peanut butter and honey. Cage traps were baited with diced meat. Traps were checked within 2 hours of sunrise each morning, with any captures identified and released at point of capture. Traps were re-baited where necessary. The selected locations of the trap lines focused on stratification units as well as areas consisting of understorey that would provide protection for terrestrial mammal species. The location of each trap line is shown in **Figure 3**.

Terrestrial traps targeted small terrestrial mammals such as dasyurids (e.g. Antechinus and Dunnarts), and rodents (e.g. rats and mice). A total of two trapping transects were undertaken within the site containing 25 Elliot A, 25 Elliot B and six cage traps per line. This resulted in 200 Elliott A trap nights, 200 Elliott B trap nights and 48 cage trap nights within the site.

2.3.6 Hair Tubes

Surveys were undertaken using Faunatech Hair Tubes across the site. These were baited with rolled oats, peanut butter and honey. Trees in which arboreal Hair Tubes were erected were sprayed each day with a brown sugar and water mix. At each site 10 arboreal and 10 terrestrial Hair Tubes were set. The location of each trap line is shown in **Figure 3**.

Hair Tubes targeted small-medium mammals such as dasyurids (eg. Antechinus and Dunnarts), rodents (e.g. rats and mice), gliders, and bandicoots. A total of two trapping transects were undertaken within the site, resulting in 80 arboreal trap nights and 80 terrestrial trap nights.

Any hair samples retrieved during the survey were sent to Barbara Triggs at 'Dead Finish' for analysis.

2.3.7 Herpetofauna

Herpetofauna (frog and reptile) searches were carried out across the site targeting areas of appropriate habitat. Some suitable reptile habitat was scattered throughout the site including areas of rock assemblages, logs and/or leaf litter.

The swamp areas and dams were targeted for amphibians.

2.3.8 Micro-Chiropteran Bats

Microbat echolocation calls were recorded using Anabat II Detector and CF ZCAIM units set to remotely record for the entire night (6pm to 6am). Each survey site had four consecutive nights of sampling, with emphasis placed on those areas deemed likely to provide potential foraging and flyway sites for microbats. The location of each microbat call survey site is shown in **Figure 4**.

Bat call analysis was undertaken by Echo Ecology. Each call sequence ('pass') was assigned to one of three categories, according to the confidence with which an identification could be made, being:

- Definite - Pass identified to species level and could not be confused with another species;
- Probable - Pass identified to species level and there is a low chance of confusion with another species; or
- Possible - Pass identified to species level but short duration or poor quality of the pass increases the chance of confusion with another species.

Harp Traps were also utilised at both trap line locations. Harp Traps are designed to catch microbats, allowing for visual identification of species occurring on the site. No microbats were caught during surveys. **Appendix 4** shows the Anabat report with all results whilst **Figure 4** shows Harp Trap locations.

2.3.9 Koala Surveys

Koala surveys and habitat assessments were undertaken in accordance with the CKPoM. Ground truthing confirmed or refined areas of Preferred Koala Habitat as mapped by the PSC Koala Habitat Planning Map. Koala food trees were recorded on GPS. Koala SATs conducted along transects extending outward from areas of Preferred Koala Habitat were used to measure koala activity levels and establish the extent of Habitat Buffer areas.

2.3.10 Spotlighting

Spotlighting was undertaken with the use of a 75-Watt hand-held spotlight and head torch whilst driving and walking over the site. Areas of dense bush were targeted, however tracks were also spotlighted whilst

entering and exiting the site. A total of 8 person hours of spotlighting was conducted over two nights. **Figure 4** displays the spotlighting survey effort across the site.

2.3.11 Nocturnal Call Playback

Pre-recorded calls of Owl, Koala and Glider species with the potential to occur within the site were broadcast during the surveys in an effort to elicit vocal responses or to attract the species to the playback site. The calls were broadcast through an amplification system (loud hailer) designed to project the sound for at least 1km under still night conditions.

As described by Kavanagh and Peake (1993) and Debus (1995), the call of each species was broadcast for at least five minutes, followed by five minutes of listening, and stationary spotlighting. Following the final broadcast and listening, the area was spotlighted on foot. Species targeted included the Barking Owl (*N. connivens*), Powerful Owl (*Ninox strenua*), Masked Owl (*T. novaehollandiae*) and Koala (*Phascolarctos cinereus*). A total of two call playback sessions were undertaken within the site. The location of the call playback sites are shown in **Figure 4**.

2.3.12 Secondary Indications and Incidental Observations

Opportunistic sightings of secondary indications (scratches, scats, diggings, tracks etc.) of resident fauna were noted. Such indicators included:

- Distinctive scats left by mammals;
- Scratch marks made by various types of arboreal animals;
- Nests made by various guilds of birds;
- Feeding scars on Eucalyptus trees made by Gliders;
- Whitewash, regurgitation pellets and prey remains from Owls;
- Aural recognition of bird and frog calls;
- Skeletal material of vertebrate fauna; and
- Searches for indirect evidence of fauna (such as scats, nests, burrows, hollows, tracks, and diggings).

Any scats or pellets collected on site were sent to Barbara Triggs at “Dead Finish” for analysis.

2.4 Habitat Survey

An assessment of the relative value of the habitat present on site was conducted. Significant fauna habitat including hollow-bearing trees, hollow logs and termite nests were identified. This was undertaken to assist with the development of actions to minimise potential impacts of the proposal on resident fauna. The assessment also considered the potential value of the site (and surrounds) for all major guilds of native flora and fauna.

Habitat assessment for threatened species known to occur or with the potential to occur in the area was based on the specific habitat requirements of each threatened fauna species in regards to home range, feeding, roosting, breeding, movement patterns and corridor requirements. Consideration was given to contributing factors including topography, soil, light and hydrology for threatened flora and assemblages.

2.5 Limitations

Limitations associated with this Ecological Assessment Report are presented herewith. The limitations have been taken into account specifically in relation to threatened species assessments, results and conclusions.

In these instances, a precautionary approach has been adopted; as such 'assumed presence' of known and expected threatened species, populations and ecological communities has been made where relevant and scientifically justified to ensure a holistic assessment.

2.5.1 Seasonality

Threatened flora species should be surveyed within their respective flowering periods to ensure accurate identification. Surveys have been undertaken outside the flowering period of some cryptic species and in these cases the precautionary principle has been applied and the potential presence of these species has been analysed based on the presence of suitable habitat.

The flowering and fruiting plant species that attract some nomadic or migratory threatened species, often fruit or flower in cycles spanning a number of years. Furthermore, these resources might only be accessed in some areas during years when resources more accessible to threatened species fail. As a consequence, threatened species may be absent from some areas where potential habitat exists for extended periods and this might be the case for nomadic and opportunistic species.

2.5.2 Data Availability & Accuracy

The collated threatened flora and fauna species records provided by the Wildlife Atlas are known to vary in accuracy and reliability. Traditionally this is due to the reliability of information provided to the NPWS for collation and/or the need to protect specific threatened species locations. For the purposes of this assessment this information has been considered to have a maximum accuracy of ± 1km.

Threatened flora and fauna records within the region were predominantly sourced from the online OEH Bionet and SEWPAC Protected Matters Search Tool. Limitations exist with regards to this data and its accuracy.

2.5.3 Fauna

The presence of fauna within a particular area is not static over time, may be seasonal or in response to the availability of a particular resource. Some fauna species that have been recorded in the local area occur on a seasonal or migratory basis, and may be absent from the locality for much of the year. Fauna behaviours may have also affected detectability; species that are easily disturbed or cryptic may not have been detected during surveys.

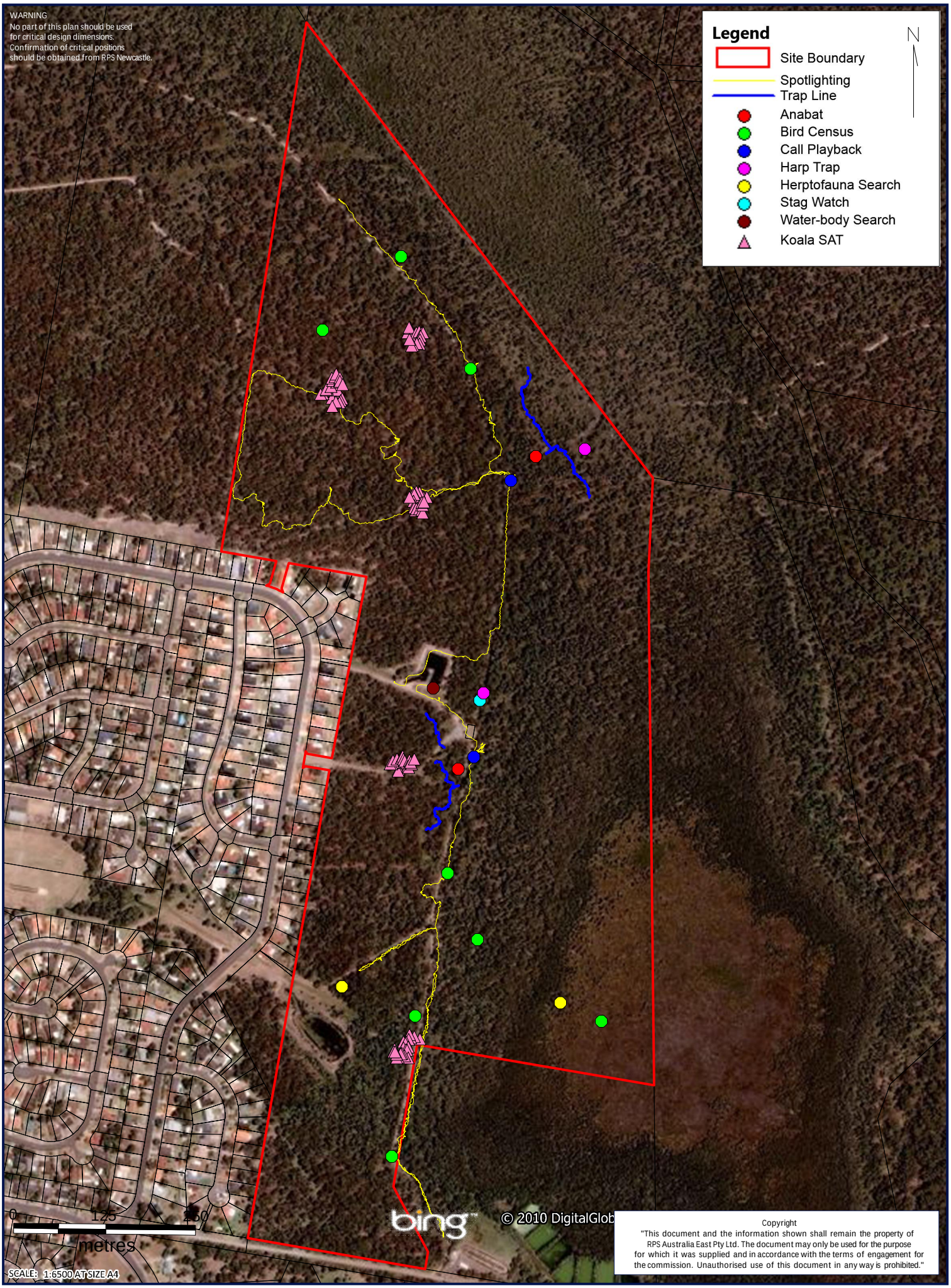
As such, where survey effort targeting particular threatened fauna species has not been undertaken, habitat assessment and prediction of the occurrence of threatened fauna species has been applied. The precautionary principle was applied where marginal habitat was identified or predicted to occur or where species are migratory or nomadic and were therefore likely to utilise habitat components at some stage during their life cycle.

2.5.4 Flora

The cryptic nature of many flora species makes them very difficult to detect even when they are known to be present. There is a range of cryptic plant species that have a brief flowering period and hence a small window of effective 'detectability'. Due to seasonality and other factors some threatened species that are not detected cannot be discounted as occurring within The Site. Flora Surveys were undertaken on 6-10 May 2013.

Table 2 Threatened Flora Species likely to occur within the Study Area. (Seasonality).

Threatened Flora Species	Recommended Survey Time	Flowering Period in Months of the Year											
		January	February	March	April	May	June	July	August	September	October	November	December
Allocasuarina defungens	Survey Anytime												
Angophora inopina	Survey Anytime												
Asperula asthenes	**Survey Only During Flowering**												
Callistemon linearifolius	Survey Anytime												
Cryptostylis hunteriana	**Survey Only During Flowering**												
Diuris arenaria	**Survey Only During Flowering**												
Eucalyptus camfieldii	Survey Anytime												
Eucalyptus parramattensis subsp. *decadens*	Survey Anytime												
Grevillea parviflora subsp. *parviflora*	Survey Anytime												
Maundia triglochinoides	Survey Anytime												
Melaleuca biconvexa	Survey Anytime												
Persicaria elatior	**Survey Only During Flowering**												
Rulingia prostrata	Survey Anytime												
Senecio spathulatus	**Survey Best During Flowering**												
Streblus pendulinus	Survey Anytime												
Tetratheca juncea	**Survey Best During Flowering**												



TITLE: FIGURE 4: FAUNA SURVEY EFFORT

LOCATION: LOT 1 COACHWOOD DRV MEDOWIE

DATUM: GDA 94
PROJECTION: MGA ZONE 56

DATE: 3/09/2013
PURPOSE: REPORT FIGURE

LAYOUT REF: J:\JOBS\116k\116873 Medowie\10-Drafting\Workspaces
VERSION (PLAN BY): A A4 (ZA)

CLIENT: CARMAN SURVEYORS PTY LTD
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3.0 Results

3.1 Desktop Assessment

3.1.1 Literature Review

A review of the database search results identified the following threatened species, populations and ecological communities as potentially occurring within or in the locality of the site (**Table 3**). All potential and known occurring marine species were excluded from the assessment as no marine habitats occur on the site.

Table 3 Threatened Flora and Fauna Desktop Search Results

Scientific Name	Common Name	TSC Act	EPBC Act	No. of Records	Notes and Source
Flora					
Allocasuarina defungens	Dwarf Heath Casuarina	E	E	0	Species or species habitat likely to occur within area[2]
Angophora inopina	Charmhaven Apple	V	V	20	Recorded within 10km of the site[1] Species or species habitat likely to occur within area[2]
Asperula asthenes	Trailing Woodruff	V	V	0	Species or species habitat likely to occur within area[2]
Asterolasia elegans	-	E	E	0	Species or species habitat may occur within area[2]
Callistemon linearifolius	Netted Bottle Brush	V	-	12	Recorded within 10km of the site[1]
Cryptostylis hunteriana	Leafless Tongue-orchid	V	V	0	Species or species habitat likely to occur within area[2]
Diuris arenaria	Sand Doubletail	E	V	9	Recorded within 10km of the site[1] Species or species habitat likely to occur within area[2]
Eucalyptus camfieldii	Camfield's Stringybark	V	V	2	Recorded within 10km of the site[1] Species or species habitat likely to occur within area[2]
Eucalyptus parramattensis subsp. *decadens*	Earp's Gum	V	V	111	Recorded within 10km of the site[1] Species or species habitat likely to occur within area[2]
Grevillea parviflora subsp. *parviflora*	Small-flower Grevillea	V	V	8	Recorded within 10km of the site[1]
Maundia triglochinoides	-	V	-	4	Recorded within 10km of the site[1]
Melaleuca biconvexa	Biconvex Paperbark	V	V	1	Recorded within 10km of the site[1] Species or species habitat known to occur within area[2]

Scientific Name	Common Name	TSC Act	EPBC Act	No. of Records	Notes and Source
Persicaria elatior	Knotweed	V	V	0	Species or species habitat likely to occur within area[2]
Phaius australis	Lesser Swamp-orchid	E	E	0	Species or species habitat may occur within area[2]
Rulingia prostrata	Dwarf Kerrawang	E	E	4	Recorded within 10km of the site[1] Species or species habitat likely to occur within area[2]
Senecio spathulatus	Coast Groundsel	E	-	1	Recorded within 10km of the site[1]
Streblus pendulinus	Siah's Backbone	-	E	0	Species or species habitat likely to occur within area[2]
Tetratheca juncea	Black-eyed Susan	V	V	2	Recorded within 10km of the site[1] Species or species habitat known to occur within area[2]
Amphibians					
Crinia tinnula	Wallum Froglet	V	-	47	Recorded within 10km of the site[1]
Litoria aurea	Green and Golden Bell Frog	E	V	0	Species or species habitat may occur within area[2]
Mixophyes balbus	Stuttering Frog	E	V	0	Species or species habitat likely to occur within area[2]
Mixophyes iteratus	Giant Barred Frog	E	E	0	Species or species habitat may occur within area[2]
Birds					
Anthochaera phrygia	Regent Honeyeater	CE	E, M	1	Recorded within 10km of the site[1] Species or species habitat known to occur within area[2]
Botaurus poiciloptilus	Australasian Bittern	E	E	1	Recorded within 10km of the site[1] Species or species habitat known to occur within area[2]
Burhinus grallarius	Bush Stone-curlew	E	-	2	Recorded within 10km of the site[1]
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	17	Recorded within 10km of the site[1]
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-	1	Recorded within 10km of the site[1]
Daphoenositta chrysoptera	Varied Sittella	V	-	6	Recorded within 10km of the site[1]
Dasyornis brachypterus	Eastern Bristlebird	E	E	0	Species or species habitat likely to occur

Scientific Name	Common Name	TSC Act	EPBC Act	No. of Records	Notes and Source
					within area[2]
Dromaius novaehollandiae	Emu (population in the New South Wales North Coast Bioregion and Port Stephens local government area)	E2	-	6	Recorded within 10km of the site[1]
Ephippiorhynchus asiaticus	Black-necked Stork	E	-	15	Recorded within 10km of the site[1]
Epthianura albifrons	White-fronted Chat	V	-	7	Recorded within 10km of the site[1]
Erythrotriorchis radiatus	Red Goshawk	CE	V	0	Species or species habitat likely to occur within area[2]
Glossopsitta pusilla	Little Lorikeet	V	-	2	Recorded within 10km of the site[1]
Ixobrychus flavicollis	Black Bittern	V	-	1	Recorded within 10km of the site[1]
Lathamus discolor	Swift Parrot	E	E	4	Species or species habitat likely to occur within area[2]
Neophema pulchella	Turquoise Parrot	V	-	1	Recorded within 10km of the site[1]
Ninox strenua	Powerful Owl	V	-	9	Recorded within 10km of the site[1]
Oxyura australis	Blue-billed Duck	V	-	1	Recorded within 10km of the site[1]
Pandion cristatus	Eastern Osprey	V	M	2	Recorded within 10km of the site[1]
Petroica boodang	Scarlet Robin	V	-	1	Recorded within 10km of the site[1]
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	-	3	Recorded within 10km of the site[1]
Rostratula australis	Australian Painted Snipe	E	V, M	0	Recorded within 10km of the site[1]
Stictonetta naevosa	Freckled Duck	V	-	1	Recorded within 10km of the site[1]
Tyto novaehollandiae	Masked Owl	V	-	8	Recorded within 10km of the site[1]
Mammals					
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	0	Species or species habitat may occur within area[2]
Dasyurus maculatus maculatus	Spotted-tailed Quoll (SE Mainland Pop)	V	E	22	Recorded within 10km of the site[1] Species or species habitat known to occur within area[2]
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	1	Recorded within 10km of the site[1]
Miniopterus australis	Little Bentwing-bat	V	-	24	Recorded within

Scientific Name	Common Name	TSC Act	EPBC Act	No. of Records	Notes and Source
					10km of the site[1]
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	9	Recorded within 10km of the site[1]
Mormopterus norfolkensis	Eastern Freetail-bat	V	-	4	Recorded within 10km of the site[1]
Myotis macropus	Southern Myotis	V	-	3	Recorded within 10km of the site[1]
Petaurus australis	Yellow-bellied Glider	V	-	1	Recorded within 10km of the site[1]
Petaurus norfolcensis	Squirrel Glider	V	-	58	Recorded within 10km of the site[1]
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	0	Species or species habitat may occur within area[2]
Phascogale tapoatafa	Brush-tailed Phascogale	V	-	13	Recorded within 10km of the site[1]
Phascolarctos cinereus	Koala (Qld, NSW, Vic and ACT Populations)	V	V	2151	Recorded within 10km of the site[1] Species or species habitat known to occur within area[2]
Potorous tridactylus tridactylus	Long-nosed Potoroo	V	V	1	Recorded within 10km of the site[1] Species or species habitat may occur within area[2]
Pseudomys novaehollandiae	New Holland Mouse	-	V	21	Recorded within 10km of the site[1] Species or species habitat known to occur within area[2]
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	13	Recorded within 10km of the site[1] Foraging, feeding or related behaviour known to occur within area[2]
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	11	Recorded within 10km of the site[1]
Threatened Ecological Communities					
Lowland Rainforest of Subtropical Australia		E	CE	0	Community may occur within area[2]

Key:

V Vulnerable Species
E Endangered Species
E2 Endangered Population
CE Critically Endangered
M Migratory

1 - OEH (2013) *Atlas of NSW Wildlife*, Office of Environment and Heritage (Accessed May 2013).

2 - SEWPAC (2013) Protected Matters Search, Department of Sustainability, Environment, Water, Population and Communities (Accessed May 2013).

Migratory species listed under the EPBC Act have also been considered under this assessment. **Table 4** displays these potentially occurring migratory species.

Table 4 Potentially occurring Migratory Species

Scientific Name	Common Name	EPBC Act Status
Actitis hypoleucos	Common Sandpiper	M
Anthochaera phrygia	Regent Honeyeater	E,M
Apus pacificus	Fork-tailed Swift	M
Ardea alba	Great Egret	M
Ardea ibis	Cattle Egret	M
Arenaria interpres	Ruddy Turnstone	M
Calidris acuminata	Sharp-tailed Sandpiper	M
Calidris canutus	Red Knot, Knot	M
Calidris ferruginea	Curlew Sandpiper	M
Calidris ruficollis	Red-necked Stint	M
Calidris tenuirostris	Great Knot	M
Charadrius bicinctus	Double-banded Plover	M
Charadrius mongolus	Lesser Sand Plover	M
Diomedea antipodensis	Antipodean Albatross	M
Diomedea gibsoni	Gibson's Albatross	M
Gallinago hardwickii	Latham's Snipe	M
Haliaeetus leucogaster	White-bellied Sea Eagle	M
Heteroscelus brevipes	Grey-tailed Tattler	M
Hirundapus caudacutus	White-throated Needletail	M
Limosa lapponica	Bar-tailed Godwit	M
Limosa limosa	Black-tailed Godwit	M
Macronectes giganteus	Southern Giant-Petrel	M
Macronectes halli	Northern Giant-Petrel	M
Merops ornatus	Rainbow Bee-eater	M
Monarcha melanopsis	Black-faced Monarch	M
Monarcha trivirgatus	Spectacled Monarch	M
Myiagra cyanoleuca	Satin flycatcher	M
Numenius madagascariensis	Eastern Curlew	M
Numenius minutus	Little Curlew	M
Numenius phaeopus	Whimbrel	M
Puffinus carneipes	Flesh-footed Shearwater	M
Pluvialis fulva	Pacific Golden Plover	M
Pluvialis squatarola	Grey Plover	M
Rhipidura rufifrons	Rufous Fantail	M
Rostratula benghalensis	Painted Snipe	M, V
Sterna albifrons	Little Tern	M

Scientific Name	Common Name	EPBC Act Status
Thalassarche bulleri	Buller's Albatross	M
Thalassarche cauta (sensu stricto)	Shy Albatross	M
Thalassarche impavida	Campbell Albatross	M
Thalassarche salvini	Salvin's Albatross	M
Thalassarche steadi	White-capped Albatross	M
Tringa stagnatilis	Marsh Sandpiper	M
Xenus cinereus	Terek Sandpiper	M

3.1.2 Vegetation Mapping

A review of regional mapping - 'Lower Hunter & Central Coast Regional Environmental Management Strategy (LHCCREMS)', (NPWS 2003) identified four vegetation communities within the site, namely;

- MU 30 Coastal Plains Smooth Barked Apple Woodland;
- MU 40 Swamp Oak Rushland Forest;
- MU 42 Riparian Melaleuca Swamp Woodland (EEC); and
- MU 44 Coastal Wet Sand Cyperoid Heath.

MU 42 is listed as Endangered Ecological Community under the NSW TSC Act.

Ground-truthing of vegetation on site established that the LHCCREMS mapping to be largely inaccurate. Only MU 30, MU 42, and MU 44 were actually recorded on site, with one additional vegetation community recorded, MU 37 Swamp Mahogany – Paperbark Forest (EEC). Additionally, the vegetation community boundaries as mapped by LHCCREMS are broadly inconsistent with the boundaries observed during ground-truthing of the vegetation.

3.2 Field Survey

The prevailing weather conditions during the site survey period are presented in **Table 5** below:

Table 5 Prevailing Weather Conditions*

	6 May 2013	7 May 2013	8 May 2013	9 May 2013	10 May 2013
Temperature	7.8-20.6	11.6-20.7	9.5-20.7	7.6-22.5	8.6-22.5
Wind (km/h)	39	22	26	24	19
Cloud	3	2	6	1	0
Rain (mm) (24 hrs to 9:00am)	0	4.4	0	0.2	0
Sun Rise	0629	0630	0631	0631	0632
Set	1709	1709	1708	1707	1706
Moon Rise	0240	0338	0435	0532	0627
Set	1446	1520	1556	1633	1714

*Sources: http://www.bom.gov.au/climate/dwo/IDCJDW2145.latest.shtml
http://www.ga.gov.au/bin/geodesy/run/gazmap_sunrise?placename=medowie&placetype=0&state=0#loc
http://www.ga.gov.au/bin/geodesy/run/gazmap_moonrise?placename=medowie&placetype=0&state=0#loc

3.2.2 Flora Survey

Ground-truthing of the site using a combination of the RDP assessment methodology and quadrat surveys identified four vegetation communities (Map Units MU)) on the site, namely:

- MU 30 Coastal Plains Smooth-barked Apple Woodland (Plate 2);
- MU 37 Swamp Mahogany – Paperbark Forest (Plate 3);
- MU 42 Riparian Melaleuca Swamp Woodland (Plate 1); and
- MU 44 Coastal Wet Sand Cyperoid Heath (Plate 4).

Four vegetation communities were mapped as occurring on site in LHCREMMS (NPWS 2003).

MU 42 Riparian Melaleuca Swamp Woodland

Plate 1 MU 42 Riparian Melaleuca Swamp Woodland

Classification: This vegetation community corresponds with the EEC '*Swamp sclerophyll forest on coastal floodplains of the NSW north coast, Sydney Basin bioregion and South East Corner bioregions'* listed under the TSC Act.

Description: This vegetation community occurs in areas of high rainfall on deep alluvial soils within the wetter areas of the site including drainage lines and gully areas. It occurs on the central coast lowlands from Wyong to Port Stephens (NPWS 2003).

Area: 13.88 hectares.

Canopy Layer To 22 metres with 50% Projected Foliage Cover (PFC). Dominant species included: *Melaleuca quinquenervia, Eucalyptus robusta, E. piperita, E. resinifera* with inclusions of *A. costata* and *E. umbra.*

Tall Shrub Layer: To 9m with 30% PFC. Dominant species include *Glochidion ferdinandi* (Cheese Tree) and *Melaleuca linariifolia* (Flax-leaved Paperbark).

Shrub Layer: To 5 metres with 38% PFC. Dominant species include *Banksia spinulosa* (Hairpin Banksia) and *Callistemon salignus* (Willow Bottlebrush).

Ground Layer To 2 metre with 95% PFC. Dominant species include *Gahnia sieberiana* (Red-fruited Saw-sedge), *Pteridium esculentum* (Bracken Fern), *Gahnia clarkei* (Tall Saw-sedge), *Adiantum aethiopicum* (Common Maidenhair) and *Oplismenus aemulus* (Australian Basket Grass),

MU 30 Coastal Plains Smooth-barked Apple Woodland

Plate 2 MU 30 Coastal Plains Smooth-barked Apple Woodland

Classification: This vegetation community does not correspond with any TSC Act and/or EPBC Act listed EEC.

Description: This community is a dry, shrubby woodland occurring along the coastal plain south from the Wyong region to Medowie near Port Stephens in the north. It is spread across a range of geologies from the Narrabeen Group, Permian Coal Measures and Medowie Sediments on low to undulating topography (NPWS 2003).

Area: 31.41 hectares.

Canopy Layer To 24 metres with 35-40% Projected Foliage Cover (PFC). Dominant species include *Angophora costata* (Smooth-barked Apple) and *Eucalyptus umbra*. Other species such as *E. piperita*, *Corymbia gummifera*, *E. haemastoma* and *E. globoidea* were also present within this community.

Tall Shrub Layer: To 20 metres with 5-25% PFC. This layer is dominated largely by *Allocasuarina littoralis* (Black She-oak) with other species such as *Glochidion ferdinandi*, *Callistemon salignus* and *Pittosporum undulatum* (Sweet Pittosporum) occurring randomly.

Shrub Layer: To 2-6 metres with 10-40% PFC. The understory layer is dominated by *Acacia longifolia* (Sydney Golden Wattle) but occurs with *Melaleuca linariifolia*, *Banksia spinulosa*, *Breynia oblongifolia* (Coffee Bush), *Persoonia linearis* (Narrow-leaf Persoonia), *A. ulicifolia* (Prickly Moses) and *Dodonaea triquetra* (Large-leaf Hop-bush).

Ground Layer To 1 metre with 70-90% PFC. The dominant ground layer species include *Imperata cylindrica* (Blady Grass), *Pteridium esculentum*, *Entolasia stricta* (Wiry Panic), *Gahnia clarkei*, *Microlaena stipoides* (Weeping Grass) and *Gonocarpus tetragynus*.

Other: Common scrambling species included *Billardiera scandens* (Hairy Apple Berry) and *Glycine tabacina.*

MU 37 Swamp Mahogany – Paperbark Forest

Plate 3 MU 37 Swamp Mahogany – Paperbark Forest

Classification: This vegetation community corresponds with the EEC '*Swamp sclerophyll forest on coastal floodplains of the NSW north coast, Sydney Basin bioregion and South East Corner bioregions'* listed under the TSC Act.

Description: This community consists of wet forest occurring along the coastal plain south from the Central Coast to the Port Stephens area. It is associated with coastal alluvial geology of Quaternary sands and sediments on low areas of impeded drainage near coastal swamps, lagoons, drainage lines, and alluvial flats (NPWS 2003).

Area: 8.34 hectares.

Canopy Layer Dominant species include *Melaleuca quinquenervia* (Broad-leaved Paperbark) and *Eucalyptus robusta* (Swamp Mahogany), with the former replacing the latter and forming pure stands in wetter areas with standing water.

Shrub Layer: The understory layer was largely absent particularly in wetter areas with standing water, however in places low trees such as *Glochidion ferdinandi* var. *ferdinandi* (Cheese Tree) are present.

Ground Layer The dominant ground layer species include *Lepyrodia scariosa* (Scale Rush), *Lepidosperma laterale* (Variable Sword-sedge), *Blechnum indicum* (Swamp Water Fern), and *Calochlaena dubia* (Rainbow Fern).

MU 44 Coastal Wet Sand Cyperoid Heath

Plate 4 MU 44 Coastal Wet Sand Cyperoid Heath

Classification: This vegetation community does not correspond with any TSC Act and/or EPBC Act listed EEC.

Description: This community consists of wet heath found on coastal sandy soils with permanently high water tables. The majority of its distribution is within the Tomago sand plain. The community varies in structure from heathland to low open forest, but in all situations is characterised by an abundance of water tolerant sedges (NPWS 2003).

Area: 4.04 hectares.

Canopy Layer Scattered low stunted *M. quinquenervia* and *E. robusta*.

Shrub Layer: The shrub layer is open to very open and dominated by *Melaleuca linariifolia*, *Melaleuca ericifolia*, and *Leptospermum continentale*.

Ground Layer The ground consists of very dense *Lepyrodia scariosa.*

TITLE:	FIGURE 5: VEGETATION MAPPING	LOCATION:	LOT 1 COACHWOOD DRV MEDOWIE	DATUM:	GDA 94	DATE:	3/09/2013
				PROJECTION:	MGA ZONE 56	PURPOSE:	REPORT FIGURE

LAYOUT REF: I:\JOBS\116K\116873 Medowie\10-Drafting\Workspaces
VERSION (PLAN BY): A A4 (ZA)

CLIENT: CARMAN SURVEYORS PTY LTD
JOB REF: PR116873

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3.2.3 Significant Flora

Targeted searches for threatened flora species identified in **Table 3** as potentially occurring on site were conducted during field surveys. No species listed under the TSC Act or EPBC Act were identified during these searches.

3.3 Fauna Survey

Survey techniques employed to determine the composition of fauna species on site resulted in a total of 64 species being detected.

3.3.1 Avifauna

A total of 42 bird species were recorded during field surveys. Bird species identified predominantly consisted of common woodland species such as the Noisy Friarbird (*Philemon corniculatus*), Rainbow Lorikeet (*Trichoglossus haematodus*), Fan-tailed Cuckoo (*Cacomantis flabelliformis*) and Yellow-faced Honeyeater (*Lichenostomus chrysops*).

One threatened species listed as Vulnerable under the TSC Act, namely the Glossy-black Cockatoo (*Calyptorhynchus lathami*) was recorded on site. This species is known to occupy open woodlands such as those found on site.

An inventory of fauna species recorded on the site is provided in **Appendix 3**.

3.3.2 Arboreal Mammal Trapping

No fauna species were caught in arboreal traps during the trapping period.

3.3.3 Terrestrial Mammal Trapping

Five species of mammal were caught in terrestrial Elliot traps during the trapping period, namely Brown Antechinus (*Antechinus stuartii*), Yellow-footed Antechinus (*Antechinus flavipes*), Bush Rat (*Rattus fuscipes*), Swamp Rat (*Rattus lutreolus*) and Common Brushtail Possum (*Vespadelus vulpecula*). There was a clear difference in preference of habitats of the native mammal species caught on site with Swamp Rats (*Rattus lutreolus*) preferring MU 42 and Bush Rats (*Rattus fuscipes*) preferring MU 30.

No threatened mammals were identified during trapping efforts.

A full list of mammal species recorded on site is provided in **Appendix 3**.

3.3.4 Hair Tubes

Multiple hair samples were collected using the Hair Tube methods on site. Hairs collected were identified as being from the native Bush Rat (*Rattus fuscipes*), Common Brushtail Possum (*Trichosurus vulpecula*) and *Rattus* sp.

3.3.5 Herpetofauna

Two reptiles and four amphibians were detected on site. Both reptiles were common skinks, namely the Delicate Garden Skink (*Lampropholis delicata*) and Fence Skink (*Cryptoblepharus* sp.) that were found within the woodland community. All four amphibian species were common species that were largely restricted to the wetter swamp habitats on site. These species included the Common Eastern Froglet (*Crinia*

signifera), Striped Marsh Frog (*Limnodynastes peronii*), Bibron's Toadlet (*Pseudophryne bibronii*) and Jervis Bay Treefrog (*Litoria jervisiensis*).

No threatened reptile or amphibian species were detected on site during surveys.

A full list of herpetofauna species recorded on site is provided in **Appendix 3**.

3.3.6 Micro-Chiropteran Bats

A total of five microbat species were detected via the use of Anabat echo-location call recorders while no species were caught using harp traps. Of the five species, the TSC Act listed Little Bentwing Bat (*Miniopterus australis*) was recorded. The confirmed species include:

- Gould's Wattled Bat (*Chalinolobus gouldii*);
- Chocolate Wattled Bat (*Chalinolobus morio*);
- Little Bentwing Bat (*Miniopterus australis*) (**Vulnerable** under the TSC Act);
- Eastern Freetail Bat (*Mormopterus* sp 2); and
- White-striped Freetail Bat (*Tadarida australis*).

A number of additional bat species that are known to occur within the locality of the site but could not be confidently identified are listed in the Anabat Call Recording Report.

Refer to **Appendix 3** for a detailed list of recorded species and **Appendix 4** for the Anabat Call Recording report.

3.3.7 Koala Surveys

Habitat assessments were carried out in accordance with methodology described in the CKPoM. All areas mapped as Preferred Koala Habitat by PSC Koala Habitat Planning Map were investigated and verified during ground truthing on site. As per CKPoM all individuals of listed koala food trees were marked and recorded on sub metre accuracy GPS.

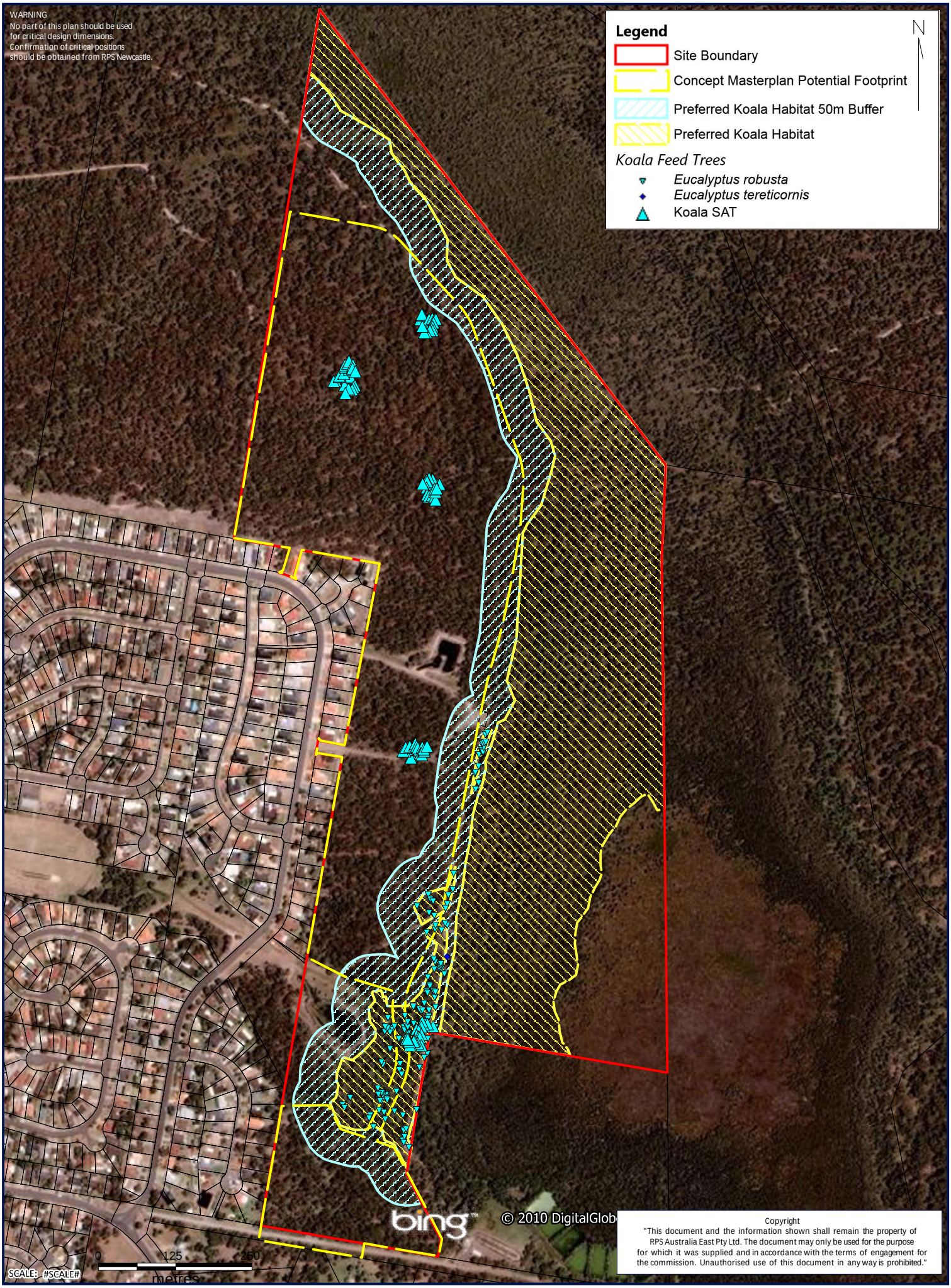
Five koala SATs were conducted on site to help delineate the extent of Habitat Buffers. No koalas or signs of koala (scratches, scats) were observed during these surveys. As such, the boundaries of Preferred Koala Habitat mapped on site were adjusted to reflect the results of ground truthing. As per the CKPoM, Habitat Buffers were set at the 50 meter minimum due to the lack of signs of presence of koalas recorded during SATs conducted along transects extending outward from areas of Preferred Koala Habitat.

3.3.8 Spotlighting

Limited fauna species were recorded during spotlighting events. However one threatened species, the Grey-headed Flying-fox (*Pteropus poliocephalus*) listed as Vulnerable under the TSC Act, was recorded feeding in high numbers within the riparian vegetation during both nights of spotlighting.

3.3.9 Nocturnal Call Playback

No responses to call playback calls were heard during the surveys. Specific owl species are known to occur within the wider area so their presence cannot be ruled out, however factors such as weather, survey timing may have contributed to the detectability of target species.



TITLE:	FIGURE 6: KOALA HABITAT MAPPING	LOCATION:	LOT 1 COACHWOOD DRV MEDOWIE	DATUM:	GDA 94	DATE:	3/09/2013
				PROJECTION:	MGA ZONE 56	PURPOSE:	REPORT FIGURE
LAYOUT REF:	J:\JOBS\116k\116873 Medowie\10-Drafting\Workspaces						
VERSION (PLAN BY):	A A4 (ZA)						

CLIENT:	CARMAN SURVEYORS PTY LTD	RPS AUSTRALIA EAST PTY LTD (ABN 44 140 292 762) 241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303 T: 02 4940 4200 F: 02 4961 6794 www.rpsgroup.com.au
JOB REF:	PR116873	RPS

3.4 Habitat Survey

3.4.1 Terrestrial Habitats

The Open Forest (MU 30) and Swamp Areas (MU 37, 42, 44) provide suitable habitat for a number of small terrestrial mammals, especially where the thickets of understorey grass species are most dense, as evidenced by the results of the fauna survey. Amongst the dense grass, logs and other woody debris were often present, particularly throughout the woodland community, offering refuge for small mammals and reptiles.

The bank edges of tracks were prime habitat for particular amphibian species such as Bibron's Toadlet (*Pseudophryne bibronii*) which were recorded on numerous occasions. The dams on site provide aquatic habitat for a number of *Litoria* frog species whilst the inundated lands within the Swamp habitats provide habitat for *Limnodynastes* and *Crinia* species.

Open woodland habitats are suitable for grazing macropods and ground foraging bird species. The site does not show signs of heavy grazing pressure from non-native species, however, introduced European Hares and Rabbits were frequently observed on site. Weeds were quite prevalent in some areas, particularly associated with disturbance around tracks and water control ponds.

The water bodies on site invite a guild of aquatic bird species that would otherwise be absent such as Australasian Grebes and Hardheads. Theses water bodies also offer a permanent water supply for all fauna on site.

3.4.2 Arboreal Habitats

The swamp (MU 42) vegetation community contains *Eucalyptus robusta* (Swamp Mahogany) which is listed as a preferred koala feed tree under the Port Stephens Council CKPoM. This vegetation type is also suitable for a range of bird and mammal species as it provides foliage, pollen, nectar and invertebrates throughout the winter season. Grey-headed Flying-foxes were observed in high abundances feeding on both *Eucalyptus* and *Melaleuca* species across the site. Eucalypt species in the woodland vegetation would provide resources during the summer periods when the Swamp vegetation ceases seasonal flowering. *Allocasuarina* species occur frequently throughout the MU 30 woodland vegetation, varying from scattered individuals to occasionally dense stands. These provide ample foraging for Glossy Black-cockatoos, which were observed feeding in the *Allocasuarina* stands on site.

A moderate density of hollows occurs across the site, primarily throughout the MU 30 woodland community providing roosting opportunities for hollow dependant birds such as cockatoos and mammals such as gliders. Arboreal termite nests were observed often throughout the site offering nesting opportunities for Kingfisher species and varanid species such as Lace Monitors (*Varanus varius*). Very few hollows were large enough to support hollow dependant Owl species, however the site is suitable for foraging based on the available prey species observed during surveys.

Few stags occurred across the site within the MU 30 woodland vegetation with only a limited portion of them being suitable for use by small species such as microbats or birds.

3.4.3 Fauna Habitat Connectivity

The site is well connected to surrounding vegetated lands to the north, east and southeast.

Medowie State Forest lies to the north and west of the site covering an area of approximately 1800 hectares. This area is open to logging and currently experiences regular disturbances such as dumping and

recreational use such as dirt bike and horse riding. Connectivity from the site to this state forest will not be fragmented as a result of the proposal; however the reduction of habitat on site may drive resident species into these disturbed environments.

Development will occur within koala Habitat Linking Areas, which may reduce connectivity between Preferred Koala Habitat along the eastern half of the site and Preferred Koala Habitat to the north-west of the site within Medowie State Forest.

Moffats Swamp Nature Reserve is located to the east and southeast of the site encompassing approximately 151 hectares of native vegetation. The eastern portion of the site is to be dedicated as a conservation area and will remain directly connected to the reserve and in turn to Salt Ash Weapons Range (SAWR). Accessibility for threatened species such as Koalas and Squirrel Gliders that are known to use these habitats will remain unaffected by the proposal in this area.

A number of smaller reserves including Worimi Nature Reserve, Wallaroo State Forest and Medowie State Conservation Area also connect to the vegetation in the wider locality.

Urban Development exists to the west of the site, reducing connectivity for resident fauna. Urban environments also increase the abundance of domestic pets such as cats and dogs that pose a threat to terrestrial and arboreal fauna species.

Overall, the proposal will expand upon existing urban development to the west of the site however connectivity to the surrounding vegetated environments will not be fragmented or experience a reduction in connectivity for mobile fauna in the area.

3.5 Conservation Recommendations

Based on the results of field surveys and desktop assessments, conservation values have been placed upon significant attributes within site. The majority of the MU 42 Riparian Melaleuca Swamp Woodland and MU 37 Swamp Mahogany – Paperbark Forest is to be retained within the proposed conservation area as this vegetation is listed as an EEC and identified as Preferred Koala Habitat by the CKPoM. It is recommended that all *Eucalyptus robusta* present on site be retained, as this species is listed as a preferred koala food tree by the CKPoM. Within the MU 30 Smooth Barked Apple Woodland, hollow bearing trees should be retained wherever possible. Fifty metre Koala Habitat Buffers and Habitat Linking Areas as defined in the CKPoM extend into the Smooth Barked Apple Woodland as such the removal of native vegetation should be minimised within these areas where possible.

4.0 Impact Assessment

4.1 Proposed Works

The proposal involves a zoning change for the site from its current zoning of 7a Environment Protection to a combination of R2 Low Density Residential and E1 National Park and Nature Reserve zoning. The proposed R2 Low Density Residential land use zoning covers an area of 35.34 hectares with 32.23 hectares being native vegetation. Within that area a concept masterplan (dated 17/07/2013 Carman Surveyors ref: 2165-7C) has been prepared which will require 26.90 hectares of native vegetation to potentially be removed (see **Figure 6**). The vegetation to be retained within the proposed E1 rezoning will be conserved in perpetuity. The development footprint for the proposed residential development has been considered in this assessment, together with ongoing impacts of an active residential area.

4.2 Likely Impacts

Likely impacts are those impacts that may arise as a result of activities associated with clearing of native vegetation, on site construction, ongoing activities associated with the development such as roads, traffic, and pets, and further degradation of retained vegetation such as weed infestation and erosion.

4.2.1 Loss of native vegetation

Based on the residential development concept masterplan approximately 0.45 hectares of MU 42 Riparian Melaleuca Swamp Woodland and 26.45 hectares of MU 30 Coastal Plains Smooth-barked Apple Woodland may be affected as a result of the proposal.

4.2.2 Loss of fauna habitat

The resources within the habitat affected include small hollows, foraging trees, stags and ground debris such as grass cover, logs, leaf litter and rocks. The area affected, 26.45 hectares of MU 30 Woodland, is habitat for foraging woodland bird, reptile, macropod, possum and glider species. Thirty one individual *Eucalyptus robusta*, may be affected by the proposed development area.

4.2.3 Habitat fragmentation/ loss of fauna habitat connectivity

As a result of habitat clearing, fragmentation will not be increased on site. The areas to be removed currently adjoin existing urban development and will increase this area. However, the urban areas to be established in the north of the site may decrease connectivity between habitats in the east of the site, and off-site habitat within Medowie State Forest.

4.2.4 Alteration and degradation of aquatic habitats

The conservation land use zoning areas to be retained on site include the swamps and riparian zones to maintain ecological integrity of these sensitive habitats. The far eastern edge of the site includes a SEPP 14 wetland, number 792 (Moffats Swamp), which is outside the area of proposed impact. The SEPP 14 wetland occurs on site only at the far eastern edge and outside of areas of the proposed impact.

Increased pollutants including erosion from cleared land during the construction phase and ongoing runoff from urban developments have the potential to decrease water quality within existing wetland areas. The proposed development concept plan includes water sensitive urban design features intended to mitigate these impacts as well as those from the existing urban development to the west.

4.2.5 Fauna injury and/or mortality

The proposal involves the removal of hollow bearing trees which presents a threat to hollow-dwelling fauna on site. Ongoing threats as a result of the proposal include increased traffic and thus vehicle-animal strikes on site due to road upgrades. Noise and light levels will be comparable to the existing levels experienced within the adjacent existing development however the area of extent will increase as a result of the proposed residential development which may negatively impact upon fauna behaviour on site. The potential increase of domestic pets specifically cats and dogs will potentially occur due to the proposed residential development. Cats and dogs are a threat to native fauna, particularly terrestrial fauna and koalas which are known to occur within the locality.

4.2.6 Edge effects and weed invasion

The site was found to contain at least thirty-four weed species, including Blackberry, Lantana, Pampas Grass, and large patches of Crofton Weed, no alligator weed was observed within water bodies on site. Ground disturbance associated with construction and urban development could potentially increase the spread of these species on site. Current regular unauthorised vehicular movements on site could introduce weed species from other areas that could potentially become established within the conservation areas. The development of the site will limit the ability of unauthorised vehicles to access the conservation area and will therefore reduce the potential impact from vehicles.

4.3 Threatened Species and Communities Likelihood of Occurrence Assessment

Within Section 3.1 there are 18 threatened flora species, 44 threatened fauna species and two EECs listed on the TSC Act and/or EPBC Act that are known or predicted to occur within a 10 kilometre radius of the site.

The likelihood of occurrence is presented in tabulated form (refer to **Table 7**)

'**Species / Community'** – Lists each threatened species / EEC known from the locality (10km radius). The status of each threatened species under the TSC Act and the EPBC Act are also provided.

'**Habitat Description'** – Provides a brief account of the species / community and the preferred habitat attributes required for the existence / survival of each species / community.

'Likelihood of Occurrence on Site' – Assesses the likelihood of each locally recorded species and EEC to occur within the site, using knowledge of each species' habitat and lifecycle requirements and with regard the habitat types present within the site, results of the literature review and database searches and current field investigations. The location and number of records of the species (OEH Atlas of NSW Wildlife) were also considered in determining probability of occurrence.

'Potential for Impact' – Assesses the likelihood of impacts to each species / community that would result from the proposed development, taking into account direct and indirect short and long-term impacts

Table 6 Threatened Species/Communities Assessment Table

Species/Community	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence	Potential Impact
Flora					
Allocasuarina defungens Dwarf Heath Casuarina	E	E	Small, prostrate shrub found in low heath, open woodland, dry sclerophyll, generally on loamy clays and sand. Occurs from the Lower Hunter south to Southern Highlands. Recently found in several locations within the HEZ and other parts of the Cessnock LGA where it has been found growing in Kurri Sand Swamp Woodland (KSSW). Has also been recently recorded as isolated populations within Yellow Bloodwood Woodland and Blue-leaved Stringybark Woodland.	This species has not been recorded on site in current or previous surveys but has been recorded within 10km of the site. The woodland occurring on the site is not associated with preferred sandy and loamy clay soils. Given the extensive survey efforts targeting this species presence on site and the suboptimal habitat present, it is considered **unlikely** to occur.	This species was not recorded on site and suboptimal habitat exists on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Angophora inopina Charmhaven Apple	V	V	Small to medium tree found in shallow sandy soils in open woodland, swamp woodland and wet heath. The main occurrences of this species are in the Wyong and Lake Macquarie LGA's (from Charmhaven to Wyee and Morisset, and north to near Toronto), with disjunct populations also in Port Stephens LGA (south of Karuah).	This species was not recorded on site during current surveys however 20 records exist within 10km of the site. Of the known populations remaining for this species, one occurs south of Karuah in an area of bushland contiguous with the site. It is likely to occur in swamp habitats on the site.	Despite the fact that this species is likely to occur on site, this conspicuous species is most likely to occur in swamp habitats and was not recorded during extensive searches within the impact areas. Therefore, it only has potential to occur within conservation areas and is unlikely to be affected by the proposed activities. AoS for this species is not required.
Asperula asthenes Trailing Woodruff	V	V	This species is a low, trailing perennial herb with leaves and stipules in whorls of four around the stem. It occurs only in NSW, having been found at damp sites, often along river banks at scattered locations from Bulahdelah to Kempsey, as well as Port Stephens and Wallis Lakes.	This species was not detected on site and no records exist within 10km of the site. Although damp habitats occur on site, the known locations of existing plants are alongside river banks, which do not occur on site. It is therefore considered **unlikely** to occur.	This species was not recorded on site and suboptimal habitat exists on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Asterolasia elegans	E	E	Occurs on Hawkesbury sandstone. Found in sheltered forests on mid- to lower slopes and valleys, e.g. in or adjacent to gullies which support sheltered forest. The canopy at known sites includes Turpentine (*S. glomulifera* subsp. *glomulifera*), Smooth-barked Apple (*A. costata*), Sydney Peppermint (*E. piperita*), Forest Oak (*A. torulosa*) and Christmas Bush (*C. gummiferum*).	This species was not detected on site and no records exist within 10km of the site. The site does not support preferred habitat (Hawkesbury Sandstone) for the species. Therefore it is considered **unlikely** to occur.	This species was not recorded on site and suboptimal habitat exists on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Callistemon linearifolius Nettle Bottle Brush	V	-	Shrub that grows in dry sclerophyll forest on the coast and adjacent ranges. Re-sprouting / juvenile specimens difficult to distinguish from other *Callistemon* species such as *C. rigidus* (Stiff Bottlebrush) or *C. linearis* (Narrow-leaved Bottlebrush) without the aid of flowering parts.	Surveys on site did not detect this species however 12 records exist within 10km of the site. The woodlands found on site, particularly wetter areas, comprise suitable habitat for this species, therefore it has **potential** to occur.	Despite having potential to occur on site, this conspicuous species was not recorded during extensive searches within the impact areas. Therefore, it only has potential to occur within conservation areas and is unlikely to be affected by the proposed activities. AoS for this species is not required.
Cryptostylis hunteriana Leafless Tongue-orchid	E	V	A very rare leafless, saprophytic orchid, which has a symbiotic relationship with a mycorrhizal fungi which provides the plant with all its nutrient requirements. This orchid remains underground for the majority of its lifecycle, flowering periodically when conditions are optimal to reproduce. This species is extremely cryptic as it does not flower every year. Known to occur within a range of habitats including woodlands to swamp heaths. Within the Hunter region larger populations have been typically found in woodland dominated by *E. racemosa* (Scribbly Gum) and it prefers areas with an open grassy understorey. The species typically prefers moist sandy soils in sparse to dense heath and sedgeland, or moist to dry clay loams in coastal forests. In port stephens LGA, this species is strongly associated with and typically restricted to Nerong volcanic peaks (eg. Gan Gan hill, Lemon Tree Passage water reservoir, Tomaree headland).	This species was not detected on site and no records exist within 10km of the site. . The habitat in which it is known to occur are not found on site. It is considered **unlikely** to occur.	This species was not recorded on site and suboptimal habitat exists on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Diuris arenaria Sand Doubletail	E	V	This species is known only from the Tomaree Peninsula near Newcastle in the North Coast botanical subdivision of New South Wales. It occurs in power line easements on the Tomago Sandbeds in regularly slashed sandy heaths.	This species was not detected on site however nine records exist within 10km of the site. These records are from an isolated population outside of the site and this species is extremely rare. The sandy habitats in which it is known to occur are not found on site. It is considered **unlikely** to occur.	This species was not recorded on site and is rare within the surrounding area, thus this species is unlikely to be affected by the proposed activities, and therefore AoS for this species is not required.

Species/Community	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence	Potential Impact
Eucalyptus camfieldii Camfield's Stringybark	V	V	Tree or mallee to 10m high, but often less. Rare and localised, in coastal shrub heath on sandy soils on sandstone, often restricted drainage. Records from the Hunter Region largely in near coastal areas from the Port Stephens LGA to the Central Coast (OEH 2013). The record of *Eucalyptus camfieldii* form the NPWS Atlas originates from a specimen collected from mining rehabilitation by S.Bell, and incorrectly determined as *E. camfieldii* by the National Herbarium. Ken Hill (National Herbarium) has since revised the determination, and it is most likely that this specimen represents a form of *Eucalyptus capitellata*	This species was not detected on site however two records exist within 10km of the site. Coastal shrub heath on sandy soils on sandstone does not occur on site. Therefore it is considered **unlikely** to occur.	This conspicuous species was not recorded during comprehensive targeted searches on site and suboptimal habitat exists on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Eucalyptus parramattensis subsp. *decadens* Earp's Gum	V	V	Red Gum species that grows in dry sclerophyll woodland on sandy soils, often in low damp sites. Locally this species occurs almost exclusively in association with Kurri Sand Swamp Woodland (KSSW) and ecotonal areas. Recorded in swamp woodland on RAAF Base Williamtown (URS 2001)..	This species was not detected on site however 111 records exist within 10km of the site. The vegetation communities found on site do not comprise habitat that is known to support this species in the region, therefore it is **unlikely** to occur.	Despite having potential to occur on site, the preferred habitat of this species is found almost entirely within conservation areas and comprehensive searches failed to detect the species within the small areas of suitable habitat within impact areas. Thus this species is unlikely to be affected by the proposed activities; therefore AoS for this species is not required.
Grevillea parviflora subsp. parviflora Small-flower Grevillea	V	V	A low open to erect shrub. Occurs in light, clayey soils in woodlands. Most plants appear capable of suckering from a rootstock. Relatively widespread within the Cessnock LGA. Occurs within Werakata National Park. Much confusion surrounds the taxonomy of this species and other similar *Grevillea* taxa and a NPWS-funded study of the species is currently in progress.	This species was not detected on site however eight records exist within 10km of the site. The vegetation communities found on site comprise suitable habitat for this species, therefore it has **potential** to occur.	Despite having potential to occur on site, the preferred habitat of this species is found almost entirely within the conservation zone of the assessment area and comprehensive searches failed to detect the species within the limited extent of suitable habitat within impact areas. Thus this species is unlikely to be affected by the proposed activities; therefore AoS for this species is not required.
Maundia triglochinoides	V	-	A perennial emergent aquatic plant that grows in swamps, lagoons, dams, channels, creeks or shallow freshwater 30 - 60 cm deep on heavy clay, low nutrients. Associated with wetland species e.g. *Triglochin procerum*.	This species was not detected on site however four records exist within 10km of the site. Although two dams occur on site in which this species could inhabit, thorough surveys did not detect this species. It is therefore considered **unlikely** to occur.	This species was not recorded on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Melaleuca biconvexa Biconvex Paperbark	V	V	A shrub to small tree, which grows in poorly drained areas on the Central Coast with outlying populations at Jervis Bay and Port Macquarie. Records in the Hunter Region are confined to western Lake Macquarie (Atlas of NSW Wildlife data). It may occur in dense stands adjacent to watercourses, in association with other *Melaleuca* species or as an understorey species in wet forest.	This species was not detected on site and only a single record exists within 10km of the site. However, suitable habitat is found on site primarily within the riparian vegetation communities, therefore it has **potential** to occur.	Despite having potential to occur on site, the preferred habitat of this species is found almost entirely within conservation areas and comprehensive searches failed to detect the species within the small areas of suitable habitat within impact areas. Thus this species is unlikely to be affected by the proposed activities; therefore AoS for this species is not required.
Persicaria elatior Knotweed	V	V	Known from the North Coast, Central Coast and South coast regions of NSW. Inhabits damp places including coastal swamp, watercourses, streams, lakes, swamp forest and disturbed areas. Grows on sandy, alluvial soils.	This species was not detected on site and no records exist within 10km of the site. Although water bodies do exist on site, they do not provide the suitable environment for this species to occur, and detailed assessment of aquatic areas on site did not detect this species. It is therefore considered **unlikely** to occur.	This species was not recorded on site and suitable habitat does not persist on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Phaius australis Lesser Swamp-orchid	E	E	Grows in *Melaleuca quinquenervia* swamps and in sclerophyll forest, on the coast, at or near sea level; reported north from Lake Cathie, but chiefly north from the Evans Head district.	This species was not detected on site and no records exist within 10km of the site. Extensive *Melaleuca quinquinerva* swamps are found on site but the site is a considerable distance south of its known range. . It is therefore considered **unlikely** to occur.	This species was not recorded on site and suitable habitat does not persist on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Rulingia prostrata Dwarf Kerrawang	E	E	A prostrate shrub forming mats greater than 1m in width. Occurrs on sandy, sometimes peaty soils in a wide variety of habitats and occurs within heath, dry sclerophyll and Coastal sands around Tomago. Less than 100 plants occur at the Tomago sandbeds north of Newcastle. Recorded in recently burnt wet heathland on RAAF Base Williamtown and adjoining Hunter Water lands. Appears to be a post disturbance coloniser.	This species was not detected on site however four records exist within 10km of the site. Riparian and swamp woodlands on site could provide habitat for this species, therefore it has **potential** to occur.	Despite having potential to occur on site, the preferred habitat of this species is found almost entirely within conservation areas and comprehensive searches failed to detect the species within the small areas of suitable habitat within impact areas. Thus this species is unlikely to be affected by the proposed activities; therefore AoS for this species is not required.
Senecio spathulatus Coast Groundsel	E	-	Grows in frontal dunes and is known from south of Sydney to north of Newcastle in the Myall lakes region.	This species was not detected on site and only a single record exists within 10km of the site. No frontal dunes exist within the site. Therefore it is **unlikely** to occur.	This species was not recorded on site and preferred habitat does not persist on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this

Species/Community	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence	Potential Impact
					species is not required.
Streblus pendulinus Siah's Backbone	-	E	This tall shrub or tree that inhabits warmer rainforests along watercourses north from Milton, NSW.	This species was not detected on site and no records exist within 10km of the site. No rainforests occur on site in which this species inhabits. It is considered **unlikely** to occur.	No suitable habitat for this species occurs on site, thus this species is unlikely to be affected by the proposed activities, and therefore AoS for this species is not required.
Tetratheca juncea Black-eyed Susan	V	V	Occurs in a variety of forested and heathy habitats. Locally found in Open Forests and Woodlands with dense, undisturbed understorey, often in association with *A. costata* / *C. gummifera* on slopes with south-easterly aspects.	This species was not detected on site however four records exist within 10km of the site. Potential habitat occurs within the MU 30 vegetation where *A. costata* dominates. Therefore it has **potential** to occur.	This species has potential to occur on site, therefore has the potential to be impacted upon by the proposal. A 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1** as well an AoS (EPBC Act) in **Section 5.6.**
Amphibians					
Crinia tinnula Wallum Froglet	V	-	Occurs in coastal, low-lying acid Paperbark forest, within the 'wallum country' (often on sandy soils) coastal heaths and wetlands. Known to occur within wet forest habitats in the Lower Hunter and western Lake Macquarie. Its distribution ranges from Maryborough in Queensland south to Kurnell near Sydney. Large populations have been recorded in the Myall Lakes National Park area and Moffats Swamp Nature Reserve near Medowie and it has been recorded on the western side of Lake Macquarie on the Morisset peninsula.	Current and previous surveys did not detect this species on site. There are 47 records of the species within 10km of the site. Suitable swamp habitat occurs on site which this species could inhabit. It is considered as having **potential** to occur.	As this species has the potential to occur, it could be impacted upon as a result of the proposal. A 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
Litoria aurea Green and Golden Bell Frog	E	V	Inhabits swamps, lagoons, streams and ponds as well as dams, drains and storm water basins. Thought to be displaced from more established sites by other frog species, thus explaining its existence on disturbed sites. Previously widespread within the region, but now sparsely distributed within the Lower Hunter and Central Coast areas. A relatively stable population occurs on Kooragang Island.	This species was not detected on site during surveys and no records within 10km of the site exist. Wetland habitats suitable to this species do not occur on site for this species and current known populations do not occur within 10km of the site. Therefore it is considered **unlikely** to occur.	This species was not recorded on site and suboptimal habitat exists on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Mixophyes balbus Stuttering Frog	E	V	Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Breed in streams during summer after heavy rain, outside the breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor. Eggs are laid on rock shelves or shallow riffles in small, flowing streams.	This species has not been recorded on site or within 10km of the site. No suitable rainforest persist on site in which this species would occur. Therefore it is **unlikely** to occur.	This species was not recorded on site and suboptimal habitat exists on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Mixophyes iteratus Giant Barred Frog	E	E	Mostly restricted to wet sclerophyll forest and rainforest, including Antarctic Beech forest. Usually found within close proximity to permanent running water (Robinson, M, 1998). Hunter Region records are largely confined to the Watagan National Park and to the north of Heaton State Forest (Atlas of NSW Wildlife data).	This species has not been recorded on site or within 10km of the site. No suitable rainforest persist on site in which this species would occur. Therefore it is **unlikely** to occur.	This species was not recorded on site and suboptimal habitat exists on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Birds					
Anthochaera Phrygia Regent Honeyeater	CE	E, M	Nomadic Honeyeater that disperses to non-breeding areas, including the coast, in winter, where flowering trees are sought. Within the region, mostly recorded in Box-Ironbark Eucalypt associations along creek flats, river valleys and foothills. Coastal swamp forests in Lower Hunter are used when more western resources fail. The main feed tree for coastal areas is *E. robusta* (Swamp Mahogany). Hunter records are more common in near coastal areas such as Cessnock LGA. Feed trees in this region are *C. maculata* (Spotted Gum), *E. fibrosa* (Broad-leaved Ironbark), *E. crebra* (Narrow-leaved Ironbark) and various stringybark sp. Nests mainly west of the divide, although local breeding attempts have occurred at Quorrobolong.	This species was not detected on site and only one record exists within 10km of the site. *E. robusta* dominates half of the site which is preferred habitat for this species. Although records in the locality are low the substantial available habitat could be utilised by this species. It is considered as having **potential** to occur.	As this species has the potential to occur, it could be impacted upon as a result of the proposal. A 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1** as well an AoS (EPBC Act) in **Section 5.6.**
Botaurus poiciloptilus	E	E	The distribution of this species ranges from south-east	This species was not detected on site but one record exists	This species was not recorded on site and suboptimal habitat

Species/Community	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence	Potential Impact
Australasian Bittern			Queensland to south-east South Australia, Tasmania and south-west of Western Australia. Preferred habitat includes permanent and seasonal freshwater habitats. It forages in shallow water in wetlands with tall dense vegetation (Garnett et al. 2010).	within 10km of the site. Two permanent damns exist on site however the habitat surrounding these ponds does not provide areas of suitable foraging habitat for this species. Therefore it is considered **unlikely** to occur.	exists on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Burhinus grallarius Bush Stone-curlew	E	-	Prefers open woodland, dry watercourses with fallen branches, leaf litter and sparse grass. Also occurs in coastal scrub, mangrove fringes, golf courses, rail reserves, wooded remnants on roadsides, orchards and plantations. Breeding pairs observed in near shore habitats in south-western Port Stephens and Brisbane Waters.	This species was not detected on site and only two records exist within 10km of the site. The dense understory that exists across the site is not preferred by this ground dwelling species. Therefore it is considered **unlikely** to occur.	This species was not recorded on site and suboptimal habitat exists on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Calyptorhynchus lathami Glossy Black-Cockatoo	V	-	Occurs in forests and woodlands where it forages predominantly on *Allocasuarina* cones. Requires large Eucalypt tree hollows for nesting. Sparse occurrences on the valley floor, but resident in ranges and adjacent areas surrounding the Hunter Valley. Most commonly encountered around the south and south western areas of the lake and in the Watagan Mountains N.P. These locations have good stands of *Allocasuarina* sp., especially *A. littoralis* (Black She-oak)	This species was **recorded** on site during surveys.	This recorded species has the potential to be impacted upon as a result of the proposal. A 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
Climacteris picumnus victoriae Brown Treecreeper (eastern subsp.)	V	-	Frequents drier forests and woodlands, particularly open woodland lacking a dense understorey. Also found in grasslands in proximity to wooded areas where there are sufficient logs, stumps and dead trees nearby. Occasionally found in mallee and *E. camaldulensis* (River Red Gum) forest bordering wetlands with an open understorey of *Acacia* sp., *Muehlenbeckia* sp. (Lignum), *Typha sp*. (Cumbungi) and *Poa* sp. (grasses). Feeds on invertebrate larvae and small insects, particularly ants. Utilises hollows for roosting/nesting.	This species was not detected on site however one record exists within 10km of the site. The woodland present on site consists of a dense understory that is not preferred by this species. Therefore it is considered **unlikely** to occur.	This species was not recorded on site and suboptimal habitat exists on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Daphoenositta chrysoptera Varied Sittella	V	-	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	This species was not detected on site however six records exist within 10km of the site. Suitable woodland habitat occurs on site for this species. Therefore it is considered as having **potential** to occur.	This species has potential to occur and therefore may be impacted upon as a result of the proposal. A 7-part test of significance (TSC Act) has been prepared for this species in **Appendix 1**.
Dasyornis brachypterus Eastern Bristlebird	E	E	The Eastern Bristlebird occurs in three separate populations; one in south-east Queensland and north-east NSW and the other two south of Wollongong (NSW). It inhabits a wide range of habitats including sedgeland, heathland, schlerophyll forest, woodland and rainforest.	This species was not detected on site or within 10km of the site. The distribution of this species persists as three disjunct populations, the closest one being on the Central Coast of NSW. Based on this distribution and lack of records it is considered **unlikely** to occur.	This species was not recorded on site and the site is outside of its known distribution, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Dromaius novaehollandiae Emu (population in the New South Wales North Coast Bioregion and Port Stephens local government area)	E2	-	The species was formerly widespread in north-eastern NSW, but that population is now isolated and largely restricted to coastal and near-coastal areas between Ballina – Evans Head and Red Rock, extending west to the Bungawalbin area. There have also been some recent records from the Port Stephens area. The Emu population in the NSW north coast bioregion and Port Stephens Local Government Area has been listed as an endangered population under the Threatened Species Conservation Act 1995.	This species was not recorded on site however six records from the endangered Port Stephens population exist within 10km of the site. The site consists of dense vegetation that would not be suited to this species. It is therefore considered **unlikely** to occur.	This species was not recorded on site and suitable habitat does not exist on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Ephippiorhynchus asiaticus Black-necked Stork	E	-	Inhabits swamps associated with river systems and large permanent pools but sometimes appears on the coast or in estuaries. It has also been recorded on farm dams and sewage treatment ponds. Within the Hunter Region it occurs spasmodically on freshwater or estuarine wetlands, along coastal and near coastal environments such as Gloucester.	This species was not detected on site however 15 records exist within 10km of the site. Suitable dams and swamps do exist on site in which this species could utilise. Therefore it is considered as having **potential** to occur.	This species has potential to occur and therefore may be impacted upon as a result of the proposal. A 7-part test of significance (TSC Act) has been prepared for this species in **Appendix 1**.
Epthianura albifrons White-fronted Chat	V	-	This species is found in damp open habitats, particularly estuarine and marshy grounds, as well as wetlands containing saltmarsh, bordered by open grasslands or lightly timbered lands (Higgins et al. 2001). The species is	This species was not detected on site however seven records exist within 10km of the site. Suitable saline environments in the form of estuaries, saltmarshes and wetlands do not persist on site. Therefore it is considered	This species was not recorded on site and suitable habitat does not exist on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this

Species/Community	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence	Potential Impact
			also observed in open grasslands and sometimes in low shrubs bordering wetland areas. Inland, the White-fronted Chat is often observed in open grassy plains, saltlakes and saltpans that are along the margins of rivers and waterways (Higgins et al. 2001; Barrett et al. 2003). The species is sensitive to human disturbance and is not found in built areas.	**unlikely** to occur.	species is not required.
Erythrotriorchis radiates Red Goshawk	CE	V	The Red Goshawk occurs in coastal and sub-coastal areas in wooded and forested lands of tropical and warm-temperate Australia. Riverine forests are also used frequently. Such habitats typically support high bird numbers and biodiversity, especially medium to large species which the goshawk requires for prey. The Red Goshawk nests in large trees, frequently the tallest and most massive in a tall stand, and nest trees are invariably within one km of permanent water.	This species was not detected on or within 10km of the site. Due to its preference of foraging among subtropical rainforest and melaleuca forest along coastal rivers, the habitat on site does not constitute suitable foraging habitat for this species. Therefore it is considered **unlikely** to occur.	This species was not recorded on site and suitable habitat does not exist on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Glossopsitta pusilla Little Lorikeet	V	-	*Glossopsitta pusilla* extends from Cairns to Adelaide coastally and to inland locations. Commonly found in dry, open eucalypt forests and woodlands. Can be found in roadside vegetation to woodland remnants. *G. pusilla* feeds on abundant flowering Eucalypts, but will also take nectar from *Melaleuca* sp and *Mistletoe* sp. *E. albens* (White Box) and *E. melliodora* (Yellow Box) are favoured food sources on the western slopes in NSW. On the eastern slopes and coastal areas favoured food sources are *C. maculata* (Spotted Gum), *E. fibrosa* (Broad-leaved Ironbark), *E. robusta* (Swamp Mahogany) and *E. pilularis* (Blackbutt). Nesting takes place in hollow bearing trees.	This species was not recorded on site and only two records exist within 10km of the site. Suitable foraging trees such as *E. robusta* and *A. costata* occur on site. Therefore it is considered as having **potential** to occur.	This species has potential to occur and therefore may be impacted upon as a result of the proposal. A 7-part test of significance (TSC Act) has been prepared for this species in **Appendix 1**.
Ixobrychus flavicollis Black Bittern	V	-	Solitary species, living near water (estuarine to brackish) in mangroves and other trees which need to form only a narrow fringe of cover. A riparian species that occasionally ventures into the open within estuarine habitats. Sedentary resident along Dora and Stockton Creeks in western Lake Macquarie has also been recorded semi-regularly in the Paterson River but is likely to occur in any brackish to estuarine forested coastal creeks in the lower NSW coast.	This species was not detected on site however a single record exists within 10km of the site. Mangroves and estuaries in which this species habituates do not occur on site. Therefore it is **unlikely** to occur.	This species was not recorded on site and suitable habitat does not exist on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Lathamus discolour Swift Parrot	E	E	On the mainland this species frequents Eucalypt forests and woodlands with large trees having high nectar production during winter. Mainland winter foraging sites often vary from year to year. Nests only in Tasmania, but regularly visits the Hunter Region in winter. Visits the Hunter Region when food sources are abundant or food sources are lacking in other areas. Food sources used in the Hunter include *E. robusta* (Swamp Mahogany) on the coast, and near coastal to inland *Lathamus discolour* uses *C. maculata* (Spotted Gum), *E. fibrosa* (Broad-leaved Ironbark) and *E. crebra* (Narrow-leaved Ironbark). Occasional records have come from *E. alba* (White Box) and *E. sideroxylon* (Mugga Ironbark). These food source trees have been recorded as roosting sites for *L. discolor*.	This species was not detected on site however four records exist within 10km of the site. *E. robusta* dominates a portion of the site, providing preferred foraging habitat for this species. Therefore it is considered as having **potential** to occur.	This species has potential to occur and therefore may be impacted upon as a result of the proposal. A 7-part test of significance (TSC Act) has been prepared for this species in **Appendix 1** as well an AoS (EPBC Act) in **Section 5.6.**
Neophema pulchella Turquoise Parrot	V	-	The Turquoise Parrot's range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Prefers to feed in the shade of a tree and spends most of the day on the ground searching for the seeds or grasses and herbaceous plants, or browsing on vegetable matter.	This species was not detected on site however one record exists within 10km of the site. The site does contain woodland however the suburban development surrounding the site would limit the species' potential to occur on site. Therefore it is considered **unlikely** to occur.	This species was not recorded on site and suitable habitat does not exist on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Ninox strenua Powerful Owl	V	-	Occurs in wet or dry sclerophyll forests and woodlands where suitable prey species occur (being predominantly arboreal mammals). Requires large hollows, usually in	This species was not detected on site however nine records exist within 10km of the site. An abundance of small mammals and Grey-headed Flying-foxes on site	The proposal may have a significant impact on this potentially occurring species. Therefore a 7-part test of significance

Species/Community	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence	Potential Impact
			Eucalypt trees, for nesting. Roosts in dense vegetation within such areas. Roosts in dense vegetation within such species as *S. glomulifera* (Turpentine), *A. littoralis* (Black She-Oak), *A. melanoxylon* (Blackwood), *A. floribunda* (Rough-barked Apple), *E. cupressiformis* (Cherry Ballart) and *M. nodosa* (Ball Honeymyrtle). Many coastal records exist across the Hunter region.	provides suitable foraging habitat for this species however the site lacked suitably sized roosting hollows. It has the **potential** to occur on site.	(TSC Act) has been applied to this species in **Appendix 1**.
Oxyura australis Blue-billed Duck	V	-	Blue-billed Ducks are widespread through NSW, though mainly found south of the Murray-Darling Basin. Young birds may disperse widely. They are almost wholly aquatic, preferring deep water in large permanent wetlands or dams where aquatic flora is abundant. Blue-billed Ducks feed on the seeds and leaves of freshwater plants as well as on midges, caddisfly and dragonfly larvae.	This species was not detected on site however one record exists within 10km of the site. Two permanent bodies of water occur on site in which this species could utilise. Therefore it is considered as having **potential** to occur.	The proposal may have a significant impact on this potentially occurring species. Therefore a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
Pandion cristatus Eastern Osprey	V	M	Ospreys are found right around the Australian coast line, except for Victoria and Tasmania. They are common around the northern NSW coast, especially on rocky shorelines, islands and reefs. The species is uncommon to rare or absent from closely settled parts of south eastern Australia. There are few records from inland areas.	This species was not detected on site however two records exist within 10km of the site. Ospreys are coastline specialists focusing on reefs, shorelines and islands, all of which are not associated within the site. Therefore it is considered **unlikely** to occur.	This species was not recorded on site and suitable habitat does not exist on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Petroica boodang Scarlet Robin	V	-	Ranges from SE Qld to the Victoria coast into South Australia. Also occurs in Western Australia in the south west. *P. boodang* occur in single, pairs, in summer, forages in stringybark, other eucalypt woodland, from stumps, low branches (Pizzey 2007). Perches prominently, flying down swiftly to seize prey. Is part migratory in which in autumn/winter moves to more open habitats. Habitat are foothill forests, woodlands, watercourses, in autumn/winter more open habitats, river red gum woodlands, golf courses, parks, orchards and gardens (Pizzey 2007).	This species was not detected on site however one record exists within 10km of the site. This species is known from more open woodland than that which occurs on site. Therefore it is considered **unlikely** to occur.	This species was not recorded on site and suitable habitat does not exist on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Pomatostomus temporalis temporalis Grey-crowned Babbler (eastern subspecies)	V	-	Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. As well as open Eucalypt woodlands with a grassy groundcover and sparse, tall shrub layer. *P. temporalis temporalis* may also be observed along streams in cleared areas and grassy road verges.	This species was not detected on site however three records exist within 10km of the site. The vegetation communities that occur on site do not constitute preferred habitat for this species. Therefore it is considered **unlikely** to occur.	This species was not recorded on site and suitable habitat does not exist on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Rostratula australis Australian Painted Snipe	E	V	This species has a widespread distribution along the east coast of Australia. Preferred habitats include shallow freshwater wetlands, swamps and inundated grassland.	This species was not detected on or within 10km of the site. The dams on site are not considered suitable habitat for this species, and of the swamp habitat that does occur, the understory is deemed too dense for this species to occur. Therefore it is considered **unlikely** to occur.	This species was not recorded on site and suitable habitat does not exist on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Stictonetta naevosa Freckled Duck	V	-	Occurs in the river-dependent wetlands of south-eastern Australia, including the Murray- Darling and Lake Eyre regions, and southwest western Australia. Generally inhabits plankton- rich lentic freshwaters, particularly marshes with dense vegetation of lignum, cumbungi, canegrass, paperbark or tea-tree. Although freshwaters are favoured, waterbodies of various salinities are utilised. The preferred breeding habitats are permanent freshwater swamps or creeks with dense vegetation.	This species was not detected on site however one record exists within 10km of the site. Freckled Ducks require permanent bodies of water in the form of swamps and marshes, both of which do not occur on site. The dams that persist on site do not constitute preferred habitat Therefore it is consider **unlikely** to occur.	This species was not recorded on site and suboptimal habitat exists on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Tyto novaehollandiae Masked Owl	V	-	Found in a range of habitats, locally within sclerophyll forests and woodlands where appropriate/preferred prey species occur (being predominantly terrestrial mammals). Requires large Eucalypt hollows for nesting and prefers to roost in these hollows as well.	This species was not recorded on site during current or however eight records exist within 10km of the site. Hollows large enough to support this species are not present on site but due to the presence of gliders and possums on site, it is classed as potential foraging habitat for this species. Therefore it is considered as having **potential** to occur.	The proposal may have a significant impact on this recorded species. Therefore a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.

Species/Community	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence	Potential Impact
Mammals					
Chalinolobus dwyeri Large-eared Pied Bat	V	V	This species forages in tall open forests and the edges of rainforest. It roosts in mine shafts and similar structures. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of *H. ariel* (Fairy Martin), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves. They remain loyal to the same cave over many years. Found in well-timbered areas containing gullies. The relatively short, broad wing combined with the low weight per unit area of wing indicates manoeuvrable flight. This species probably forages for small, flying insects below the forest canopy. Hunter Region records for this species are largely confined to the Watagan Mountains, but it has been recorded on the southern side of Port Stephens (OEH 2012a).	This species was not detected on site and no records exist within 10km of the site. Based on its habitat preference of rainforest edges and the use of caves and existing mining shafts for roosting, it is considered **unlikely** to occur as these habitat requirements do not persist on site.	This species was not recorded on site and suitable habitat does not exist on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Dasyurus maculatus maculatus Spotted-tailed Quoll (SE Mainland Pop)	V	E	Found in a variety of forested habitats. This species creates a den in fallen hollow logs or among rocky outcrops. Generally does not occur in otherwise suitable habitats that are in close proximity to urban development. Hunter Region records are largely confined to the surrounding ranges (OEH 2012a).	This species was not detected on site however 22 records exist within 10km of the site. The site supports potential foraging habitat for this species however a lesser degree of den habitat available on site due to a lack of abundant hollow logs and absent caves. Therefore it is considered as having **potential** to occur.	The proposal may have a significant impact on this species. Therefore a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1** as well an AoS (EPBC Act) in **Section 5.6.**
Falsistrellus tasmaniensis Eastern False Pipistrelle	V	-	This species is found in a variety of forest types such as open forests, woodlands and wetter sclerophyll forests (usually with trees >20m). This species roosts in tree hollows and caves. Appears to locally favour upland habitats. A limited number of records occur on the central coast and the Lower Hunter Region (OEH 2012a).	This species was not recorded on site during current surveys and only a single record exists within 10km of the site. Suitable foraging and roosting habitat does persist on site. Therefore it is considered as having **potential** to occur.	The proposal may have a significant impact on this species. Therefore a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
Miniopterus australis Little Bentwing-bat	V	-	Prefers to forage in well-vegetated areas, such as within wet and dry sclerophyll forests and rainforests. Requires caves or similar structures for roosting habitat. Largely confined to more coastal areas in the Lower Hunter Region (OEH 2012a).	This species was **recorded** on site during current surveys.	The proposal may have a significant impact on this recorded species. Therefore a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
Miniopterus schreibersii oceanensis Eastern Bentwing-bat	V	-	This species utilises a range of habitats for foraging, including rainforest, wet and dry sclerophyll forests, woodlands and open grasslands. Requires caves or similar structures for roosting habitat. Widely distributed across the Lower Hunter Region (OEH 2012a).	This species was not recorded on site however nine records exist within 10km of the site. As this species occurs in a variety of habitats it could forage on site. Therefore it has **potential** to occur.	The proposal may have a significant impact on this species. Therefore a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
Mormopterus norfolkensis Eastern Freetail-bat	V	-	This species is distributed south of Sydney extending north into south-eastern Queensland. There are no records west of the Great Dividing Range. Most records of this species have been reported from dry Eucalypt forest and woodland. It is expected that open forested areas and the cleared land adjacent to bushland, constitutes important habitat for this species. It is a predominantly tree-dwelling species, roosting in hollows or behind loose bark in mature Eucalypts. Widely distributed across the Lower Hunter Region (OEH 2012a).	This species was not recorded on site however four records exist within 10km of the site. As this species occurs in a variety of habitats it could forage on site. Therefore it has **potential** to occur.	The proposal may have a significant impact on this species. Therefore a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
Myotis macropus Southern Myotis	V	-	Usually found near bodies of water, including estuaries, lakes, reservoirs, rivers and large streams, often in close proximity to their roost site. Although usually recorded foraging over wet areas, it also utilises a variety of wooded habitats adjacent to such areas including rainforest, wet and dry sclerophyll forest, woodland, and swamp forest. Roosts in small colonies of between 15 and several hundred individuals in caves, mines and disused railway tunnels. A number of records from the Central Coast, with fewer numbers in the Lower Hunter	This species was not detected on site however three records exist within 10km of the site. The dams on site offer potential foraging habitat for this species, whilst the wooded areas may provide suitable roosting habitat. Therefore it is considered as having **potential** to occur.	The proposal may have a significant impact on this potentially occurring species. Therefore a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.

Species/Community	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence	Potential Impact
			Region (OEH 2012a) and Central Hunter Region (RPS pers. obs.).		
Petaurus australis Yellow-bellied Glider	V	-	Usually associated with tall, mature wet Eucalypt forest. Also known from tall dry open forest and mature woodland. The diverse diet of this species is primarily made up of Eucalypt nectar, sap, honey dew, manna and invertebrates found under decorticating bark and pollen. Tree hollows for nest sites are essential, as are suitable food trees in close proximity. Most records in the Lower Hunter Region occur in the Watagan Mountains and other areas exhibiting significant stands of forest (OEH 2012a).	This species was not detected on site with only one record existing within 10km of the site, and no records from the Tomaree or Tillagerry peninsulas. The woodlands on site contain few very large mature trees and few suitable hollows for this species. While the woodlands on site could be utilized by this species, they contain few of the habitat features necessary for persistence of this species in the area. Therefore Yellow-bellied Glider is considered **unlikely** to occur.	This species was not recorded on site and suboptimal habitat exists on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Petaurus norfolcensis Squirrel Glider	V	-	Occurs in eucalypt forests and woodlands where it feeds on sap exudates and blossoms. In these areas tree hollows are utilised for nesting sites. This species also requires winter foraging resources when the availability of normal food resources may be limited, such as winter-flowering shrub and small tree species. Widely distributed across the lower hunter region (OEH 2012a).	This species was not detected on site however 58 records exist within 10km of the site. Suitable habitat trees for foraging and roosting exist within both vegetation communities on site. Therefore it is considered as having **potential** to occur.	The proposal may have a significant impact on this potentially occuring species. Therefore a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
Petrogale penicillata Brush-tailed Rock-wallaby	E	V	Occurs in forests and woodlands along the Great Divide and on the western slopes in escarpment country with rocky outcrops, steep rocky slopes, gorges, boulders and isolated rocky areas. The majority of populations favour north-facing aspects, but some southern aspects have been recorded. Apart from the critical rock structure *Petrogale penicillata* also requires adjacent vegetation types, associated types include, dense rainforest, wet sclerophyll, vine thicket, dry sclerophyll forest and open forest. They also require suitable caves and rocky overhangs for shelter and also for 'lookout' posts. Records exist from the Watagan Mountains where it is associated with the above habitats (OEH 2012a.	Current and previous surveys did not detect this species on site and no records exist within 10km of the site. No suitable habitat requirements in the form of rock formations occur on site. Therefore it is considered **unlikely** to occur.	This species was not recorded on site and no suitable habitat exists on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Phascogale tapoatafa Brush-tailed Phascogale	V	-	The Brush-tailed Phascogale is a tree hollow dependant marsupial associated with dry, forested habitats in south-eastern Australia (van der Ree *et al*. 2006) that have a sparse ground cover of herbs, grasses, scleromorphic shrubs or leaf litter (NPWS 1999). However, individuals have also been recorded in heath, swamps, rainforest and wet sclerophyll forest (NPWS 1999). Brush-tailed Phascogales prefer eucalypt woodland with high densities of hollows as a single individual may use up to 20 nesting sites within a single year (Strahan 2004). Nesting sites can include hollow tree limbs, rotten stumps and disused bird nests (Strahan 2004). This largely arboreal species spends the majority of its time in the canopy hunting for insects.	This species was not detected on site however 13 records exist within 10km of the site. Though hollow density is not high on site, the resources available throughout both vegetation communities could support this species. Therefore it is considered as having **potential** to occur.	The proposal may have a significant impact on this potentially occurring species. Therefore a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
Phascolarctos cinereus Koala (Qld, NSW, Vic and ACT Populations)	V	V	Occurs in forests and woodlands where it requires suitable feed trees (particularly *Eucalyptus* spp.) and habitat linkages. Will occasionally cross open areas, although it becomes more vulnerable to predator attack and road mortality during these excursions. Records from the Lower Hunter Region are largely confined to the greater Port Stephens area, the Lake Macquarie hinterland and the Watagan Mountains, with a small number of records from Cessnock LGA (OEH 2012a).	This species was not detected on site however 2151 records exist within 10km of the site, including very old records (ca. 1938) from within the site (OEH 2013). The riparian/swamp vegetation is dominated by *E. robusta* which is listed as a preferred feed tree for Koalas. It is therefore considered highly **likely** to occur.	The proposal may have a significant impact on this potentially occurring species. Therefore a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1** as well an AoS (EPBC Act) in **Section 5.6.**
Potorous tridactylus tridactylus Long-nosed Potoroo	V	V	Prefers cool rainforest, wet sclerophyll forest and heathland. Sleeps by day in a nest on the ground, and digs for succulent roots, tubers, fungi and subterranean insects. Some diggings seemingly attributable to this species may belong to *Isoodon macrourus* (Northern Brown Bandicoot). Records exist from the Karuah vicinity (Gunninah 1999) and the Gosford LGA (OEH 2012a).	This species was not detected on site and a single record exists within 10km of the site. None of the preferred habitats occur on site for this species. Therefore it is considered **unlikely** to occur.	This species was not recorded on site and suboptimal habitat exists on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.

Species/Community	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence	Potential Impact
Pseudonomys novaehollandiae New Holland Mouse	-	V	This species has a patchy distribution within open woodlands, heathlands and in hind dune vegetation throughout Eastern Australia. In the Hunter Region the species stronghold is in the Myall Lakes region.	This species was not detected on site however 22 records exist within 10km of the site. Suitable heathland and dune vegetation does not persist on site. Therefore it is considered **unlikely** to occur.	This species was not recorded on site and suboptimal habitat exists on site, thus this species is unlikely to be affected by the proposed activities, therefore AoS for this species is not required.
Pteropus poliocephalus Grey-headed Flying-fox	V	V	This species forages over a large area for nectar/fruits. Seasonally roosts in communal base camps situated within wet sclerophyll forests or rainforests. Frequently observed to forage in flowering Eucalypts. May occur anywhere within the Hunter Region where food or roosting resources are available.	This species was **recorded** on site during surveys.	This recorded species has the potential to be impacted upon as a result of the proposal. A 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1** as well an AoS (EPBC Act) in **Section 5.6.**
Scoteanax rueppellii Greater Broad-nosed Bat	V	-	Forages in moister gullies and wet sclerophyll forests as well as in lightly wooded areas and open spaces/ecotones. This species roosts in tree hollows and is relatively widespread within the Lower Hunter Region (OEH 2012a).	This species was not recorded on site however 11 records exist within 10km of the site. Moister habitats occur throughout the swamp vegetation in which this species could occur. Therefore it has **potential** to occur.	The proposal may have a significant impact on this species. Therefore a 7-part test of significance (TSC Act) has been applied to this species in **Appendix 1**.
Vegetation Communities					
Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion ; commensurate with Lower Hunter Spotted Gum Ironbark Forest (MU 17) (LHCREMMS)	E		This community is widespread throughout the central to lower Hunter Valley, with forests between Cessnock and Beresfield forming the core of its distribution. This community is dominated by *Corymbia maculata* (Spotted Gum) and *Eucalyptus fibrosa* (Broad-leaved Ironbark) with occasional occurrences of *E. punctata* (Grey Gum) and *E. crebra* (Grey Ironbark). Classified by the Lower Hunter Central Coast Regional Biodiversity Conservation Strategy (LHCCREMS) as Map Unit (MU) 17.	The vegetation composition used to determine the presence of this ecological community was not found to occur on site. This community therefore does not occur.	Due to it not occurring on site, it is considered that this vegetation community is **unlikely** to be impacted on by the proposal. No further assessment is required.
Lowland Rainforest of Subtropical Australia		CE	This community occurs on basalt and alluvial soils, including sand and old elevated alluvial soils. Generally occurs <300m above sea level. This community typically occurs in areas with high annual rainfall (>1300mm). This community is generally a tall closed forest with a relatively low abundance of species from the genera *Eucalyptus*, *Melaleuca* and *Casuarina*. Has an incredibly diverse tree flora composition and the canopy varies between stands. Has high species richness.	The vegetation composition used to determine the presence of this ecological community was not found to occur on site. This community therefore does not occur.	Due to it not occurring on site, it is considered that this vegetation community is **unlikely** to be impacted on by the proposal. No further assessment is required.
Swamp sclerophyll forest on coastal floodplains of the NSW north coast, Sydney Basin bioregion and South East Corner bioregions	E		This community occurs on humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Occurs below 20m elevation (sometimes up to 50m). Generally an open forest, but may consist of a reduced canopy in parts. The community is primarily determined by the frequency and duration of waterlogging and the texture, salinity nutrient and moisture content of the soil. Composition varies with latitude.	Floristic surveys used to determine the composition of vegetation communities on site delineated this EEC as **occurring** on site.	As this community occurs on site, it has the potential to be impacted upon as a result of the proposal. Therefore a 7-part test of significance (TSC Act) has been applied to this community in **Appendix 1**.

Notes:

V = Vulnerable Species. CE = Critically Endangered Species
E = Endangered Species M = Migratory

4.4 Impact Assessment under the TSC Act

Section 5A of the EP&A Act lists seven factors that must be taken into account in the determination of the significance of potential impacts on 'threatened species, populations or ecological communities (or their habitats)' listed under the TSC Act. The Assessment of Significance (7-part test) is used to determine whether there is likely to be a significant impact on threatened species, populations or ecological communities, or their habitats and thus whether a Species Impact Statement (SIS) is required. **Table 7** identified the following species (**Table 7**) as requiring assessment via seven part tests under the TSC Act.

Table 7 TSC Act listed species to be assessed.

TSC Act Listed Species	
Critically Endangered Species	
Regent Honeyeater	
Endangered Species	
Swift Parrot	Black-necked Stork
Vulnerable Species	
Wallum Froglet	Squirrel Glider
Glossy-black Cockatoo	Koala
Varied Sittella	Eastern bentwing-bat
Little Lorikeet	Little Bentwing-bat
Powerful Owl	Southern Myotis
Blue-billed Duck	Greater Broad-nosed Bat
Masked Owl	Eastern False Pipistrelle
Spotted-tail Quoll	Eastern Freetail-bat
Grey-headed Flying-fox	Brush-tailed Phascogale
Flora	
Tetratheca juncea (Black-eyed Susan)	
Threatened Ecological Communities	
Swamp sclerophyll forest on coastal floodplains of the NSW north coast, Sydney Basin bioregion and South East Corner bioregions	

The application of the 7-part test to each species concluded that there is not likely to be a significant effect on threatened species, populations or ecological communities, or their habitats arising from the proposed activities.

4.5 Port Stephens Council Comprehensive Koala Plan of Management (CKPoM)

Consideration is to be given to the following matters when assessing rezoning requests including any amendment to the Port Stephens LEP Prior to approving any such rezoning proposal, Council is to take into consideration the likely impacts of the development made possible by the rezoning including environmental impacts on both the natural and built environment, and social and economic impacts on the locality. In particular Council should be satisfied that the rezoning would:

a) Not result in development within areas of Preferred Koala Habitat or defined Habitat Buffers;

(a) The proposed activity as described in the proposed Concept Masterplan (Carman Surveyors ref: 2165-7C) will result in development within Habitat Buffers and within a small area of Preferred Koala habitat.

b) Allow for only low impact development within areas of Supplementary Koala Habitat and Habitat Linking Areas;

(b) The proposed activity will result in development within Habitat Linking Areas. To be classified as "low impact development" as defined within the CKPoM, all development within the Habitat Linking Areas must maximise the retention and minimise the degradation of native vegetation, and must be consistent with the objectives of the "Performance Criteria for Development Applications."

c) Minimise the removal of any individuals of preferred koala food trees, where ever they occur on the site; and

(c) The proposed Concept Masterplan would potentially result in removal of 31 *Eucalyptus robusta*, a preferred koala food tree. However, all of these trees occur at the edge of urban development areas, with only scattered individuals occurring within urban infill lots. These trees within urban infill could potentially be retained within the established residential properties. The only large clusters of *E. robusta* occur within areas designated as access roads and the alignment of these roads has been adjusted to avoid these trees where possible.

d) Not result in development which would sever koala movement across the site. This should include consideration of the need for maximising tree retention on the site generally and for minimising the likelihood of impediments to safe/unrestricted koala movement.

The proposed development has potential to restrict koala movement across the site within defined Habitat Linking Areas. Measures should be adopted within the urban areas to maximise tree retention and minimise the likelihood of impediments to safe/unrestricted koala movement. Such measures will be addressed at the development stage of the project.

4.6 Impact Assessment under the EPBC Act

Matters of National Environmental Significance (MNES) are identified by the Protected Matters Report generated by the Protected Matters Search (**Appendix 4**). The following MNES are considered in this assessment.

4.6.1 World Heritage Properties:

The site is not a World Heritage area, and is not in close proximity to any such area.

4.6.2 National Heritage Places:

The site is not a National Heritage area, and is not in close proximity to any such area.

4.6.3 Wetlands of International Significance (declared Ramsar wetlands):

Two Ramsar listed Wetlands occur within 10km of the site. These include the Hunter Estuary Wetland and Myall Lakes. The Hunter Estuary Wetland comprises Kooragang Nature Reserve and Shortland Wetlands and is located approximately 8 km south west of the site. The Myall lakes Wetland is located within the Myall Lakes National Park and comprises four main lakes (the Bombah Broadwater, Boolambayte, Two Mile and Myall Lakes) together with the lesser areas of Nerong Creek, Upper and Lower Myall River, Boolambayte Creek, Fame Cover Inlet and Broughton Island.
The proposed activity of clearing is not expected to have an impact on any connected body of water; therefore the proposal will not impact upon either the Hunter Estuary Wetland or Myall Lakes.

4.6.4 Great Barrier Reef Marine Parks:

The site is not part of or within close proximity to any Great Barrier Reef Marine Park.

4.6.5 Commonwealth Marine Areas:

The site is not part of or within close proximity to any Commonwealth Marine Area.

4.6.6 Threatened Ecological Communities;

No Threatened Ecological Communities listed under the EPBC Act were found to occur within 10km of the site.

4.6.7 Threatened Species

The Likelihood of Occurrence assessment in **Section 5.3** determined that several species listed under the EPBC Act potentially occur in habitat found on site. The species are as follows:

Endangered Species

- Spotted-tailed Quoll
- Regent Honeyeater
- Swift Parrot

Vulnerable Species

Flora

- *Tetratheca juncea*

Fauna

- *Koala*
- *Grey-headed* Flying-fox

Endangered species listed under the EPBC Act

Under the EPBC Act, an action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of a population;
- reduce the area of occupancy of the species;
- fragment an existing population into two or more populations;
- adversely affect habitat critical to the survival of a species;

- disrupt the breeding cycle of a population;
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;
- introduce disease that may cause the species to decline; or
- interfere with the recovery of the species.

The Regent Honeyeater, Swift Parrot and Spotted-tailed Quoll utilise a range of forest and woodland environments. The Regent Honeyeater and Swift Parrots arrive in the Hunter region during their migratory periods during the winter months for half the year, with the site being at the northern extent of their distribution. The trees available on site offer foraging habitat to these species. Extensive, unfragmented habitat exists within the surrounding areas offering additional foraging habitat to the species.

The Spotted-tail Quoll requires large hollow logs and ground vegetation which are found on site. It is likely to use the wooded portions of the site at the north and south for foraging, and heavily wooded areas providing higher quality resources occur in surrounding habitats. The habitat on site is not considered critical for any of these species and surrounding vegetation within 10km of the site provides higher quality and more abundant resources. The proposed activity will result in an incremental loss of foraging habitat for these three species, however the proposed activity is not expected to have a significant impact on these matters of NES.

Vulnerable species listed under the EPBC Act

Under the EPBC Act, an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of an important population of a species;
- reduce the area of occupancy of an important population;
- fragment an existing important population into two or more populations;
- adversely affect habitat critical to the survival of a species;
- disrupt the breeding cycle of an important population;
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;
- introduce disease that may cause the species to decline; or
- interfere substantially with the recovery of the species.

Flora

Neither *Cryptostylis hunteriana* nor *Tetratheca juncea* were detected as their preferred habitat does not occur on the site; however surveys were conducted outside the flowering period for these cryptic species and as such they may not have been detectable. Approximately 26.90 hectares of native vegetation may be affected by the proposal which represents a small incremental loss of habitat for these species within the locality. However, 26.58 hectares of conservation areas will be retained, and extensive suitable habitat occurs to the north and east of the site. Therefore, the proposal is not expected to have a significant impact on these matters of NES.

Fauna

Although not observed the koala could potentially utilise the site for foraging, resting and as a movement corridor. A number of Eucalypt species present on site are suitable feed trees for this species. As per the Concept Masterplan the proposal will result in the removal of some feed tree species. While the proposed activity may result in development within koala Habitat Buffers and Habitat Linking Areas as defined in the CKPoM, it will not fragment an existing population, adversely affect critical habitat, modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline. While the potential area of occupancy may be reduced, the site is not likely to support an important population of koalas, as koala activity is likely to be very low on site as there were no signs of activity recorded during targeted searches and SATs.

The Grey-headed Flying-fox would utilise canopy trees on site for foraging and roosting. Various Eucalyptus trees including *E. robusta* and *E. tereticornis* may be removed as a part of the proposal; however larger vegetation parcels surround the site which this species can utilise for foraging and roosting. The trees affected by the proposal do not comprise a significant area of potential habitat available to the species in the locality.

Although the proposed activity is expected to have some impacts on koalas and Grey-headed Flying-foxes, the level of impact is unlikely to be significant on these matters of NES based on the surrounding available habitats and vegetation being retained on site.

4.6.8 Migratory Species

Forty-three migratory species nationally listed under the EPBC Act have been recorded or have potential habitat within a 10 km radius of the site (see **Table 4**). The following species are considered as having potential to occur on site:

- Regent Honeyeater
- Black Faced Monarch
- Satin Flycatcher
- Rufous Fantail

Under the EPBC Act, an action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;
- result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

The Regent Honeyeater, Black Faced Monarch, Satin Flycatcher, and Rufous Fantail inhabit woodlands and could potentially be found in any of the woodland habitats on site. The vegetation to be cleared as part of the proposed activity represents an incremental loss of habitat for the migratory woodland bird species, however this vegetation is not considered important habitat for these species and extensive areas of this habitat persists around the site. Therefore it is unlikely that the proposal will have a significant impact on any migratory species.

4.6.9 EPBC Act Assessment Conclusion

Pursuant to the EPBC Act, an assessment of potential impacts arising from the proposal on MNES has been undertaken. This assessment has been undertaken in accordance with the EPBC Act and *EPBC Act Policy*

Statement 1.1 - Significant Impact Guidelines Matters of National Environmental Significance (DEWHA, 2009).

No threatened species, threatened ecological communities or listed migratory species are expected to be impacted upon as a result of the proposal. Surface impacts as a result of the proposed zoning change and resulting construction are limited to the removal of approximately 26.90 hectares of remnant vegetation, and the availability of large areas of similar habitat in close proximity to the site leads to the conclusion that the thresholds for determining that a significant impact is likely, as listed above, have not been reached. It is therefore considered unlikely that the above listed threatened and migratory species will be affected by the proposal.

4.7 Key Threatening Processes

A Key Threatening Process (KTP) is defined in the TSC Act as a process that "threatens, or could threaten, the survival or evolutionary development of species, populations or ecological communities". They are listed under Schedule 3 of the TSC Act and may adversely affect threatened species, populations or ecological communities or could cause species, populations or ecological communities that are not threatened to become threatened.

Seven KTP's have the potential to arise as a consequence of the construction of the proposed development:

- Anthropogenic Climate Change;
- Clearing of native vegetation;
- Invasion, establishment and spread of *Lantana camara*;
- Invasion of native plant communities by exotic perennial grasses;
- Infection of native plants by *Phytophthora cinnamomi*;
- Loss of hollow-bearing trees; and
- Removal of dead wood and trees.

No other KTP's are believed to be likely to occur as a consequence of the proposed clearing and subsequent industrial development.

4.8 Water Management Act 2000

The far eastern edge of the site includes a SEPP 14 wetland, number 792 (Moffats Swamp), which is outside the area of proposed impact. The SEPP 14 wetland occurs on site only at the far eastern edge and outside of areas of the proposed impact. The Vegetated Riparian Zone (VRZ) adjoining the Category 4 wetland is more than the 40 m (see **Figure 5**) required by the Guidelines for Riparian Corridors on Waterfront land (NSW Office of Water) and will therefore not be a controlled activity.

5.0 Recommendations

The following recommendations are provided to mitigate potential impacts on all biodiversity values on site with particular focus on any species, population or ecological community listed under the TSC Act and/or EPBC Act:

- MU 42 Riparian Melaleuca Swamp Woodland and MU 37 Swamp Mahogany – Paperbark Forest vegetation on site should be retained due to its importance as and EEC, wetland, and Preferred Koala Habitat.
- Clearance of native vegetation should be minimised as far as is practicable.
- The extent of vegetation clearing is to be clearly identified on construction plans.
- Extent of clearing should be fenced with highly visible temporary fencing to ensure that clearing does not extend beyond the area required.
- Attempts should be made to relocate hollow logs and felled trees containing hollows into adjacent habitats to provide further habitat resources for native fauna;
- Nest boxes should be installed within the conservation areas at a ratio of one nest box per hollow-bearing tree removed to compensate for the removal of hollows throughout the vegetation to be cleared, these nest boxes should be monitored and maintained for a period of at least three years;
- Any clearing should be supervised by a qualified ecologist to ensure previously identified habitat trees are 'soft-felled'. Felled trees must be left for a short period of time on the ground to give any fauna trapped in the trees an opportunity to escape before further processing of the trees. The ecologist is to handle any injured or displaced fauna and relocate displaced fauna were necessary.
- Site inductions during construction are to include a briefing regarding the local fauna of the site and identification of protocols to be undertaken if fauna are encountered.
- Conservation lands are to be managed in perpetuity to enhance and maintain ecological integrity and habitat value across the site.
- Appropriate koala feed trees such as *Eucalyptus robusta* and *Eucalyptus tereticornis* are to be included in vegetation management corridors, wherever possible within the urban areas, and plantings of advanced *E. robusta* within retained conservation areas
- Appropriate control measures should be employed to ensure that construction equipment operating within the site do not bring materials (soils, weeds etc.) onto the site that may infect surrounding vegetation with *Phytophthora cinnamomi*.
- Minimise disturbance to the wetland areas where possible. Locate soil or stockpiles away from watercourses to limit potential transport of these substances into the watercourses via runoff.
- Appropriate erosion and sedimentation controls to be implemented prior to the commencement of construction and maintained during construction.
- Appropriate landscaping of the site within any urban development to enhance retained vegetation, habitat corridors, and to provide seasonal foraging resources for species such as Grey-headed Flying-fox, Swift Parrot and Regent Honeyeater.
- Implement urban design actions identified within the CKPoM (e.g. appropriate fencing, domestic animal controls)
- Ongoing weed monitoring to be implemented and potential weed infestations appropriately managed to minimise the spread of weeds on the site. Management of noxious weeds are to be undertaken in accordance with the *Noxious Weeds Act* 1993.

6.0 Conclusion

In total, 21 threatened fauna species and eight flora species listed under the Threatened Species Conservation Act 1995 were identified with potential or known habitat within the site. Of these, 21 fauna species and one flora species were assessed as having potential to occur within impact areas. Assessments of Significance (see **Appendix 1**) concluded that the proposal was unlikely to significantly impact on any of these threatened species.

In total, five threatened fauna species and seven threatened flora listed under the Environmental Protection and Biodiversity Conservation Act 1999 were assessed to possibly occur on the site or the site supports preferred habitat for the species. Of these, five threatened fauna and one threatened flora species was assessed as having potential to occur within impact areas. Assessments under the EPBC Act (see **Section 5.6**) concluded that the proposed activity was unlikely to significantly impact on any of the identified species.

Assessment under the CKPoM found that Preferred Koala Habitat, Habitat Buffers, and Habitat Linking Areas occur on site. Koala SATs were used to assess activity levels on site. SATs recorded no koala activity, and therefore Habitat Buffers were set at the minimum 50 meters around Preferred Koala Habitat. All koala food trees found within potential impact areas were recorded on GPS and marked with flagging tape.

Field surveys undertaken within the site resulted in the identification of three threatened fauna species, namely the Grey-headed Flying-fox (*Pteropus poliocephalus*), Little Bentwing-bat (*Miniopterus australis*), and Glossy Black-cockatoo (*Calyptorhynchus lathami*). No threatened flora species were identified within the site during field surveys.

Four vegetation communities, MU 30 Smooth Barked Apple Woodland, MU 37 Swamp Mahogany – Paperbark Forest (EEC), MU 42 Riparian Melaleuca Swamp Woodland (EEC), and MU 44 Coastal Wet Sand Cyperoid Heath, were delineated on site through rapid data point surveys and consultation with existing literature.

The habitats on site were of good quality due to the presence of hollow-bearing trees, diverse stratum of understorey shrubs, and dense ground cover of logs, leaf-litter, grasses, and sedges. The habitats on site are contiguous with extensive surrounding native bushland.

Multiple Key Threatening Processes listed under the TSC Act will be contributed to as a result of the proposal however with recommendations to mitigate and minimise environmental impacts these processes can be controlled.

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Appendix 1

TSC Act Seven Part Test

TSC Act Assessment of Significance (7-Part Test)

Section 5A of the EP&A Act lists seven factors that must be taken into account in the determination of the significance of potential impacts of proposed activities on 'threatened species, populations or ecological communities or their habitats' (threatened biota) listed under the TSC Act. The '7-part test' is used to determine whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats and thus whether a Species Impact Statement (SIS) is required to be produced.

The significance of the impacts on those threatened species and EECs which have been recorded in the site or are likely to occur and are likely to utilise habitat to be potentially impacted by the proposed activities (see **Table 3**) have been assessed. The following communities and species have been considered:

Fauna

Critically Endangered

- Regent Honeyeater

Endangered

- Swift Parrot
- Black-necked Stork

Vulnerable

- Wallum Froglet
- Glossy-black Cockatoo
- Varied Sittella
- Little Lorikeet
- Powerful Owl
- Blue-billed Duck
- Masked Owl
- Koala
- Squirrel Glider
- Spotted-tailed Quoll
- Brush-tailed Phascogale
- Eastern Freetail-bat
- Southern Myotis
- Grey-headed Flying-fox
- Greater Broad-nosed Bat
- Eastern False Pipistrelle
- Little Bentwing-bat
- Eastern Bentwing-bat

Flora

Vulnerable

- *Tetratheca juncea* (Black-eyed Susan)

Threatened Ecological Communities

- Swamp sclerophyll forest on coastal floodplains of the NSW north coast, Sydney Basin bioregion and South East Corner bioregions

(a) 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.

Threatened Flora

- *Tetratheca juncea* (Black-eyed Susan)

T. juncea is distributed in disjunct populations, generally in coastal districts from about Bulahdelah south to Wyong in the south. Populations were once known from the Port Jackson and Botany Bay areas, although these are now considered extinct (Harden 2002). The predominant populations of *T. juncea* appear to be concentrated within the Lake Macquarie catchment, although recent work around the northern shores of Port Stephens has revealed that substantially sized populations occur in this area, potentially outnumbering the majority of the Lake Macquarie populations. *T. juncea* occurs in sandy heath and dry sclerophyll forests throughout its range.

Suitable habitat on site exists within the Smooth Barked Apple woodland. Due the relatively small area to be cleared and the large extent of higher quality more suitable habitat surrounding the site, it can be considered that the proposed development is not 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.

Threatened Fauna

Woodland/Forest Birds

- Regent Honeyeater (*Anthochaera phrygia*);
- Swift Parrot (*Lathamus discolor*);
- Glossy-black Cockatoo (*Calyptorhynchus lathamii*);
- Varied Sittella
- Little Lorikeet *(Glossopsitta pusill*a);

Neither the Regent Honeyeater nor Swift Parrot were detected within the site, however the habitat is considered suitable for foraging during winter migration. Both species commonly feed nectar produced by winter-flowering eucalypts such as *E. robusta* and hence, potential foraging habitat for these species may be impacted by the proposal. Although suitable habitat occurs on site, the preferred winter flowering species will be retained within the conservation area of the site. Thus, it is unlikely that the proposal will affect the life cycle of these species such that a viable local population is likely to be placed at risk of extinction.

Glossy-black Cockatoos are specialised Allocasuarina and Casuarina tree feeders. This species was detected feeding on *Allocasuarina littoralis* on site. Allocasuarina species occur throughout both communities on site, but primarily through the Smooth Barked Apple woodland to be cleared. This species will lose 26.45 hectares of suitable foraging habitat; however the surrounding state forest and reserve areas contain a high amount of further suitable foraging habitat in which this species could utilise. Thus, it is unlikely that the proposal will affect the life cycle of these species such that a viable local population is likely to be placed at risk of extinction.

The Little Lorikeet was not detected on site. This species feeds on nectar and pollen primarily from flowering eucalypts but also melaleucas and mistletoes. Thus, the proposal may affect potential foraging habitat for this species. Little Lorikeets nest in hollow openings mainly in smooth-barked eucalypts such as *E. viminalis*, *E. blakelyi* and *E. dealbata*. These tree species were not detected across the sites and consequently only marginal breeding habitat occurs for Little Lorikeets on site. Retention of suitable foraging habitat will occur within the conservation areas of the site. Thus, it is unlikely that the proposal will affect the life cycle of these species such that a viable local population is likely to be placed at risk of extinction.

Aquatic Birds

- Black-necked Stork (*Ephippiorhynchus asiaticus*); and
- Blue-billed Duck (*Oxyura australis*)

The Black-necked Stork is distributed in coastal and subcoastal northern and eastern Australia, south to central-eastern NSW. This species is found in shallow, permanent, freshwater terrestrial wetlands and surrounding marginal vegetation including swamps, floodplains, watercourses, freshwater meadows, wet heathland, farm dams and shallow floodplains. They forage in shallow, still water, preferring open wetlands.

The Blue-billed Duck is endemic to Australia and occurs in temperate wetlands of the south-eastern and south-western parts of the country. Occurs in large, deep, open, fresh water dams and lakes but has also been observed in sewage ponds, large rivers and saline water bodies. This surface feeder feeds on aquatic insects, larvae, flies, dragonflies and water beetle larvae.

Both species have not been detected on site and whilst two small water bodies do exist on site, the surrounding Hunter Estuary would provide an extensive area of more suitable and preferred habitat. The dams will not be removed as a result of the proposal. It is considered unlikely that the proposal will affect the life cycle of the Black-necked Stork and Blue-billed Duck such that a viable local population of the species is likely to be placed at risk of extinction.

Forest Owls

- Powerful Owl (*Ninox strenua*); and
- Masked Owl (*Tyto novaehollandiae*)

These forest owl species occur in wet or dry sclerophyll forests and woodlands in the coastal, tablelands and to the western plains of NSW where they hunt for a range of mammalian prey. These species nest in large hollows (preferably Eucalypt trees) where they also roost. Roosting can also occur in dense canopy vegetation, commonly within *S. glomulifera*, *A. littoralis* and *A. melanoxylon*. These owls are specialist predators of arboreal marsupials such as the Common Brushtail Possum, Greater Glider, Sugar Glider and Grey-headed Flying-fox. In addition, some terrestrial mammals commonly taken include the Bush Rat and Brown Antechinus. A high density of small mammals (many of which are hollow-dependent), is required for a suitable foraging habitat for these Forest Owls.

Both the Powerful Owl and Masked Owl have not been detected on site. An abundance of prey species including Grey-headed Flying-foxes, Common Brushtail Possums, Sugar Gliders and smaller rodents and marsupials were recorded across the site. As no hollows of a suitable size for roosting were recorded, the proposal may therefore only impact on potential foraging habitat for the two forest owls within the site. However, due to their widespread distributions and range of habitat utilisation, it is considered unlikely that the proposal will affect the life cycle of the Forest Owls such that a viable local population of the species is likely to be placed at risk of extinction.

- Wallum Froglet (*Crinia tinnula*)

The Wallum Froglet was not recorded during this survey, however it has been recorded from the surrounding area, including the vicinity of Moffats Swamp. Wallum Froglets are likely to be present in wetland habitats on site, particularly amongst the sedges of the Coastal Wet Sand Cyperoid Heath and Swamp Mahogany – Paperbark Forest in the far eastern end of the assessment area. The two dams found within the impact area are suitable though less likely to support this species. No wetland habitats will be destroyed as a result of the proposed action. Potential indirect impacts from erosion, sedimentation, and pollutants in runoff will be controlled during construction. Appropriate water management features will be included in the rural development to minimize impacts to the adjacent wetlands. Provided these controls are in place, the proposed activity will not affect the life cycle of the Wallum Froglet such that a viable local population of this species is likely to be placed at risk of extinction.

- Spotted-tail Quoll (*Dasyurus maculatus*)

The distribution of the Spotted-tail Quoll ranges from South Queensland to Kosciuszko NP, mainly within 200 km of the coast. A total of 44 known sites have been recorded in NSW, however detailed distribution and abundance records of this species are absent due to the scale of its entire range. The Spotted-tail Quoll inhabits a wide variety of forest types including rainforest, wet and dry sclerophyll forest, coastal heathlands and woodlands. Habitat requirements include hollow logs, hollow-bearing trees, rock shelters or other suitable den sites as well as relatively dense vegetation for foraging. This species is an opportunistic carnivore and hunts a wide range of prey such as small mammals like possums, gliders and rats as well as birds, reptiles and invertebrates.

The Spotted-tail Quoll was not recorded within the site during fauna surveys. The site is significantly lacking in suitably sized hollow logs in which this species requires, although foraging habitat does exist on site, particularly in the areas to be retained. Due to its widespread distribution and specific habitat requirements, it is considered unlikely that the proposal will affect the life cycle of the Spotted-tail Quoll such that a viable local population of the species is likely to be placed at risk of extinction.

- Squirrel Glider (*Petaurus norfolcensis*)

The distribution of the Squirrel Glider ranges from western Victoria up to north Queensland mainly inland of the Great Dividing Range. A separate population exists along the coast between southern QLD and southern NSW. The species is widely distributed in the Hunter region and has been recorded within adjacent areas of the sites. Squirrel Gliders inhabit dry sclerophyll forests, woodlands and swamp forests where it feeds on sap exudates and blossoms. Hollow-bearing trees are used as dens for shelter and breeding and are consequently an essential part of the habitat.

This species was not recorded during surveys. However, Sugar Gliders were detected on site, which this species is known to cohabit with. Some hollow bearing trees will be removed as a result of the proposal, which is a potential threat to the species. However the surrounding connecting vegetation is extensive and supports an abundance of hollows that are suitable for use by this species. Due to the connectivity to larger vegetation patches available within the locality it is considered unlikely that the proposal will affect the life cycle of the Squirrel Glider such that a viable local population of the species is likely to be placed at risk of extinction.

- Grey-headed Flying-fox (*Pteropus poliocephalus*)

The Grey-headed Flying-fox is distributed from Melbourne, Victoria up to Bundaberg in Queensland and mainly inhabits sclerophyll forests, woodlands, subtropical and temperate rainforests as wells as heaths and swamps. The selection of habitat is dependent on the availability of foraging opportunities in the form of nectar, pollen and fruits. Common feed trees include Eucalyptus, Melaleuca and Banksia. Grey-headed Flying-foxes are known to migrate long distances in response to foraging availability as nectar and pollen varies over time. Communal roost sites are commonly located in close proximity to a reliable food source and near water bodies, in coastal areas within rainforest patches, mangroves or riparian vegetation.

Grey-headed Flying-foxes were detected in high numbers within the swamp vegetation on site. The swamp vegetation is not considered suitable habitat for a camp to persist on site, and all individuals were observed flying into the site as opposed to persisting during days and nights. It can therefore be considered that this species only uses the site for foraging on a transient basis. Potential impacts of the proposal of this species would therefore be limited to the removal of foraging opportunities. The retention of the swamp vegetation in which this species forages will occur. Therefore it is considered unlikely that the proposal will affect the life cycle of the Grey-headed Flying-fox such that a viable local population of the species is likely to be placed at risk of extinction.

- Koala (*Phascolarctos cinereus*)

The Koala (*Phascolarctos cinereus*) occurs along the east coast of Australia and extends into Woodland, Mulga and River Red Gum forests west of the Great Dividing Range. The range of the Koala covers all such suitable areas of NSW. In drier forested areas, Koalas are generally observed as individuals in low densities. They are more abundant in coastal woodland and in open forest - where they have been found in densities as high as ten individuals per hectare. They are rare or absent in wet forests in the southern part of their range above 600 m, which may be due more to distribution of Eucalypt species than climate, as the Koala is limited to areas where there are acceptable food trees (OEH, 2013).

Koala's diet is generally restricted to that of Eucalypt leaves. On occasion, non-Eucalypt foliage is eaten. The foliage of *Eucalyptus camaldulensis* (River Red Gum), *E. microcorys* (Tallowwood), *E. tereticornis* (Forest Red Gum), *E. punctata* (Grey Gum), *E. viminalis* (Ribbon Gum) and *E. robusta* (Swamp Mahogany) are some of the preferred Eucalypt species. Koalas use a wide variety of tree sizes, and do not preferentially use large or tall trees in NSW forests, although this has been listed as a habitat preference in areas where trees are generally small, stunted or nutrient deprived. The breeding biology of this species is characterised by the occurrence of discrete core, sedentary breeding groups. A core group may comprise up to several dozen individuals that are usually well separated from other breeding groups. These core groups produce a continual supply of dispersing nomadic sub-adults. Individuals within core breeding groups occupy semi-exclusive territories. There is interaction with and marginal overlap of territories between adjacent individual animals. The territories of breeding males generally occur within a matrix of adjacent territories of breeding females. In the overlap zones of adjacent territories of breeding individuals, individual trees occur that are habitually used for interaction between the two animals concerned. These breeding core interaction trees (sometimes termed "home range trees") are readily identifiable by scratched "trails" up the bole and copious dung deposits at the base of the tree. Breeding occurs in summer and young females produce one young (rarely twins) each year (OEH, 2013).

No koalas or signs of koalas were detected on site. A SEPP 44 Schedule 2 listed feed tree, namely *Eucalyptus robusta* (Swamp Mahogany), occurs throughout the swamp vegetation on site. This habitat is however being retained as conservation zoned lands. The habitat to be removed within the impact areas includes a very small area (approximately 0.45 hectares) of potential foraging habitat for this species, including a loss of 31 *E. robusta* trees. The site is surrounded by extensive areas of contiguous vegetation, of which thousands of records or this species exist. Therefore, it is considered that the proposal will not affect the life cycle of the Koala such that a viable local population of the species is likely to be placed at risk of extinction.

Cave-roosting bats

- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*); and
- Little Bentwing-bat (*Miniopterus australis*).

Both the Little Bentwing-bat and Eastern Bentwing-bat have a widespread distribution ranging from Cape York to NSW with Eastern Bentwing-bat spreading down to Central Victoria. These insectivorous bats commonly inhabit wet and dry sclerophyll forests as well as rainforests. All species require caves or similar structures with specific characteristics for roosting purposes. Suitable roost sites are not common and should therefore be considered of high conservation significance.

The Little Bentwing-bat was detected on site during surveys, whilst the Eastern Bentwing Bat was not. No caves exist on site however there is the possibility that these species could roost in artificial structures such as houses that border the site to the west. Little Bentwing-bats have also been recorded roosting in tree hollows, however their choice of roost sites is highly variable with factors relating to microclimate, leaf litter, tree height, hollow entrance and hollow size, amongst others (Richardson 1977). Some clearing will occur as a result of the proposal however large areas of conservation lands are being retained on site. Hollows do persist within the remaining vegetation suitable for hollow nesting species such as this. The habitat

surrounding the site and within the wider locality contains a range of vegetation types with varying sized tree hollows that would be more suitable in accommodating a colony of microbats.

Therefore, it is considered that the proposal will not affect the life cycle of the above cave-roosting bats such that a viable local population of the species is likely to be placed at risk of extinction.

Hollow-roosting Bats

- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*);
- Southern Myotis (*Myotis macropus*); and
- Greater Broad-nosed Bat (*Scoteanax rueppellii*).

All hollow-roosting bats have widespread distributions ranging mainly along coastal areas from southern QLD to Victoria. The Southern Myotis prefers wetland habitat near estuaries and large lakes while all the remaining bats inhabit wet or dry sclerophyll forests, rainforests or woodlands. These species primarily roost in tree hollows but also under decorticating bark and in cracks and fissures. The Southern Myotis roosts in caves, artificial habitats and tree hollows.

None of the above hollow-roosting bats were recorded on site during surveys. The site does support hollows which could support small roosting colonies of microbats. Most of these species have also been noted to roost in artificial structures similarly to the cave-roosting bats, hence they could potentially be occupying built structures such as houses and sheds that border the western boundary of the site. The removal of vegetation on site may reduce foraging and roosting habitat for these species, however larger parcels of connective land exist to the north, south and east of the site that could easily provide the required resources for all the above hollow-roosting bats.

Therefore, it is considered unlikely that the proposal will affect the life cycle of the above Hollow-roosting bats such that a viable local population of the species is likely to be placed at risk of extinction.

(b) 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,

There was no endangered population considered to have a potential of occurring within the sites. Therefore, the above assessment is not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(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

(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

- One Endangered Ecological Community, namely (MU 42) '*Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin Bioregion and South East Corner Bioregions'* was recorded and mapped on site. This vegetation community will be retained on site as a conservation zone, with only a very small area (approximately 0.45 hectares) extending into the impact area. The proposal it is not considered to:

(i) 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

(ii) substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

Flora

- *Tetratheca juncea* (Black-eyed Susan)

This species was not detected within the site. Approximately 26.90 hectares of potential habitat will be removed from the site as a result of the proposed activities.

Fauna

Woodland/Forest Birds

- Regent Honeyeater (*Anthochaera phrygia*);
- Swift Parrot (*Lathamus discolor*);
- Glossy-black Cockatoo (*Calyptorhynchus lathami*);
- Varied Sittella (*Daphoenositta chrysoptera*); and
- Little Lorikeet *(Glossopsitta pusill*a);

Potential foraging habitat for the Regent Honeyeater and Swift Parrot occurs within the swamp vegetation on site which is being retained as conservation lands.

The Glossy-black Cockatoo, Varied Sittella and Little Lorikeet would forage mostly within the Angophora woodland available on site. Approximately 26.90 hectares of potential habitat will be removed as a result of the proposed activities.

Aquatic Birds

- Black-necked Stork (*Ephippiorhynchus asiaticus*); and
- Blue-billed Duck (*Oxyura australis*)

Both aquatic species would utilise the dams and immediate surrounding vegetated environments in the impact areas and the more open areas of the swamps on the eastern end of the assessment area. The dams are to be retained and/or enhanced in quality on site. The swamps are outside the impact areas. No potential habitat will be removed for these species as a result of the proposal.

Forest Owls

- Powerful Owl (*Ninox strenua*); and
- Masked Owl (*Tyto novaehollandiae*);

Potential foraging habitat exists within the site for both Forest Owl species. Consequently, approximately 26.90 hectares of potential habitat will be removed from the site, as a result of the proposed activities.

- Wallum Froglet (*Crinia tinnula*)

No wetland habitats will be removed as a result of the proposed activity.

Mammals

- Spotted Tail Quoll (*Dasyurus maculatus*)

Potential foraging habitat exists within the site for the Spotted Tail Quoll. Consequently, approximately 26.90 hectares of potential habitat will be removed from the site as a result of the proposed activities.

- Squirrel Glider (*Petaurus norfolcensis*)

Both potential foraging and breeding habitat exists within the site for the Squirrel Glider, primarily in the Angophora Woodland. Consequently, approximately 26.90 hectares of potential habitat will be removed from the site as a result of the proposed activities.

- Grey-headed Flying-fox (*Pteropus poliocephalus*)

Foraging habitat occurs across within the Swamp vegetation for this species. Potetnail foraging habitat occurs within the Angophora woodland. Consequently, approximately 26.90 hectares of potential habitat will be removed from the site as a result of the proposed activities.

- Koala (*Phascolarctos cinereus*)

Foraging habitat for this species occurs within the Swamp vegetation on site, with potential foraging habitat occurring within the Angophora woodland. Consequently, approximately 0.45 hectares of potential habitat will be removed from the site as a result of the proposed activities.

Cave-roosting bats

- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*); and
- Little Bentwing-bat (*Miniopterus australis*).

Potential foraging habitat occurs across the extent of the site for both Cave-roosting bats. Approximately, 26.90 hectares of potential foraging habitat will be removed from the site.

Hollow-roosting Bats

- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*);
- Southern Myotis (*Myotis macropus*); and
- Greater Broad-nosed Bat (*Scoteanax rueppellii*).

The site provides suitable foraging and breeding habitat for all the Hollow-roosting Bats except the Southern Myotis, which prefers wetland habitats. Consequently, approximately 26.90 hectares of potential habitat will be removed from the site, as a result of the proposed activities.

(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**

The vegetation to be removed will not fragment and area of vegetation, only reduce its overall size. The retained vegetation will maintain connectivity to a larger contiguous patch of surrounding vegetation. The far northern end of the impact area may however impede movement between the existing swamp woodlands of the assessment area to the east and swamp woodlands outside the assessment area to the west. These swamp woodlands will remain connected, though the distance required to travel between these areas will be increased.

(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**

Flora

- *Tetratheca juncea* (Black-eyed Susan)

This species was not detected on site and the habitat to be removed is not considered critical habitat for this species. The surrounding vegetation particularly those more elevated areas to the North East where other records exist offers more suitable habitat for this species to inhabit. The habitat being removed is not considered important for the long-term survival of this species within the locality.

Fauna

Woodland/Forest Birds

- Regent Honeyeater (*Anthochaera phrygia*);
- Swift Parrot (*Lathamus discolor*);
- Glossy-black Cockatoo (*Calyptorhynchus lathami*);
- Varied Sittella
- Little Lorikeet *(Glossopsitta pusill*a);

The Regent Honeyeater, Swift Parrot, Varied Sittella and Little Lorikeet were not detected on site and the surrounding vegetation offers less disturbed and more suitable habitat for these species. The vegetation to be retained within the conservation zone will continue to provide winter flowering species for the Regent Honeyeater and Swift Parrot specifically. The potential foraging habitat present within the site is not considered to be significant for the long-term survival of these woodland/forest bird species in the locality.

The Glossy-black Cockatoo was detected on site foraging in *Allocasuarina littoralis*. The vegetation to be removed, 26.45 hectares of Angophora woodland, contains foraging habitat for this species. The vegetation to be retained does however contain tree species suitable for this species, as does the surrounding extensive areas of native vegetation. The foraging habitat present within the site is not considered to be significant for the long-term survival of the Glossy-black Cockatoo species in the locality.

Aquatic Birds

- Black-necked Stork (*Ephippiorhynchus asiaticus*); and
- Blue-billed Duck (*Oxyura australis*)

The habitat to be removed on site is not considered to be significant for the long-term survival of these species in the locality.

- Wallum Froglet (*Crinia tinnula*)

The potential foraging habitat present within the site is not considered to be significant for the long-term survival of these species in the locality.

Forest Owls

- Powerful Owl (*Ninox strenua*); and
- Masked Owl (*Tyto novaehollandiae*);

The potential foraging habitat present within the site is not considered to be significant for the long-term survival of these species in the locality.

Mammals

- Spotted Tail Quoll (*Dasyurus maculatus*)

The potential foraging habitat present within the site is not considered to be significant for the long-term survival of this species in the locality.

- Squirrel Glider (*Petaurus norfolcensis*)

The potential foraging and/or breeding habitat present within the site is not considered to be significant for the long-term survival of this species in the locality.

- Grey-headed Flying-fox (*Pteropus poliocephalus*)

The habitat to be removed on site is not considered to be significant for the long-term survival of this species in the locality.

- Koala (*Phascolarctos cinereus*)

The habitat to be removed on site is not considered to be significant for the long-term survival of this species in the locality.

Cave-roosting Bats

- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*); and
- Little Bentwing-bat (*Miniopterus australis*).

The habitat to be removed on site is not considered to be significant for the long-term survival of this species in the locality.

Hollow-roosting Bats

- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*);
- Southern Myotis (*Myotis macropus*); and
- Greater Broad-nosed Bat (*Scoteanax rueppellii*).

The habitat to be removed on site is not considered to be significant for the long-term survival of this species in the locality.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No areas of critical habitat occur within the site.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

Flora

The proposed activity will result in habitat loss for *Tetratheca juncea*. However, known populations of these species with high conservation priority are not found on site.

Fauna

Woodland/Forest Birds

- Regent Honeyeater (*Anthochaera phrygia*);

- Swift Parrot (*Lathamus discolor*);
- Glossy-black Cockatoo (*Calyptorhynchus lathami*);
- Varied Sittella
- Little Lorikeet *(Glossopsitta pusill*a);

Of the threatened Woodland/Forest Birds under consideration for this site, two of the species had a recovery plans or threat abatement plan, including:

- Regent Honeyeater; and
- Swift Parrot.

As potential habitat will be removed during the current proposal, the proposal would be inconsistent with objective 1 in **Table 6** (Clearing of native vegetation) of the National Recovery Plan for the Swift Parrot *Lathamus discolour* (Saunders and Tzaros 2011).

One specific objective listed under the Regent Honeyeater Recovery plan 1999-2003 (Menkhorst et al. 1999) states that 'maintaining and enhancing the value of Regent Honeyeater habitat at Key sites and throughout their former range...'. The proposal removes potential foraging habitat for this species and is therefore inconsistent with this recovery plan.

Aquatic Birds

- Black-necked Stork (*Ephippiorhynchus asiaticus*); and
- Blue-billed Duck (*Oxyura australis*)

No recovery or threat abatement plans have been developed for the Black-necked Stork or Blue-billed Duck at this stage.

Forest Owls

- Powerful Owl (*Ninox strenua*); and
- Masked Owl (*Tyto novaehollandiae*);

As potential habitat will be removed during the current proposal, the proposal would be inconsistent with objective 5 (minimise loss and fragmentation of owl habitat areas) of the large forest owl recovery plan (DEC 2006).

- Wallum Froglet (*Crinia tinnula*)

A National recovery plan for the wallum sedgefrog and other wallum-dependent frog species (Meyer et al. 2006) does exist. However as the habitat on site is considered to be potential habitat as opposed to known or critical habitat, it is consistent with the listed objectives.

Mammals

- Spotted Tail Quoll (*Dasyurus maculatus*)

As potential habitat will be removed during the current proposal, the proposal would be inconsistent with objective 4.1 (reduce the rate of loss and fragmentation of Spotted-tailed Quoll habitat) of the Spotted-tailed Quoll draft recovery plan (Long & Nelson, 2004).

- Squirrel Glider (*Petaurus norfolcensis*)

No recovery or threat abatement plans have been developed for the Squirrel Glider at this stage.

- Grey-headed Flying-fox (*Pteropus poliocephalus*)

As potential habitat will be removed during the current proposal, the proposal would be inconsistent with objective 1 (to identify and protect foraging habitat) of the Grey-headed Flying-fox draft recovery plan (DECCW, 2009).

- Koala (*Phascolarctos cinereus*)

A Recovery plan for the Koala does exist (DECC 2008). As the proposal is retaining the preferred foraging habitat for this species within the conservation designated area, the proposal is consistent with the objectives of the recovery plan for Koalas.

Cave-roosting Bats

- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*); and
- Little Bentwing-bat (*Miniopterus australis*).

No recovery or threat abatement plans have been developed for the Eastern Bentwing-bat or Little Bentwing-bat at this stage.

Hollow-roosting Bats

- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*);
- Southern Myotis (*Myotis macropus*); and
- Greater Broad-nosed Bat (*Scoteanax rueppellii*).

No recovery or threat abatement plans have been developed any of the Hollow-roosting Bats at this stage.

(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.

Key Threatening Processes (KTPs) are listed under Schedule 3 of the TSC Act 1995. There are seven KTPs that have the potential to affect the site as a consequence of the proposal, being:

- Anthropogenic climate change.

Potential changes to landuse that result in any increase in human activity or changes to ground cover within the site would likely increase the rate of anthropogenic climatic change in at least the short term however, by an insignificant amount.

- Clearing of native vegetation

Approximately 26.90 hectares of native vegetation will be required to be cleared to accommodate the proposal. A large portion of the site (26.58 hectares) is being retained for conservation purposes and large patches of contiguous vegetation surround the site. Therefore the proposal will contribute marginally to this KTP.

- Loss of hollow-bearing trees

A number of local threatened fauna species are reliant on hollow-bearing trees for roosting and breeding purposes, including the squirrel glider, threatened owls and hollow-roosting insectivorous bats. Many hollow-

bearing trees were recorded on site and are likely to be removed as a result of the proposal. Therefore, the proposal is expected to result in a very minor contribution to this key threatening process.

- Removal of dead wood and dead trees

Potential exists for removal of dead standing and fallen timber within the sites. Given the small area to be cleared, it is not expected that a major increase in activities relation to this KTP would result from the proposal.

- Invasion, establishment and spread of Lantana, (*Lantana camara*)

The proposal has potential to contribute to the Key Threatening Process "*Lantana camara*" due to the removal of vegetation particularly within close proximity to the EEC. *Lantana camara* does occur on site and should be controlled within the conservation zones once clearing has ceased to minimise this KTP. The proposed development will provide an opportunity to enact a weed control program to ameliorate this KTP.

- Invasion of native plant communities by exotic perennial grasses

The proposal has the potential to contribute to the Key Threatening Process "Invasion of native plant communities by exotic perennial grasses" due to the removal of vegetation. Disturbed areas within the site already contain exotic perennial grasses, and further clearing with higher levels of traffic could increase the spread of exotic species. The proposed development will provide an opportunity to enact a weed control program to ameliorate this KTP.

- Infection of native plants by *Phytophthora cinnamomi*;

The proposal has the potential to contribute to the Key Threatening Process "Infection of native plants by *Phytophthora cinnamomi*" due to the regular occurrence of vehicles on site that could be carrying and spreading the fungus. Appropriate mitigation measures involving vehicles on site will provide an opportunity to ameliorate this KTP.

Appendix 2

Flora Species List

Family	Scientific Name	Common Name
Fabaceae/faboideae/Mimosoideae	*Acacia brownii*	Heath Wattle
Fabaceae/faboideae/Mimosoideae	*Acacia falcata*	-
Fabaceae/faboideae/Mimosoideae	*Acacia irrorata* subsp. *irrorata*	Sydney Green Wattle
Fabaceae/faboideae/Mimosoideae	*Acacia longifolia* var. *longifolia*	Sydney Golden Wattle
Fabaceae/faboideae/Mimosoideae	*Acacia myrtifolia*	Red Stem Wattle
Fabaceae/faboideae/Mimosoideae	*Acacia obtusifolia*	Blunt-leaf Wattle
Fabaceae/faboideae/Mimosoideae	*Acacia terminalis*	Sunshine Wattle
Fabaceae/faboideae/Mimosoideae	*Acacia ulicifolia*	Prickly Moses
Polygonaceae	*Acetosa saggitata**	Turkey Rhubarb
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair
Asteraceae	*Ageratina adenophora**	Crofton Weed
Casuarinaceae	*Allocasuarina littoralis*	Black She-oak
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak
Poaceae	*Andropogon virginicus**	Whisky Grass
Myrtaceae	*Angophora costata*	Smooth-barked Apple
Poaceae	*Aristida vagans*	Three-awn Speargrass
Azollaceae	*Azolla filiculoides*	Pacific Azolla
Proteaceae	*Banksia spinulosa* var. *spinulosa*	Hairpin Banksia
Asteraceae	*Bidens pilosa**	Cobbler's Pegs
Pittosporaceae	*Billardiera scandens*	Hairy Appleberry
Blechnaceae	*Blechnum indicum*	Swamp Water Fern
Euphorbiaceae	*Breynia oblongifolia*	Coffee Bush
Pittosporaceae	*Bursaria spinosa subsp. spinosa*	Native Blackthorn
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush
Dicksoniaceae	*Calochlaena dubia*	Rainbow Fern
Lauraceae	*Cassytha glabella*	
Apiaceae	*Centella asiatica*	Swamp Pennywort
Poaceae	*Chloris gayana**	Rhodes Grass
Asteraceae	*Chrysanthemoides monilifera* subsp. *rotundata**	Bitou Bush
Lauraceae	*Cinnamomum camphora**	Camphor Laurel
Ranunculaceae	*Clematis aristata*	Old Man's Beard
Asteraceae	*Conyza bonariensis**	Flax-leaf Fleabane
Asteraceae	*Conyza sumatrensis**	Tall Fleabane
Poaceae	*Cortaderia selloana**	Pampas Grass
Myrtaceae	*Corymbia gummifera*	Red Bloodwood

Family	Scientific Name	Common Name
Malaceae	*Cotoneaster pannosus**	Cotoneaster (cultivar)
Poaceae	*Cymbopogon refractus*	Barbwire Grass
Poaceae	*Cynodon dactylon*	Common Couch
Alismataceae	*Damasonium minus*	Starfruit
Fabaceae/faboideae	*Desmodium rhytidophyllum*	-
Fabaceae/faboideae	*Desmodium varians*	Slender Tick-trefoil
Phormiaceae	*Dianella caerulea* var. *producta*	Blue Flax Lily
Convolvulaceae	*Dichondra repens*	Kidney Weed
Fabaceae/faboideae	*Dillwynia retorta*	Eggs and Bacon
Sapindaceae	*Dodonaea triquetra*	Hop-bush
Poaceae	*Echinopogon caespitosus*	Bushy Hedgehog-grass
Hydrocharitaceae	*Egeria densa**	Dense Waterweed
Cyperaceae	*Eleocharis gracilis*	
Cyperaceae	*Eleocharis sphacelata*	Tall Spike-rush
Poaceae	*Entolasia marginata*	Bordered Panic
Poaceae	*Entolasia stricta*	Wiry Panic
Epacridaceae	*Epacris pulchella*	Wallum Heath
Poaceae	*Eragrostis brownii*	Brown's Lovegrass
Myrtaceae	*Eucalyptus capitellata*	Brown Stringybark
Myrtaceae	*Eucalyptus globoidea*	White Stringybark
Myrtaceae	*Eucalyptus haemastoma*	Broad-leaved Scribbly Gum
Myrtaceae	*Eucalyptus piperita*	Sydney Peppermint
Myrtaceae	*Eucalyptus resinifera*	Red Mahogany
Myrtaceae	*Eucalyptus robusta*	Swamp Mahogany
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum
Myrtaceae	*Eucalyptus umbra*	Broad-leaved White Mahogany
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry
Santalaceae	*Exocarpos cupressiformis*	Native Cherry
Cyperaceae	*Gahnia clarkei*	Tall Saw-sedge
Cyperaceae	*Gahnia sieberiana*	Red-fruited Saw-sedge
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily
Phyllanthaceae	*Glochidion ferdinandi var. ferdinandi*	Cheese Tree
Fabaceae/faboideae	*Glycine clandestina*	Twining Glycine
Asclepidaceae	*Gomphocarpus fruiticosus**	Narrow Leaf Cotton Bush
Fabaceae/faboideae	*Gompholobium latifolium*	Broad-leaf Wedge-pea

Family	Scientific Name	Common Name
Haloragaceae	*Gonocarpus tetragynus*	Poverty Raspwort
Goodeniaceae	*Goodenia heterophylla*	
Proteaceae	*Hakea dactyloides*	Broad-leaved Hakea
Fabaceae/faboideae	*Hardenbergia violacea*	False Sarsparilla
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower
Dilleniaceae	*Hibbertia obtusifolia*	Grey Guinea Flower
Apiaceae	*Hydrocotyle bonariensis**	Kurnell Curse / Pennywort
Apiaceae	*Hydrocotyle laxiflora*	Stinking Pennywort
Dennstaedtiaceae	*Hypolepis muelleri*	Harsh Ground Fern
Poaceae	*Imperata cylindrica*	Blady Grass
Juncaceae	*Juncus planifolius*	Broad Rush
Fabaceae/faboideae	*Kennedia rubicunda*	Dusky Coral Pea
Myrtaceae	*Kunzea ambigua*	Tick Bush
Asteraceae	*Lagenifera stipitata*	Blue Bottle-daisy
Proteaceae	*Lambertia formosa*	Mountain Devil
Verbenaceae	*Lantana camara**	Lantana
Brassicaceae	*Lepidium spp.**	A Peppercress
Cyperaceae	*Lepidosperma concavum*	-
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge
Cyperaceae	*Lepironia articulata*	-
Myrtaceae	*Leptospermum polygalifolium*	Tantoon
Restionaceae	*Lepyrodia scariosa*	Scale Rush
Epacridaceae	*Leucopogon juniperinus*	Prickly Beard-heath
Oleaceae	*Ligustrum lucidum**	Large-leaved Privet
Oleaceae	*Ligustrum sinense**	Small-leaved Privet
Epacridaceae	*Lissanthe strigosa*	Peach Heath
Lomandraceae	*Lomandra longifolia*	Spiky-headed Mat-rush
Lomandraceae	*Lomandra obliqua*	Twisted Mat-rush
Caprifoliaceae	*Lonicera japonica**	Japanese Honeysuckle
Onagraceae	*Ludwigia peploides* subsp. *montevidensis*	Water Primrose
Myrtaceae	*Melaleuca decora*	-
Myrtaceae	*Melaleuca linariifolia*	Snow in Summer
Myrtaceae	*Melaleuca quinquenervia*	Broad-leaved Paperbark
Poaceae	*Microlaena stipoides*	Weeping Grass
Fabaceae/faboideae	*Mirbelia rubiifolia*	Heathy Mirbelia

Family	Scientific Name	Common Name
Davalliaceae	*Nephrolepis cordifolia**	Fish-bone Fern
Ochnaceae	*Ochna serrulata**	Mickey Mouse Plant
Poaceae	*Oplismenus aemulus*	Basket Grass
Poaceae	*Oplismenus imbecillis*	-
Oxalidaceae	*Oxalis sp.*	-
Poaceae	*Panicum simile*	Two Colour Panic
Poaceae	*Paspalum distichum*	Water Couch
Poaceae	*Paspalum urvillei**	Vasey Grass
Passifloraceae	*Passiflora spp.**	
Polygonaceae	*Persicaria decipiens*	Slender Knotweed
Polygonaceae	*Persicaria lapathifolia*	Pale Knotweed
Proteaceae	*Persoonia linearis*	Narrow-leaved Geebung
Philydraceae	*Philydrum lanuginosum*	Woolly Frogmouth
Euphorbiaceae	*Phyllanthus hirtellus*	Thyme Spurge
Thymelaeaceae	*Pimelea linifolia*	Slender Rice Flower
Pinaceae	*Pinus radiata**	Radiata or Monterey Pine
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum
Plantaginaceae	*Plantago lanceolata**	Ribwort
Convolvulaceae	*Polymeria calycina*	Bindweed
Lobeliaceae	*Pratia purpurascens*	Whiteroot
Asparagaceae	*Protasparagus densiflorus**	Asparagus Fern
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower
Poaceae	*Pseudoraphis paradoxa*	Slender Mudgrass
Dennstaedtiaceae	*Pteridium esculentum*	Bracken
Fabaceae/faboideae	*Pultenaea paleacea*	-
Rosaceae	*Rubus anglocandicans**	Blackberry
Rosaceae	*Rubus parvifolius*	Native Raspberry
Alismataceae	*Sagittaria platyphylla**	Sagittaria
Cyperaceae	*Schoenoplectus mucronatus*	River Clubrush
Asteraceae	*Senecio madagascariensis**	Fireweed
Fabaceae/Cesalpinioideae	*Senna pendula* var. *glabrata**	-
Poaceae	*Setaria sphacelata**	South African Pigeon Grass
Poaceae	*Themeda australis*	Kangaroo Grass
Fabaceae/faboideae	*Trifolium repens**	White Clover
Typhaceae	*Typha orientalis*	Cumbungi

Family	Scientific Name	Common Name
Verbenaceae	*Verbena bonariensis**	Purpletop
Violaceae	*Viola hederacea*	Ivy-leaved Violet
Asteraceae	*Xanthium occidentale**	Noogoora Burr
Xanthorrhoaceae	*Xanthorrhoea latifolia*	-

*Introduced Species

Appendix 3

Fauna Species List

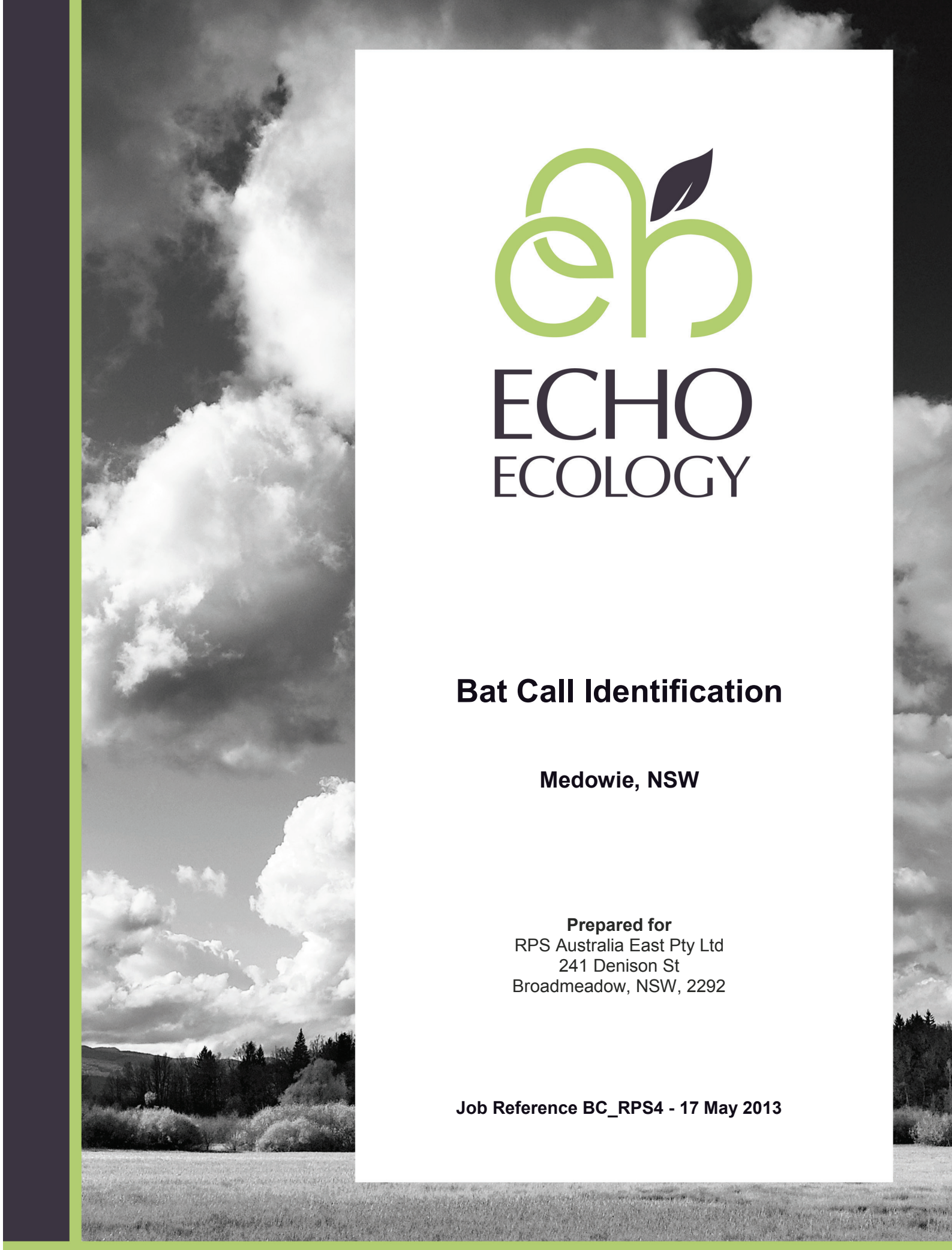
Appendix Key: * = introduced species
(C) = listed as CAMBA species
(J) = listed as JAMBA species
(E) = listed as Endangered in NSW.
(V) = listed as Vulnerable in NSW.
(V*) = Species listed under the Commonwealth EPBC Act as Vulnerable
(E*) = Species listed under the Commonwealth EPBC Act as Endangered
(M) = Species listed under the Commonwealth EPBC Act as Migratory
Species indicated in **BOLD** font are those threatened species known from within 10km of site (NPWS, 2003)

Family Name	Common Name	Scientific Name
Avifauna		
Anatidae	Pacific Black Duck	*Anas superciliosa*
	Hardhead	*Aythya australis*
Podicipedidae	Australasian Grebe	*Tachybaptus novaehollandiae*
Columbidae	Bar-shouldered Dove	*Geopelia humeralis*
	Brown Cuckoo-Dove	*Macropygia amboinensis*
	Spotted Turtle-Dove	*Streptopelia chinensis**
Phalacrocoracidae	Little Pied Cormorant	*Microcarbo melanoleucos*
Accipitridae	Whistling Kite	*Haliastur sphenurus*
Rallidae	Buff-banded Rail	*Gallirallus philippensis*
Cacatuidae	Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*
	Glossy Black-Cockatoo	***Calyptorhynchus lathami* (V)**
Psittacidae	Australian King-Parrot	*Alisterus scapularis*
	Eastern Rosella	*Platycercus eximius*
	Rainbow Lorikeet	*Trichoglossus haematodus*
Cuculidae	Fan-tailed Cuckoo	*Cacomantis flabelliformis*
	Shining Bronze-Cuckoo	*Chalcites lucidus*
Alcedinidae	Laughing Kookaburra	*Dacelo novaeguineae*
Climacteridae	White-throated Treecreeper	*Cormobates leucophaea*
Maluridae	Superb Fairy-wren	*Malurus cyaneus*
Acanthizidae	Striated Thornbill	*Acanthiza lineata*
	Brown Thornbill	*Acanthiza pusilla*
	White-browed Scrubwren	*Sericornis frontalis*
Meliphagidae	Eastern Spinebill	*Acanthorhynchus tenuirostris*
	Yellow-faced Honeyeater	*Lichenostomus chrysops*
	Noisy Miner	*Manorina melanocephala*
	Lewin's Honeyeater	*Meliphaga lewinii*
	Scarlet Honeyeater	*Myzomela sanguinolenta*
	Noisy Friarbird	*Philemon corniculatus*
	White-cheeked Honeyeater	*Phylidonyris niger*
Psophodidae	Eastern Whipbird	*Psophodes olivaceus*
Campephagidae	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*
Pachycephalidae	Golden Whistler	*Pachycephala pectoralis*
Artamidae	Pied Butcherbird	*Cracticus nigrogularis*
	Australian Magpie	*Cracticus tibicen*
	Pied Currawong	*Strepera graculina*
Rhipiduridae	Grey Fantail	*Rhipidura albiscapa*
	Willie Wagtail	*Rhipidura leucophrys*
Corvidae	Australian Raven	*Corvus coronoides*
Monarchidae	Magpie-lark	*Grallina cyanoleuca*
Petroicidae	Eastern Yellow Robin	*Eopsaltria australis*
Timaliidae	Silvereye	*Zosterops lateralis*
Estrildidae	Red-browed Finch	*Neochmia temporalis*
Mammals		
Dasyuridae	Yellow-footed Antechinus	*Antechinus flavipes*
	Brown Antechinus	*Antechinus stuartii*
Petauridae	Sugar Glider	*Petaurus breviceps*
Phalangeridae	Common Brushtail Possum	*Trichosurus vulpecula*
Macropodidae	Eastern Grey Kangaroo	*Macropus giganteus*
Pteropodidae	**Grey-headed Flying-fox**	***Pteropus poliocephalus* (V)**
Molossidae	Undescribed Freetail Bat	*Mormopterus "Species 2"*
	White-striped Freetail-bat	*Tadarida australis*
Vespertilionidae	Gould's Wattled Bat	*Chalinolobus gouldii*
	Chocolate Wattled Bat	*Chalinolobus morio*
	Little Bentwing-bat	***Miniopterus australis* (V)**
Muridae	Bush Rat	*Rattus fuscipes*
	Swamp Rat	*Rattus lutreolus*

Family Name	Common Name	Scientific Name
Felidae	Cat	*Felis catus**
Leporidae	Brown Hare	*Lepus capensis**
	Rabbit	*Oryctolagus cuniculus**
Amphibians		
Myobatrachidae	Common Eastern Froglet	*Crinia signifera*
	Brown-striped Frog	*Limnodynastes peronii*
	Bibron's Toadlet	*Pseudophryne bibronii*
Hylidae	Jervis Bay Tree Frog	*Litoria jervisiensis*
Reptiles		
Scincidae	-	*Cryptoblepharus sp.*
	Dark-flecked Garden Sunskink	*Lampropholis delicata*

Appendix 4

Anabat Report



ECHO ECOLOGY

Bat Call Identification

Medowie, NSW

Prepared for
RPS Australia East Pty Ltd
241 Denison St
Broadmeadow, NSW, 2292

Job Reference BC_RPS4 - 17 May 2013

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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

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Contents

1.0 INTRODUCTION

This report has been commissioned by RPS Australia East Pty Ltd to analyse bat echolocation call data (Anabat, Titley Electronics) collected from Medowie, 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 (Version 3.8m) software. The identification of calls was undertaken with reference to Pennay and others (2004) and through the comparison of recorded reference calls from north-eastern NSW and the Sydney Basin. Reference calls were obtained from the NSW database and from the authors personal collection.

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 could not 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 background 'noise' files or passes by bats which are too short and/or of poor quality to confidently identify.

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. Such comparisons 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.

2.1 Characteristics Used to Differentiate Species

Chalinolobus gouldii was differentiated from *Mormopterus* sp. by the presence of curved alternating pulses in good call sequences. Good call sequences which showed flat pulses with little to no alternation allowed *Mormopterus* Species 2 to be identified over *Mormopterus norfolkensis* which has alternative flat pulses, often with a downward sloping tail

Chalinolobus morio was identified from *Vespadelus vulturnus* by the presenece of a down-sweeping tail.

Miniopterus australis was differentiated from *Vespadelus pumilus* which it overlaps with, by the presence of a down-sweeping tail on pulses or higher characteristic frequency.

Myotis macropus was not able to be differentiated from *Nyctophilus* species since calls did not display characteristics that allow the genus to be separated such as pulse interval less than 75ms or greater than 95 ms, the absence of a central kink and slope between 300-400 OPS.

No capture records of *Mormopterus* species 4 exist from the Medowie area. However, there were a number of flat calls around 26kHz that were similar to this species. These calls were identified as *Mormopterus* species 4 at a possible level, but may have been confused with *Chalinolobus gouldii* calling in more structurally open areas.

3.0 RESULTS

A total of 891 call sequences were recorded, of which 470 call sequences were able to be analysed (ie were not 'noise' files or bat calls of short length). Of the bat calls, 85 call sequences (18 %) were able to be confidently identified (those classified as either definite or probable identifications) to species level (Table 1). Species recorded confidently within the site include:

- *Chalinolobus gouldii* (Gould's wattled bat)
- *Chalinolobus morio* (Chocolate wattled bat)
- *Miniopterus australis* (Little bentwing bat)
- *Mormopterus* species 2 (Eastern freetail bat)

- *Tadarida australis* (White-striped freetail bat)

Additional bat species that are known to exist within the locality of the site, but could not be confidently identified to species (those classified as possible or as a species group), include:

- *Falsistrellus tasmaniensis* (Eastern falsistrelle)
- *Miniopterus schreibersii oceanensis* (Eastern bentwing bat)
- *Mormopterus norfolkensis* (East-coast freetail bat)
- *Mormopterus* species 4 (Southern freetail bat)
- *Myotis macropus* (Large-footed myotis)
- *Nyctophilus geoffroyi* (Lesser long-eared bat)
- *Nyctophilus gouldi* (Gould's long-eared bat)
- *Scoteanax rueppellii* (Greater broad-nosed bat)
- *Scotorepens orion* (Eastern broad-nosed bat)
- *Vespadelus darlingtoni* (Large forest bat)
- *Vespadelus pumilus* (Eastern forest bat)
- *Vespadelus regulus* (Southern forest bat)
- *Vespadelus vulturnus* (Little forest bat)

It should be noted that additional bat species may be present within the site but were not recorded by the detectors and habitat assessment should be used in conjunction with these results to determine the likelihood of occurrence of other bat species.

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

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

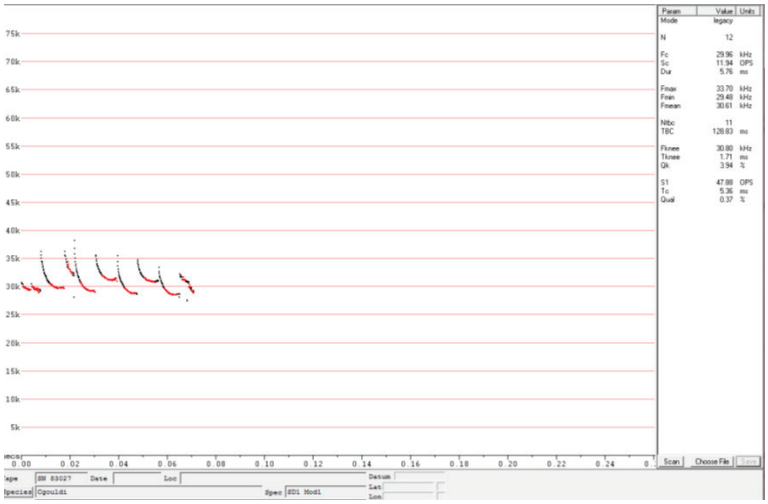
IDENTIFICATION	Anabat 3, 20130506, 6/05/2013	Anabat 3, 20130506, 7/05/2013	Anabat 3, 20130507, 7/05/2013	Anabat 3, 20130507, 8/05/2013	Anabat 4, 20130415, 15/04/2013	Anabat 4, 20130415, 16/04/2013	Anabat 4, 20130416, 16/04/2013	Anabat 4, 20130416, 17/04/2013	Anabat 4, 20130416, 18/04/2013	Anabat 4, 20130420, 20/04/2013	Anabat 4, 20130422, 22/04/2013	Anabat 4, 20130506, 6/05/2013	Anabat 4, 20130506, 7/05/2013	Anabat 4, 20130507, 7/05/2013	Anabat 4, 20130507, 8/05/2013	Anabat 4, 20130507, 9/05/2013
DEFINITE																
Chalinolobus gouldi	-	-	-	-	-	-	-	1	4	-	-	-	-	-	-	-
Chalinolobus morio	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Miniopterus australis	1	-	-	2	-	-	-	-	-	-	-	3	1	-	5	1
Tadarida australis	1	-	-	-	2	6	-	1	-	9	-	-	-	-	-	-
PROBABLE																
Chalinolobus gouldi	-	-	-	-	1	-	-	1	2	-	-	-	-	-	-	-
Chalinolobus morio	-	-	-	-	-	3	-	3	-	1	-	-	-	-	-	-
Miniopterus australis	5	3	-	3	-	-	-	-	-	-	-	4	3	-	10	2
Mormopterus species 2	-	-	-	-	-	2	-	-	1	-	-	-	-	-	-	-
Tadarida australis	-	-	-	-	1	1	-	-	-	1	-	-	-	-	-	-

IDENTIFICATION	Anabat 3, 20130506, 6/05/2013	Anabat 3, 20130506, 7/05/2013	Anabat 3, 20130507, 7/05/2013	Anabat 3, 20130507, 8/05/2013	Anabat 4, 20130415, 15/04/2013	Anabat 4, 20130415, 16/04/2013	Anabat 4, 20130416, 16/04/2013	Anabat 4, 20130416, 17/04/2013	Anabat 4, 20130416, 18/04/2013	Anabat 4, 20130420, 20/04/2013	Anabat 4, 20130422, 22/04/2013	Anabat 4, 20130506, 6/05/2013	Anabat 4, 20130506, 7/05/2013	Anabat 4, 20130507, 7/05/2013	Anabat 4, 20130507, 8/05/2013	Anabat 4, 20130507, 9/05/2013
POSSIBLE																
Chalinolobus gouldi	-	-	-	-	1	2	-	1	-	-	-	1	-	-	-	-
Chalinolobus morio	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Miniopterus australis	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-	-
Miniopterus schreibersii oceanensis	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Mormopterus species 4	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-
SPECIES COMPLEX																
Chalinolobus gouldii / Mormopterus species 2	1	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-
Chalinolobus gouldii / Mormopterus species 4	-	-	-	-	1	2	-	3	1	-	-	-	-	-	-	-
Chalinolobus gouldii / Mormopterus species 2 / *Mormopterus norfolkensis*	2	-	-	-	3	14	-	3	9	5	-	6	-	-	-	-
Chalinolobus gouldii / Scoteanax rueppellii	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Chalinolobus morio / Vespadelus pumilus / Vespadelus vulturnus	3	21	-	-	58	44	-	6	1	2	-	-	-	-	-	-
Falsistrellus tasmaniensis / Scotorepens orion	-	-	-	-	3	2	-	-	-	-	-	-	-	-	-	-

IDENTIFICATION	Anabat 3, 20130506, 6/05/2013	Anabat 3, 20130506, 7/05/2013	Anabat 3, 20130507, 7/05/2013	Anabat 3, 20130507, 8/05/2013	Anabat 4, 20130415, 15/04/2013	Anabat 4, 20130415, 16/04/2013	Anabat 4, 20130416, 16/04/2013	Anabat 4, 20130416, 17/04/2013	Anabat 4, 20130416, 18/04/2013	Anabat 4, 20130420, 20/04/2013	Anabat 4, 20130422, 22/04/2013	Anabat 4, 20130506, 6/05/2013	Anabat 4, 20130506, 7/05/2013	Anabat 4, 20130507, 7/05/2013	Anabat 4, 20130507, 8/05/2013	Anabat 4, 20130507, 9/05/2013
Falsistrellus tasmaniensis / Scotorepens orion / Scoteanax rueppellii	-	-	-	-	12	5	-	13	4	1	-	-	-	-	-	-
Miniopterus australis / Vespadelus pumilus	-	7	-	3	-	-	-	1	-	-	-	-	-	-	-	-
Miniopterus schreibersii oceanensis / Vespadelus darlingtoni / Vespadelus regulus	-	-	-	-	24	25	-	28	21	-	-	-	-	-	-	-
Nyctophilus geoffroyi / Nyctophilus gouldii / Myotis macropus	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-
Scoteanax rueppellii / Scotorepens orion	-	-	-	-	-	1	-	23	8	-	-	-	-	-	-	-
Vespadelus darlingtoni / Vespadelus regulus	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-
UNKNOWN																
Unknown	17	18	-	24	42	71	-	22	16	17	1	18	13	-	26	9
'Noise' files	13	2	19	6	17	2	6	-	-	7	4	15	17	8	4	7
TOTAL	***43***	***51***	***19***	***39***	***167***	***184***	***6***	***111***	***69***	***43***	***5***	***48***	***34***	***8***	***45***	***19***

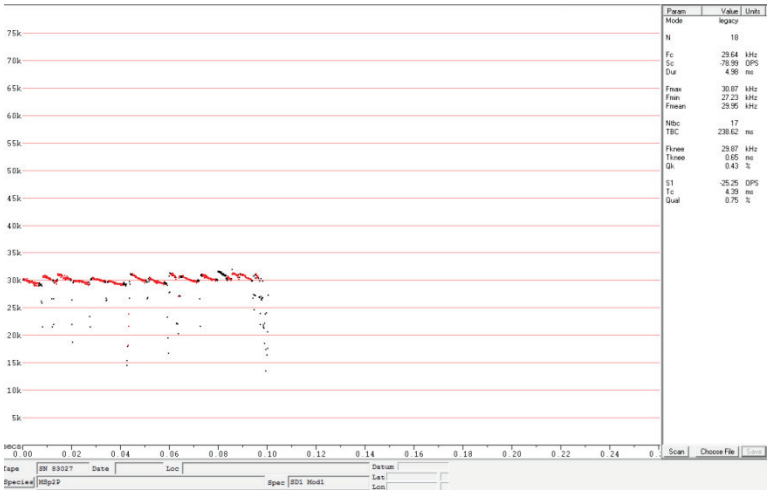
4.0 SAMPLE CALLS

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

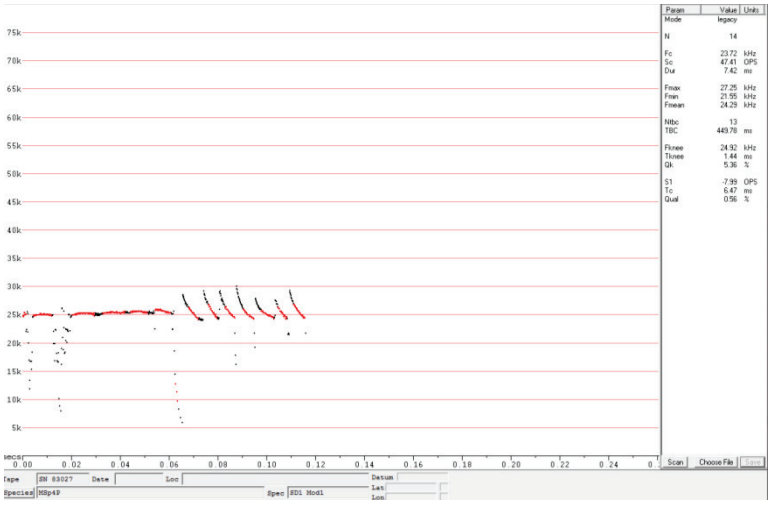


Chalinolobus gouldii - Definite Call

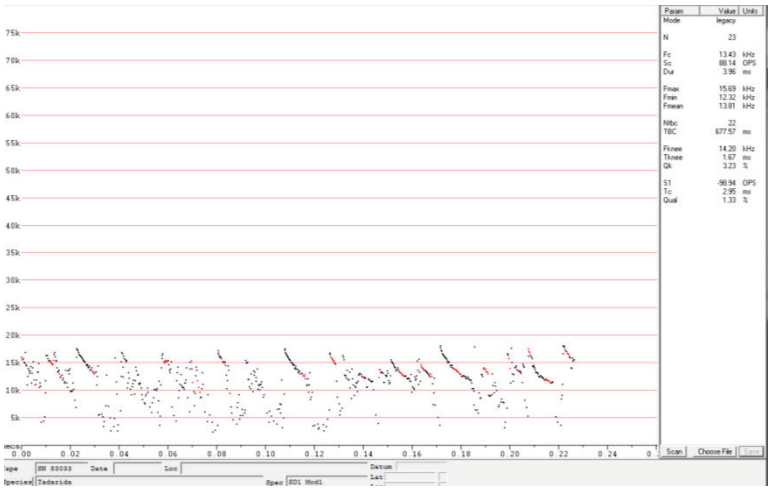
Miniopterus australis - Definite Call



Mormopterus species 2 - Probable Call



Mormopterus species 4 - Possible Call



Tadarida australis - Definite Call

5.0 REFERENCES

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Appendix 5

Staff Qualifications

Curriculum Vitae

ZIGGY ANDERSONS

Senior Ecologist/Project Manager

Newcastle, NSW

Bachelor of Science Botany Major 2010

White Card (OH&S Induction Training)

Maritime Services Boating Licence

AREAS OF EXPERTISE:

Ziggy has a diverse range of experiences in the fields of Ecology and Natural Resource Management. He has worked in the rehabilitation, ecological assessment, environmental management and business development fields across NSW and Qld. Clients have included state government agencies, civil contractors but have predominantly been within the resource sector. Ziggy is experienced in the management of large resource projects including project inception, client liaison, project design, project management, liaising with regulatory agencies and business development.

Ziggy also has experience in ecological assessment methodologies and has a particular interest in ecosystem rehabilitation and plant ID and ecology.

SELECTED PROJECT EXPERIENCE:

ENVIRONMENT

- Flora and Fauna assessment project design
- Flora and fauna identification and habitat assessment
- Targeted threatened flora and fauna surveys
- Delineation and mapping of vegetation communities
- Endangered Ecological Community (EEC) assessment
- Experience with GPS/GIS for project design and mapping
- Conducting Field Surveys for Flora, Fauna and Habitat Identification
- Report Preparation including Fauna and Flora Assessments
- Ecological Monitoring and Reporting
- Vegetation Management Plan Reporting
- Understanding of environmental legislation

PREVIOUS EXPERIENCE:

Mackay Regional Manager – Kleinfelder Ecobiological **(2012)**

Ziggy was employed to establish a regional office in Mackay to service the Central and Northern Qld regions. During his employment he was responsible for the whole gamut of activities involved in ecological consultancy including; business development, client liaison, project management, negotiations with regulatory bodies, ecological assessments, report development and review, budgeting, workflow and business management.

Ecological Consultant (Business Owner) – Evergreen Vegetation Consultants **(2010-2011)**

Ziggy owned and operated his own ecological consultancy business with a significant two year contract with Callide Mine (AngloAmerican). Ziggy was responsible for developing and implementing Management Action Plans

that related to an EPBC non-compliance as well as acting in a support role to the environmental department staff. During this period Ziggy was responsible for contractor management (quote review, contract development, contractor management), community liaison, incident investigation and management, reporting and liaising with regulatory agencies, advising senior leadership team on ecological matters etc.

Botanist and Bush Regenerator – Sustainable Resource Management Group (2009-2010)

Ziggy acted as the company's botanist and was part of the Bush Regeneration Team. The company had numerous contracts with the Hunter Valley CMA as well as Landcare groups within the Hunter and Mid North Coast region. He had a range of responsibilities including ecological assessments, report writing, quoting, project management, and team supervision.

Boatbuilder (1998-2009)

During his career as a boatbuilder Ziggy was responsible for staff supervision and client liaison for a number of multimillion dollar projects.

VOLUNTEER WORK

- Callide Valley Landcare Chair (October 2009 to 2011)
- Callide Valley Landcare Treasurer (August to October 2009)
- Clean up Australia Day Coordinator, Bohnock, NSW (March 2007)
- Self initiated weed management and revegetation of Charley's Island/ Farquhar Pk, Manning River NSW (2007-2008)

MEMBERSHIPS & ACHIEVEMENTS:

- Drivers Licence (C, MR (Motorcycle), and RMDL (Boat))
- RTD02 ChemCert Chemical Accreditation AQF III
- HLTFA301B Apply First Aid Certificate
- 91476NSW Course in Sustainable Private Native Forestry
    - Follow environmental care procedures
    - Operator core knowledge and skills
    - Protect coastal & tableland native forest
    - Apply biodiversity conservation principles
    - Apply silviculture principles
- Qld Black Coal Generic Induction (Surface)
- S1, S2, S3 Supervisor Training (Qld)
- G2 Risk Assessment Training (Qld)
- HLTFA301C - Apply First Aid
- Standard 11 Generic Induction Refresher (Qld)
- RIIVEH201A – Operate Light Vehicle
- RIIVEH305A – Operate and Maintain a Four-Wheel Drive Vehicle
- Qld BioCondition v2.1 Training

Curriculum Vitae

ROB SANSOM

Botanist/Ecologist

Newcastle, NSW

Bachelor of Science (Hons), University of New England

AREAS OF EXPERTISE:

Robert has over twelve years experience in undertaking a diverse array of ecological and environmental surveys and assessments. Rob has also produced or sourced background information on ecological and environmental matters for use by expert witnesses in support of clients in the NSW Land and Environment Court.

Rob's fields of special competence are Threatened Flora species searches; Threatened Flora, Vegetation and Bushland Management Plans; delineation and GPS plotting of Vegetation Community boundaries; and species / community / wetland monitoring surveys and reporting.

- Environmental and ecological impact assessment, monitoring and reporting
- Terrestrial flora and habitat survey design, execution, analysis and reporting
- Spatial mapping of vegetation and threatened flora species using differentially corrected
- GPS accurate to less than 1 metre
- Understanding of threatened species legislation, issues and requirements
- Bushland and vegetation management planning and monitoring
- Threatened Flora Management Plans and Monitoring
- Bushfire Threat Assessments
- Production of a wide variety of reports and assessments
- Targeted threatened flora surveys
- Flora identification and habitat assessment
- Delineation and GPS mapping of vegetation community boundaries
- Ecological Community quality assessments and reports
- Experience in PATN Statistical package

SELECTED PROJECT EXPERIENCE:

Mining

- **Angus Place** – Flora and Fauna Impact Assessment for proposed longwall mining. Includes vegetation surveys, Community Mapping, Flora Species Identification and assessment under the NSW Threatened Species Conservation Act 1995, (TSC Act 1995) and the Commonwealth Environment Protection and Biodiversity Conservation Act 1999, (EPBC Act 1999).
- **Bulga Mine Refuelling Facility** – Flora and Fauna Impact Assessment including field survey, vegetation community mapping, flora species identification, writing of Flora and Fauna Assessment to address the requirements of the TSC Act (1995) and the EPBC Act (1999).

Infrastucture

- **Transgrid - Mangrove Mountain** – Targeted searches for threatened flora species (*Tetratheca glandulosa* and *Prostanthera junonis*) prior to regular maintenance of high voltage power line easements, mark-up and mapping of locations, population extent and counts.
- **Transgrid - Bulga** – Targeted searches for threatened flora species and endangered ecological communities prior to regular maintenance of high voltage power line easements, mark-up and mapping of locations and extent. Flora and Fauna Assessment to address the requirements of the TSC Act (1995) and the EPBC Act (1999).

- **Wallarah Peninsula** – Searches for Threatened species (*Tetratheca juncea, Syzygium paniculatum* and *Grevillea parviflora*) for proposed water supply and sewer lines.

Monitoring

- **Karuah** – Annual monitoring flora and fauna surveys and reporting for a Hard Rock Quarry and Processing Plant.
- **Wambo Coal Mine** – 2 yrs annual surveys and field works associated with Landscape Function Analysis (LFA) of rehabilitated areas.

Vegetation Management

- **Cliftleigh** – Vegetation Management Plan for riparian / constructed wetland area associated with large residential development.
- **Cessnock** – Vegetation Management Plan for proposed residential development and upgrade to golf course.
- **Newnes Junction** – Flora and Fauna Management Plan for proposed sand extraction quarry.

PREVIOUS EXPERIENCE:

Botanist – Conacher Travers Pty Ltd **(12 years)**
Involved in the production of a wide assortment of ecological reports such as Flora and Fauna Assessments (FFA), Environmental Impact Assessments (EIS), Review of Environmental Factors (REF), Bush Fire Assessments (BFA) Vegetation Management Plans (VMP), Annual Monitoring Reports (AMR) and Species Impact Statements (SIS). Responsible for flora surveys, vegetation community mapping, flora species identification and flora input into reports. Also responsible for acquiring ecological data and maintaining this data to the most up-to-date status.

Botanist – Conacher Environmental Group **(1 $^{1}/_{2}$ years)**
Small Project coordinator; Botanist; Data acquisition, management, manipulation and Statistical analysis. Production of a wide variety of Reports such as FFAs, BFAs, EIS, REFs, VMPs AMR, and SIS.

Botanist / Ecologist – RPS Australia East Pty Ltd **(1 year)**
Undertaking flora and fauna field surveys, Monitoring, Land Function Analysis (LFA) and a wide variety of reports for various purposes and types of clients.

MEMBERSHIPS & ACHIEVEMENTS:

- OH&S Induction Training (Green Card)
- NPWS Scientific Investigation Licence
- NSW Animal Ethics Research Authority
- Planning for Bushfire Prone Areas (Short course)
- Trimble Short Course – Using Trimble Hand-held GPS Datalogger with Terrasync software and desktop Pathfinder Software.
- Erosion and Sediment Control – Fundamentals of Erosion and Sediment Control (Short course)

Curriculum Vitae

LAUREN VANDERWYK

Field Ecologist

Newcastle, NSW

Bachelor of Science, University of Newcastle

AREAS OF EXPERTISE:

Lauren has a broad range of ecological field experience and experience in Bushfire and Ecological Assessment reporting. Her experience within the consulting industry has primarily included a wide range of flora and fauna assessment disciplines as required by a wide range of public and private clients. Lauren's knowledge of the Central Coast and Newcastle regions has expanded extensively since the commencement of her career, particularly in the area of threatened flora and fauna species.

SELECTED PROJECT EXPERIENCE:

Environment

- Flora and fauna identification and habitat assessment
- Targeted threatened flora and fauna surveys
- Delineation and mapping of vegetation communities
- Endangered Ecological Community (EEC) assessment
- Conducting Field Surveys for Flora, Fauna and Habitat Identification
- Report Preparation including Fauna & Flora Assessments
- Ecological Monitoring and Reporting
- Bushfire Threat Assessment & Management reporting
- Understanding of environmental legislation.

Ecology

- Santos- On site supervisor for coal seam gas exploration in the Gunnedah region
- Centennial Coal Charbon– Field surveys identifying management issues for the development of a Compensatory Habitat Management Plan at Charbon Colliery
- Morisset – Flora and fauna surveys to produce an Ecological Assessment and Bushfire Threat Assessment

PREVIOUS EXPERIENCE:

Environmental Scientist - Ecobiological (2011)

Primary roles included bush regeneration and the identification of a wide range of native and non-native plant species for rehabilitation of various sites. Some ecological surveys and Ecological Assessment reporting was carried out during her time with Ecobiological.

Trainee Ecologist - Pygmy Possum Ecological Consulting (2008-2010)

Ecological field surveys were the main role at Pygmy Possum. Fauna surveys carried out across the Central Coast have provided for an increased knowledge in common and threatened fauna species as well as the vegetation communities in which they inhabit. Exposure to ecological reporting also occurred.

VOLUNTEER EXPERIENCE:

- Biodiversity research for independent researchers and Australian Geographic in East Kimberley (2011);
- Amphibian (*Litoria subglandulosa* and *Mixophyes balbus*) research at the New England Tablelands with Simon Clulow, Carl Gerhardt and Marion Anstis (2010);
- Bandicoot Research in Manly with the Australian Wildlife Conservancy (2010);
- Microbat dietary surveys and tracking at Empire Bay with Leroy Gonsalves (2010);
- Green and Golden Bell frog research at the Sydney Olympic Park (2010);
- Bush regeneration at Wamberal Lagoon Nature Reserve with National Parks and Wildlife Services primarily restoring Littoral Rainforest (EEC) (2007-2010);
- Fauna research including pit trapping, Elliot trapping, triangulation (for amphibians) and spotlighting for the Watagans fauna database (2007); and
- Bush-stone Curlew surveys at Empire Bay on the Central Coast undertaking call play back methods (2010).

MEMBERSHIPS & ACHIEVEMENTS:

- NSW Driver's Licence (Class C)
- OH&S Induction Training (White Card)
- Santos approved 4WD course
- ChemCert II certification
- Landscape Function Analysis Training
- Member of the Ecological Society of Australia (ESA)
- Member of the Hunter Bird Observatory Club (HBOC)

Curriculum Vitae

BRET STEWART

Ecologist

Newcastle, NSW

Bachelor of Science in Evolution and Ecology, University of California Davis 2004

White Card (OH&S Induction Training)

4WD Training

Senior First Aid

AREAS OF EXPERTISE:

Bret has over 10 years experience in ecological surveys, research, and reporting. His experience within the consulting industry has included a wide range of flora and fauna assessment disciplines for public and private clients. Bret has produced a number of ecological reports for the private sector as well as peer-reviewed scientific publications.

SELECTED PROJECT EXPERIENCE:

ENVIRONMENT

- Flora and fauna identification and habitat assessment
- Targeted threatened flora and fauna surveys
- Delineation and mapping of vegetation communities
- Endangered Ecological Community (EEC) assessment
- Conducting Field Surveys for Flora, Fauna and Habitat Identification
- Report Preparation including Fauna & Flora Assessments
- Ecological Monitoring and Reporting
- Understanding of environmental legislation in WA and NSW

PREVIOUS EXPERIENCE:

Ecologist – Ecologia Environment **(2008 – 2012)**

Bret conducted flora and fauna assessments across Western Australia and the Northern Territory for clients in the mining and resources sector. This work included field survey management, implementation, and reporting.

MEMBERSHIPS & ACHIEVEMENTS:

- Ecological Consultants Association of NSW (ECA)
- Birdlife Australia
- Australian Society of Herpetologists