Biodiversity Assessment Report

Lot 240 DP 1027965, 795 Medowie Road, Medowie

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Document Status

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Approval for Issue

Name	Signature	Date
Rob Dwyer		16/12/2015

Summary

RPS Australia East Pty Ltd (RPS) was engaged by Port Stephens Council (Corporate Services Group) to provide a Biodiversity Assessment Report for the proposed rezoning of Lot 240 DP 1027965 (No. 795) Medowie Road, Medowie. The proposal involves rezoning R2 – Low Density Residential and RE1 – Public Recreation via the Planning Proposal process to B2 – Local Centre.

Aims

This assessment has the aim of identifying and assessing the impacts of future land uses implicated by the rezoning proposal on threatened species, populations, ecological communities and their habitats listed within the *Threatened Species Conservation Act 1995* (TSC Act) and *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act).

Methods

Threatened biodiversity listed under the TSC Act and EPBC Act were identified through desktop investigations and subject to a 'likelihood of occurrence' analysis. A preliminary vegetation cover and condition map was prepared to guide field investigations (i.e. sampling units) and subsequently ground truthed during flora and fauna surveys performed on 25-29 May and 17 September 2015. Vegetation typing and boundary definition was updated following these surveys. A revised likelihood of occurrence analysis was prepared following completion of field surveys and impacts assessments performed for relevant matters.

Key findings

Key ecological features identified within the study area that may represent constraints for the zoning proposal include:

- Approximately 1.73 hectares of Swamp Sclerophyll Forest on Coastal Floodplains EEC;
- Primary Koala Habitat as defined under the Port Stephens Council CKPoM (2002) and The Koala Habitat Atlas Project No 6: Port Stephens LGA. An adult Koala was observed within the site; and
- Potential habitat for 20 threatened fauna species listed under the TSC Act and/or EPBC Act.

Assessment

The proposed rezoning is not likely to have a significant impact on threatened species, populations, ecological communities and their habitats listed under the TSC Act and/or EPBC Act. In applying the EPBC Act referral guidelines for the vulnerable koala, it was identified that the proposed action would adversely impact 'habitat critical to the survival of the Koala' with an uncertain impact level. The Significance Assessment indicated the proposed action is not likely to have a significant impact.

Conclusions

It is considered that a Species Impact Statement prepared under the TSC Act is not required as the proposed action is not likely to have a significant impact on listed threatened species, populations, ecological communities and their habitats. In relation to the EPBC Act, the person undertaking the proposed action should have regard for impacts on 'habitat critical to the survival of the Koala' and Section 68(2) of the EPBC Act (i.e. *A person proposing to take an action that the person thinks is not a controlled action may refer the proposal to the Minister for the Minister's decision whether or not the action is a controlled action*).

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1.0 Introduction

RPS Australia East Pty Ltd (RPS) was engaged by Port Stephens Council (Corporate Services Group) to provide a Biodiversity Assessment Report for the proposed rezoning of Lot 240 DP 1027965 (No. 795) Medowie Road, Medowie (hereafter referred to as the 'site'). A locality and site plan is provided in **Figure 1**.

1.1 Objectives

This report aims to assess the likely impacts of future land uses arising from a proposed rezoning on threatened species, populations, ecological communities and their habitats listed on the TSC Act and/or EPBC Act. Consideration of the Port Stephens Comprehensive Koala Plan of Management (CKPoM) is also provided, specifically matters raised in Appendix 4 of the CKPoM (i.e. performance criteria for development applications).

1.2 Site Particulars

Site – Lot 240 DP1027965, Medowie Road, Medowie, NSW. The site is approximately 5.97 hectares (ha).

LGA – Port Stephens Council

Zoning – The study area includes approximately 4 ha of land zoned as R2 – Low Density Residential and 2 ha of land zoned as part RE1 – Public Recreation under PSLEP 2013.

Boundaries – The site is situated on the western side of Medowie Road, is irregular in shape with two frontages to Medowie Road and frontage to the northern end of Peppertree Road.

Current Land Use – The site is currently vacant. The majority of land to the south of the site is zoned B2 – Local Centre and fronts the north side of Ferodale Road and both sides of Peppertree Road. The existing Coles Supermarket and recently approved Woolworth Supermarket have access to and from Peppertree Road.

Topography – The site contains a gradual slope from the east to the west. The highest parts of the site are in the east approximately 22m AHD to approximately 10 m AHD in the centre of the site.

Hydrology – Shallow, ephemeral drainage lines run north-south through the middle of the site.

Vegetation – The eastern third of the site has been subjected to varying levels of disturbance as a result of clearing, grazing and underscrubbing and is considered to be cleared land. The remainder of the site is predominantly remnant vegetation that includes areas of disturbance in the form of walking tracks and disused bicycle trails.

1.3 Description of the Proposal

The proposal seeks to amend the *Port Stephens Local Environmental Plan 2013* (PSLEP 2013) by rezoning Lot 240 DP 1027965 (No. 795) Medowie Road, Medowie from R2 – Low Density Residential and RE1 – Public Recreation to B2 – Local Centre. Rezoning would allow commercial / retail uses.

1.4 Scope of the Study

The scope of this Biodiversity Assessment Report is to:

- Identify vascular plant species occurring within the study area, including any threatened species listed under the TSC Act or EPBC Act;
- Ground-truth and refine existing vegetation mapping for the study area, including the presence and extent of any Endangered Ecological Communities (EECs) 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 study area and are known to occur in the wider locality;
- Assess the level of utilisation of the study area by Koalas and verify the habitat mapping within CKPoM;
- Identify ecological constraints and opportunities of the site; and
- Identify opportunities to avoid or mitigate impacts that might arise from rezoning of the site.

In addition to the survey work conducted within the study area, consideration to adjacent areas has been afforded in order to appreciate the environmental context, such as connectivity and viability of Primary Koala Habitat. This has included analysis of the connectivity (if any) between vegetation on site and surrounding areas to address concerns outlined in the CKPoM.

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). Consideration is also made with regard to any Matters of National Environmental Significance (MNES) listed federally under the EPBC Act.

1.5 Legislation and Policy

1.5.1 Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999

The purpose of the EPBC Act is to ensure that actions likely to cause a significant impact on 'matters of national environmental significance' undergo an assessment and approval process. Under the EPBC Act, an action includes a project, undertaking, development or activity. An action that 'has, will have or is likely to have a significant impact on a matter of national environmental significance' is deemed to be a 'controlled action' and may not be undertaken without prior approval from the Commonwealth Minister for the Department of the Environment (DoE). The EPBC Act identifies matters of national environmental significance (MNES) as:

- World Heritage properties;
- National Heritage places;
- Wetlands of International Importance (Ramsar wetlands);
- listed threatened species and ecological communities;
- migratory species;
- Commonwealth marine areas;
- the Great Barrier Reef Marine Park;
- nuclear actions (including uranium mining); and
- a water resource, in relation to coal seam gas development and large coal mining development.

An impact assessment has been prepared in accordance with the *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* (DotE 2013) for MNES protected under the EPBC Act (Section 18 and 18A) identified as relevant to the proposed action. Actions that have, or are likely to have, a significant impact on a MNES requires approval from the Commonwealth Minister for the Environment.

1.5.2 NSW Environmental Planning and Assessment Act 1979

The EP&A Act provides an assessment framework for the consideration of listed threatened species, populations, ecological communities and their habitats. Section 5A of the EP&A Act lists seven factors to be considered when projects are deemed to have an impact on the habitat for threatened biodiversity listed on the TSC Act. The Assessment of Significance, or Seven Part Test, sets the criteria for determining whether a project is likely to have a significant impact on threatened biodiversity that, if identified, would necessitate the preparation of a Species Impact Statement (SIS).

A Seven Part Test is provided in this report for threatened biodiversity and their habitats identified as potentially impacted by the proposed action.

1.5.3 NSW *Threatened Species Conservation Act* 1995

The TSC Act provides legal status for biota of conservation significance in NSW. The Act aims to, *inter alia*, 'conserve biological diversity and promote ecologically sustainable development'. It provides for:

- The listing of 'threatened species, endangered populations (EPs) and EECs' under Schedule 1.
- 'Critically endangered' species and CEECs listed under Schedule 1A.
- Vulnerable species and communities listed under Schedule 2.
- 'Key Threatening Processes' listed under Schedule 3.
- The preparation and implementation of Recovery Plans and Threat Abatement Plans.
- Requirements, or otherwise, for the preparation of a Species Impact Statement (SIS).

The lists of threatened species, populations and ecological communities gazetted under the TSC Act are relevant to this assessment. The impact assessment provided in this report is limited to threatened biodiversity identified as likely to occur within the subject site and impacted by the proposed action.

1.5.4 NSW Biodiversity Banking and Offsets Scheme

The NSW Biodiversity Banking and Offsets Scheme (BioBanking), established under Part 7A of the TSC Act, enables a streamlined method for biodiversity assessment (i.e. the BioBanking Assessment Methodology or BBAM) and a rigorous, credible regulatory framework for biodiversity offsetting. It provides mechanisms for the consideration of impacts on listed threatened species and communities and specifies the criteria needing to be met for the offsetting of these impacts.

The BBAM incorporates a 'maintain and improve' test to determine whether or not there will be a net impact on threatened species or native vegetation. The rules used in the assessment are designed to meet the objectives of the TSC Act and are explicitly specified in the BioBanking Assessment Methodology (OEH 2014). The results of a BioBanking assessment are expressed as the number of biodiversity credits required to be retired by a development site and the number of credits generated and available for retirement at a BioBank site (offset site).

Offset sites, otherwise known and BioBank sites, are established following the execution of signed agreements specifying the management actions required for the site and the funding arrangements necessary to maintain the management regime in perpetuity. These agreements are legally binding and are tied to the property deeds. Relinquishment or revocation of such agreements is only possible through a Ministerial direction, making such agreements the strongest regulatory covenant for biodiversity conservation within NSW outside of national park/ reserve declarations.

TITLE: FIGURE 1: SITE LOCATION	LOCATION: MEDOWIE	DATUM: GDA 94 PROJECTION: MGA ZONE 56	DATE: 26/06/2015 PURPOSE: ECOLOGY	LAYOUT REF: "J:\JOBS\126k\126773 Medowie \10 - Drafting\MapInfo Workspaces\ Eco\Report Figures"	VERSION (PLAN BY): A A4 (JS)

CLIENT: PORT STEPHENS COUNCIL
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1.5.5 NSW *National Parks and Wildlife Act 1974*

Part 8A of the *National Parks and Wildlife Act 1974* (NPW Act) regulates the undertaking of activities which may impact on threatened species, populations and ecological communities listed under the TSC Act and their habitats. The NPW Act provides that a person must not harm any animal that is a threatened species, population or ecological community; pick any plant which is part of a threatened species, population or ecological community; damage any critical habitat; or damage any habitat of a threatened species, population or ecological community without a licence being obtained under the NPW Act or TSC Act or unless another exception applies.

1.5.6 NSW *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.

1.5.7 NSW State Groundwater Dependent Ecosystems Policy (2002)

The Groundwater Dependent Ecosystem (GDE) policy was prepared as a component of the NSW State Groundwater Policy Framework. It has the purpose of protecting ecosystems reliant upon groundwater for survival so that ecological process and biodiversity of these ecosystems are maintained or restored.

1.5.8 Port Stephens Councils Comprehensive Koala Plan of Management (CKPoM, 2002)

The PSC CKPoM was prepared in accordance with State Environmental Planning Policy No. 44 - Koala Habitat Protection (SEPP 44) and approved by Council in 2002. *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 PSC CKPoM supersedes the requirements of SEPP 44 for the investigation of potential and core Koala habitat within PSC Local Government Area.

1.6 Qualifications and Licensing

Qualifications

This report was written by Mark Aitkens (BSc), with earlier draft contributions from Rhys Osborne (BSc) and Joel Stibbard (BSc), and reviewed by Rob Dwyer (BSc, Grad Dip Urban and Regional Planning) of RPS. The academic qualifications and professional experience of all RPS consultants involved in the project are documented in **Appendix 1**.

Licensing

Research was conducted under the following licences:

- NSW National Parks and Wildlife Service Scientific Investigation Licence S100536 (Valid 31 December 2015);
- Animal Research Authority (Trim File No: 01/1142) issued by NSW Agriculture (Valid 12 March 2016);
- 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 2017).

2.0 Methodology

Investigations methods, including the use of desktop information sources and site survey methods, are detailed in the following sections. The NSW BBAM was also applied as part of the assessment.

2.1 Desktop Assessment

2.1.1 Literature and databases

A review of relevant information was undertaken to provide an understanding of ecological values occurring or potentially occurring within the site and within 10 kilometres of the site ('the locality'). Information sources reviewed included:

- Fauna and flora records contained in the Office of Environment and Heritage (OEH) Atlas of NSW Wildlife that may occur within the sites' locality;
- Fauna and flora records contained in the Department of the Environment (DoE) Protected Matters Search tool that may occur within the sites' locality; and
- Existing vegetation, Koala habitat mapping and reports of relevance to the site and surrounding locality within the Port Stephens Local Government Area; and

This information was used to perform a preliminary 'likelihood of occurrence' assessment hence frame the investigation methods performed during site inspections.

2.1.2 Likelihood of Occurrence

The list of threatened species, populations and ecological communities (threatened biodiversity) identified as potentially occurring within the study area (i.e. database and literature review) was assessed to determine their likelihood of occurrence within the study area. A preliminary likelihood of occurrence analysis was performed prior to field surveys to guide methods and effort. This was subsequently refined following the completion of field survey.

Five categories for 'likelihood of occurrence' were attributed to threatened biodiversity. Habitat descriptions were generally taken from the online Threatened Species Profile Database (TSPD) (OEH 2015b). The categories are outlined in **Table 1**.

Table 1 Likelihood of Occurrence Criteria

Likelihood rating	Threatened flora criteria	Threatened and migratory fauna criteria
Known	The species was observed within the study area.	The species was observed within the study area.
High	It is likely that a species inhabits or utilises habitat within the study area.	It is likely that a species inhabits or utilises habitat within the study area.
Moderate	Potential habitat for a species occurs on the site. Adequate field survey would determine if there is a 'high' or 'low' likelihood of occurrence for the species within the study area.	Potential habitat for a species occurs on the site and the species may occasionally utilise that habitat. Species unlikely to be wholly dependent on the habitat present within the study area.
Low	It is unlikely that the species inhabits the study area.	It is unlikely that the species inhabits the study area. If present at the site the species would likely be a transient visitor. The site contains only very common habitat for this species which the species would not rely on for its on-going local existence.
Highly unlikely	The habitat is unsuitable for the species.	The habitat is unsuitable for the species.

The following terms are used in the assessment of likelihood of occurrence for threatened species.

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

'**Habitat Description'** – Provides a brief account of the species / community and the preferred habitat attributes required for the existence / survival of each species / community. Unless stipulated otherwise, all habitat descriptions have come from the *Handbook of Australian New Zealand and Antarctic Birds (HANZAB)* Volume 1 – 7 (Higgins *et al.,* eds), DoE SPRAT Profiles and/or the OEH Threatened species profiles.

'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.

2.1.3 Spatial datasets

The following spatial datasets were interrogated as part of the evaluation of landscape values:

- Mitchell Landscapes (NPWS 2003)
- IBRA Region and subregion mapping (IBRA7).

This data was used to calculate the landscape score in the BioBanking assessment.

2.2 Flora Surveys

2.2.1 Vegetation Mapping

Recent relevant native vegetation mapping was reviewed in combination with recent aerial imagery to map the likely extent of native vegetation cover. Preliminary plant community types (PCTs) were assigned to areas of relatively homogenous land cover (i.e. vegetation units), as identified by aerial photography interpretation. PCT extent was calculated in a GIS to determine required survey effort. Survey effort is defined in the NSW BBAM (OEH 2014).

Site investigations were performed involving the completion of BioMetric plots (Gibbons *et al* 2009); a method consistent with the BBAM. BioMetric plots comprise a detailed investigation of a 50 m X 20 m area (i.e. 1,000 m^2) to measure 10 variables, as indicated below:

- Native plant species richness (NPS);
- Native Overstorey Cover (NOC);
- Native Midstorey Cover (NMS);
- Native Groundcover Grasses (NGCG);
- Native Groundcover Shrubs (NGCS);
- Native Groundcover Other (NGCO);
- Exotic Species (ES);
- Overstorey Regeneration (OR);
- Fallen Log Length (FL); and
- Number of Hollow-bearing Trees (NHT).

NPS richness is determined from a 20 m X 20 m quadrat nested within the 1,000 m^2 BioMetric plot.

2.2.2 Flora Inventory

Native and exotic plant species were recorded within a 400 m^2 plot nested within the 1,000 m^2 BioMetric plot. Cover abundance for each plant species was estimated and recorded in accordance with a modified Braun Blanquet scale, as outlined below in **Table 2**.

Table 2 Braun Blanquet Scale

Modified Braun Blanquet Score	Scale
1	<5% cover and rare
2	<5% and common
3	6-25%
4	26-50%
5	51-75%
6	76-100%

2.2.3 Targeted surveys

Targeted searches for flora species of conservation significance were conducted during field surveys within potential habitats of the study area using the "Random Meander Technique" (Cropper 1993). Plant specimens of unknown or significant status were collected for later identification or lodgement with the National Herbarium in Sydney.

2.3 Fauna Surveys

A desktop assessment was performed prior to the commencement of field surveys to identify threatened fauna species (as listed under the TSC Act and/or EPBC Act) that may occur within the site. These results provided a narrative for the survey methods and effort expended during site inspections. Survey techniques performed in this investigation included Elliott trapping, hair tubes, camera traps, spotlighting, call playback, Anabat recordings and opportunistic sightings.

2.3.1 Mammal Trapping

2.3.1.1 Terrestrial Mammals

Terrestrial trapping was undertaken using Elliott A, Elliott B and camera traps. Elliott traps were baited with a mixture of rolled oats, peanut butter and honey. Camera traps were baited with commercial tinned cat food (this methodology is used in place of the now obsolete wire cage methodology). Traps were checked within two 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 intact vegetation within the sites' boundaries as well as areas consisting of understorey that would provide protection for terrestrial mammal species. Terrestrial traps targeted small terrestrial mammals such as dasyurids (e.g. Antechinus and Dunnarts), and rodents (e.g. rats and mice). One trapping transect was undertaken over four nights within the study area containing 25 Elliot A, 25 Elliot B and one camera trap per line. This resulted in 100 Elliott A trap nights, 100 Elliott B trap nights and 8 camera trap nights within the study area.

2.3.1.2 Arboreal Mammals

Arboreal trapping was undertaken using tree mounted Elliott B size traps. Traps were mounted on brackets set at approximately three metres in height on trees with a DBH greater than 30 centimetres. 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 every second 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 within the site locality. One trapping transects, containing six Elliott B size arboreal traps were installed. Trapping was undertaken over four nights, resulting in 24 arboreal trap nights within the study area.

2.3.2 Hairtubes

Hairtubes were deployed across the proposed site. These are plastic tubes fitted with double-sided sticky tape and baited at the end with rolled oats, peanut butter and honey. Mammalian fauna attracted to the baits enter the tubes, brushing against the sticky tape and depositing hair samples that can be analysed for species identification. One hairtube was deployed on the side of the tree approximately 1 metre off the ground, with another deployed at the base of the tree. Trees in which hairtubes were erected were sprayed every second day with a brown sugar and water mix as an attractant.

Hair Tubes targeted small-medium mammals such as dasyurids (e.g. Antechinus and Dunnarts), rodents (e.g. rats and mice), gliders, and bandicoots. At each location, 10 arboreal and 10 terrestrial hairtubes were set, resulting in 40 arboreal trap nights and 40 terrestrial trap nights across the three sampling locations.

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

2.3.3 Avifauna Census

An avifauna census was conducted for 20 minutes at multiple locations across the study area. Surveys were restricted to four mornings and/or late afternoons in order to record birds during peak activity periods. All birds that were observed or heard within or flying over the area were recorded, while birds that were detected outside the search area were recorded separately as opportunistic. Birds were positively identified by direct observation or by recognition of calls or distinctive features such as nests, feathers and owl regurgitation pellets. Nocturnal surveys were undertaken to detect nocturnal bird species occurring within the study area (see **Sections 2.3.7** and **2.3.8**).

2.3.4 Herpetofauna

Herpetofauna (frog and reptile) searches were carried out across the study area, targeting areas of appropriate habitat. Some suitable reptile habitat was scattered throughout the site including areas of rock assemblages, logs and/or leaf litter. Swamp areas, dams and drainage lines were targeted for amphibians and call playback was conducted to elucidate calls.

2.3.5 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 surveyed location had two consecutive nights of sampling, with emphasis placed on those areas deemed likely to provide potential foraging and flyway sites for microbats.

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.

2.3.6 Koala Surveys

Koala surveys and habitat assessments were undertaken in accordance with the Port Stephens Councils CKPoM. Ground truthing confirmed or refined areas of Preferred Koala Habitat as mapped by the Port Stephens Councils Koala Habitat Planning Map. The Koala Spot Assessment Technique (SAT) methodology as described by Phillips and Callaghan (2011) was conducted within the study area. Two SATs, each sampling 30 mature trees, were conducted within the study area. In addition, all Koala food trees as listed under the CKPoM that were identified on the study area were recorded with a Trimble D-GPS. The SATs were used to measure Koala activity levels and establish the extent of habitat utilisation within the study area.

2.3.7 Spotlighting

Spotlighting was undertaken with the use of a 75-Watt hand-held spotlight and head torch whilst walking over the development lands. Areas of dense bush were targeted, however tracks were also spotlighted whilst entering and exiting the site. A total of 2 person hours of spotlighting was conducted over two nights.

2.3.8 Nocturnal Call Playback

Pre-recorded calls of threatened Owl, Koala, Frog 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 swamp areas and drainage lines were targeted for frogs. The calls were broadcast through an amplification system (loud hailer) designed to project the sound for at least one kilometre 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 Powerful Owl (*Ninox strenua*), Barking Owl (*N. connivens*), Masked Owl (*Tyto novaehollandiae*), Yellow-bellied Glider (*Petaurus australis*), Squirrel Glider (*Petaurus norfolcensis*) and Koala (*Phascolarctos cinereus*). One call playback sessions were undertaken within the study area. However, additional targeted call playback sessions for frogs were undertaken at potential habitat locations.

2.3.9 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.

2.3.10 Habitat Survey

Recent field surveys included an assessment for the condition and value of habitat present across the study site. This was conducted to focus upon areas of remaining vegetation. Significant fauna habitat features including hollow-bearing trees, hollow logs and termite nests were identified and noted. This was undertaken to evaluate areas of the proposal that may include resident fauna. The assessment also considered the potential value of the study area (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. Mapping of Koala habitat within the study area included the identification of any Preferred Koala Feed Trees listed under the CKPoM (PSC, 2001) along with their approximate densities. The results of SATs conducted within the study area (see Section **2.2.9** above) were also utilised to assess Koala activity within the site.

The locations of flora and fauna survey methodologies across the site are provided in **Figure 2**.

2.3.11 BBAM (OEH 2014)

The latest version of the BBAM (OEH 2014) was used to calculate the ecosystem and species credits for the site as a development site. This involved an assessment of the landscape and site values to numerically calculate the biodiversity loss. Tasks performed included:

- GIS interrogation of Mitchell Landscapes, catchment boundaries, connectivity and native vegetation cover (assessment circles);
- Plot data collection from the site using BioMetric plots (Gibbons *et. al.* 2009);
- Threatened species likelihood of occurrence and targeted surveys; and
- Data entry into the online BioBanking Credit Calculator (BBCC).

The results of this assessment are expressed in a credit profile report, which specifies the number of ecosystem and species credits required to be retired should development remove the measured biodiversity values.

2.4 Survey timing, effort and data recording

2.4.1 Timing

Surveys were conducted during two periods (i.e. May and September 2015). Targeted threatened flora searches, including a flora quadrat and transect, were performed in addition to systematic fauna sampling methods over 5 days (i.e. 25-29 May 2015) using the methods described in **Section 2.4**. This was supplemented by the performing of BioMetric plots and additional targeted surveys on 17 September 2015.

2.4.2 Effort

Survey effort is provided in **Table 3**.

Table 3 Fauna Survey Effort

Terrestrial Elliot A	Terrestrial Elliot B	Arboreal Elliot B	Camera Traps	Hair Tubes Arb/Ter	Call Play Back	Anabat	Spotlighting	Flora Transects/Quadrats
Trap Nights						Hours		
100	100	24	8	40/40	1	64	2	2

2.4.3 Data recording

A hand held Trimble differential global positioning system (DGPS), accurate to less than one metre, was used to record the location of survey methodologies along with notable results including the location of threatened flora and/or fauna species.

2.5 Limitations

Limitations associated with this report 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 Atlas of NSW Wildlife 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 ±1 kilometre.

Threatened flora and fauna records within the region were predominantly sourced from the online OEH BioNet and DoE 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 and interspecific interactions. 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 the chance of detection; species that are easily disturbed or cryptic may not have been detected during surveys.

As such, habitat assessment and prediction of the occurrence of threatened fauna species has been applied where survey effort targeting particular threatened fauna species could not been undertaken. 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 for detection. Due to seasonality and other factors some threatened species that are not detected cannot be discounted as occurring within the site. Both targeted and opportunistic threatened flora surveys were conducted between 25-29 May and 17 September 2015. **Table 4** provides information regarding the seasonal flowering periods for flora species considered to potentially occur within the study area (see **Section 4.2**).

Table 4 Threatened Flora Species with potential to occur within the site (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
Callistemon linearifolius	Survey Anytime	■								■	■	■	■
Corybas dowlingii	**Survey Only During Flowering**						■	■	■				
Cryptostylis hunteriana	**Survey Only During Flowering**											■	■
Diuris arenaria	**Survey Only During Flowering**								■	■			
Diuris praecox	**Survey Only During Flowering**						■	■	■				
Eucalyptus parramattensis subsp. *decadens*	Survey Anytime	■										■	■
Grevillea parviflora subsp. *parviflora*	Survey Anytime								■	■			
Maundia triglochinoides	Survey Anytime	■	■	■						■	■	■	■
Melaleuca biconvexa	Survey Anytime										■	■	
Persicaria elatior	Survey Anytime												
Phaius australis	**Survey Only During Flowering**								■	■	■		
Pterostylis chaetophora	**Survey Only During Flowering**									■	■	■	
Tetratheca juncea	**Survey Only During Flowering**	■								■	■	■	■

TITLE: FIGURE 2 - SURVEY EFFORT

LOCATION: MEDOWIE

DATUM: GDA 94
PROJECTION: MGA ZONE 56

DATE: 27/10/2015
PURPOSE: ECOLOGY

LAYOUT REF: "J:\JOBS\126k\126773 Medowie\10 - Drafting\MapInfo Workspaces\Eco"
VERSION (PLAN BY): A A4 (MA)

CLIENT: PORT STEPHENS COUNCIL
JOB REF: 126773

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3.0 Results

3.1 Desktop Assessment

3.1.1 Literature and database review

A review of the database search results identified 21 threatened flora species, 46 threatened fauna species and eight threatened ecological communities as potentially occurring within the site or its locality. All potential and known occurring marine species were excluded from the assessment as no marine habitats occur on the site. These species are tabulated and further considered in **Section 4.0**.

3.1.2 Port Stephens CKPoM

The study area has been identified as containing areas of 'Preferred Koala Habitat' as detailed within the Koala Habitat Atlas Map (AKF 2015) as illustrated in **Figure 3**. This patch of Preferred Koala Habitat exists within lands zoned as Low Density Residential (R2) and extends partially into Public Recreation (RE01) on the eastern boundary.

3.2 Flora Surveys

3.2.1 Existing Vegetation Mapping

A review of previous vegetation mapping produced by the National Parks and Wildlife Service (2002) was undertaken prior to the commencement of field surveys. Three vegetation types have been mapped within the site, as listed below:

- Riparian Melaleuca Swamp Woodland (EEC);
- Coastal Plains Smooth-Barked Apple Woodland; and
- Alluvial Tall Moist Forest.

Regional mapping identifies 1,991.73 hectares of vegetation commensurate with the Swamp Sclerophyll Forest EEC listing (NPWS 2002), much of which occurs within the conservation lands of the nearby Medowie SCA.

3.2.2 Plant Community Types (PCTs)

Ground truthing of historical regional native vegetation cover mapping indicated some inaccuracies in vegetation boundaries and typing; a result likely attributed to the differing scales of analysis. The remnant vegetation within the site was remapped and identified to comprise two PCTs, as listed below:

- Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion (HU633) (Plate 1); and
- Smooth-barked Apple - White Stringybark - Red Mahogany - *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast (HU832).

Descriptions for these PCTs are provided in the following sections. Revised revegetation mapping is shown in **Figure 4**.

WARNING
No part of this plan should be used for critical design dimensions. Confirmation of critical positions should be obtained from RPS Newcastle.

Legend
Site Boundary
Study Area Boundary
N

Legend
KHA
Primary Habitat
Secondary Habitat (Class A)
Secondary Habitat (Class B)
Secondary Habitat (Class C)
Other Vegetation
Unknown Habitat

0 250 500
metres

SCALE: 1:7,000 AT SIZE A3

TITLE: FIGURE 3: KOALA HABITAT MAP (AKF 2015)	LOCATION: MEDOWIE	DATUM: GDA 94 PROJECTION: MGA ZONE 56	DATE: 26/06/2015 PURPOSE: ECOLOGY	LAYOUT REF: "J:\JOBS\126k\126773 Medowie\10 - Drafting\MapInfo Workspaces\Eco\Report Figures" VERSION (PLAN BY): A A3 (JS)	CLIENT: PORT STEPHENS COUNCIL JOB REF: 126773

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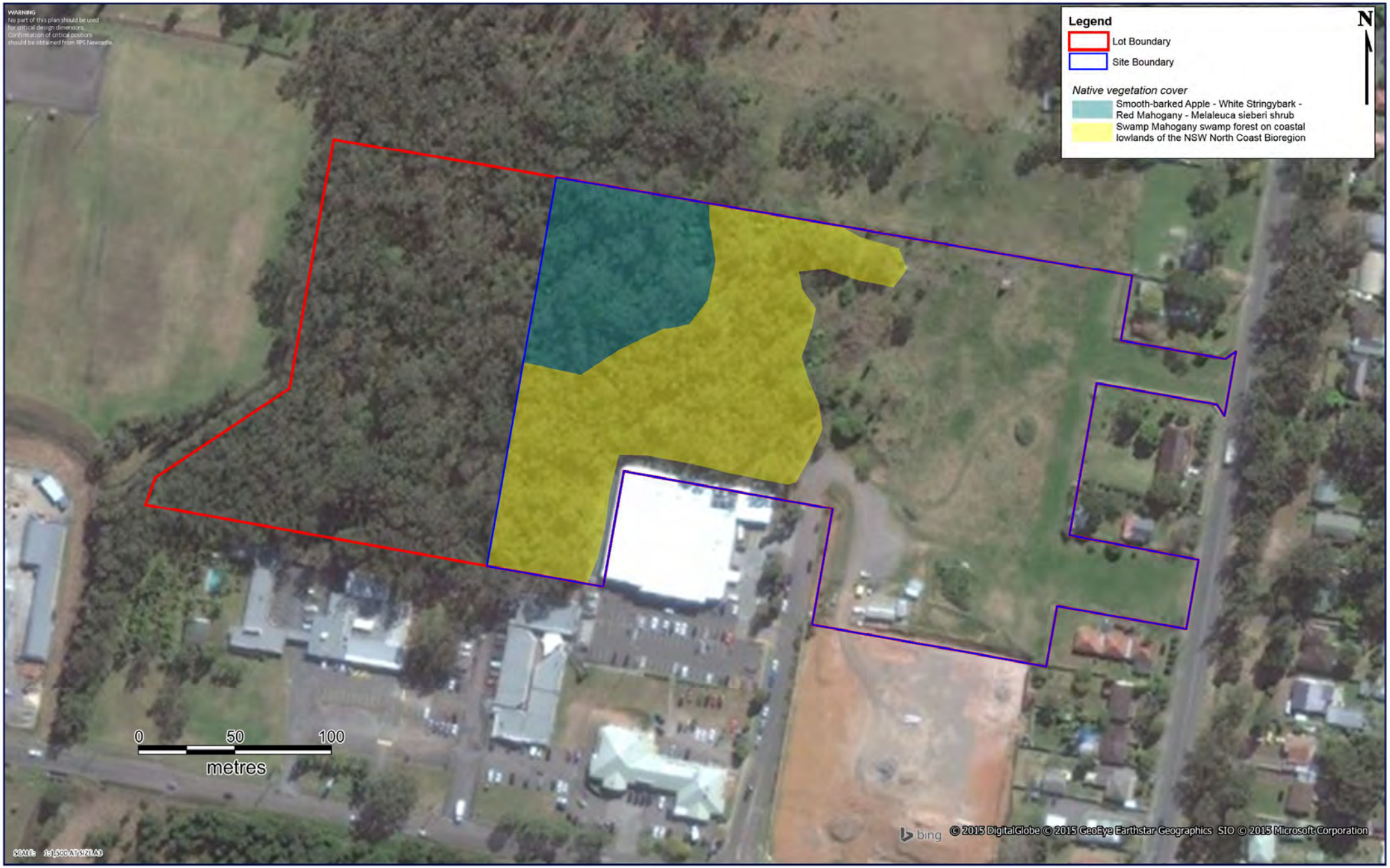

TITLE: FIGURE 4 - NATIVE VEGETATION COVER

LOCATION: MEDOWIE

DATUM: GDA 94
PROJECTION: MGA ZONE 56

DATE: 27/10/2015
PURPOSE: ECOLOGY

LAYOUT REF: "J:\JOBS\126k\126773 Medowie\10 - Drafting\MapInfo Workspaces\Eco"
VERSION (PLAN BY): A A4 (MA)

CLIENT: PORT STEPHENS COUNCIL
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3.2.2.2 HU633 Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion

Plate 1 HU633 Swamp Mahogany – Paperbark Swamp Forest

Description: This PCT typically occurs in areas of unimpeded drainage near coastal swamps. Structural differences of this community range from open forest to forest and is defined by a canopy dominated by *Eucalyptus robusta* and *Melaleuca quinquenervia*. The PCT occupies the majority of native vegetation cover within the site.

Total area: 1.22 hectares.

Canopy Layer: Dominant species within the study area included *Eucalyptus robusta* (Swamp Mahogany), *Eucalyptus tereticornis* (Forest Red Gum), and *Melaleuca quinquenervia* (Broad-leaved Paperbark). Associated species included *Eucalyptus piperita* (Sydney Peppermint) and *Eucalyptus resinifera* (Red Mahogany).

Shrub Layer: Upper shrub layer was dominated by *Pittosporum undulatum* (Sweet Pittosporum) and *Melaleuca linariafolia* (Snow in Summer). Associated species included *Glochidion ferdinandi* (Cheese Tree). The lower shrub layer included dense infestations of *Ligustrum sinense* (Small Leaved Privet) but was devoid of a lower shrub layer in other areas.

Ground Layer: The ground layer was dominated by a variety of grass and herbaceous species including *Gahnia clarkei* (Tall Saw-sedge), *Juncus sp.,* and *Hypolepis muelleri* (Harsh Ground Fern)

Classification: This vegetation community is considered commensurate with the Swamp Sclerophyll Forest on Coastal Floodplains endangered ecological community (EEC) listed under the TSC Act.

3.2.2.3 HU832 Smooth-barked Apple - White Stringybark - Red Mahogany - *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast

Description: This PCT typically occurs in areas of low relief near swamp sclerophyll forests and coastal swamps. Structural differences of this community range from open forest to forest and is characterised by a range of eucalypt species including *Angophora costata* (Smooth—barked Apple), stringybarks and mahogany. The PCT occupies the north western corner of the site.

Total area: 0.51 hectares.

Canopy Layer: Dominant species within the study area included *Angophora costata* (Smooth—barked Apple) and *Eucalyptus piperita* (Sydney Peppermint). Associated occurrences of *Eucalyptus resinifera* (Red Mahogany), *Eucalyptus pilularis* (Blackbutt) and *Eucalyptus punctata* (Grey Gum) were noted.

Shrub Layer: Upper shrub layer was dominated by *Acacia irrorata* and *Melaleuca nodosa* (Honmey Myrtle). The lower shrub layer included clumps of *Breynea oblongifoliia* (Breynea).

Ground Layer: The ground layer was dominated by a variety of grass and herbaceous species including *Imperata cylindrica* (Blady Grass), *Oplismenus imbecillis,* and *Pteridium esculentum* (Bracken Fern).

Classification: This PCT is not commensurate with a listed EEC listed under the TSC Act.

3.2.2.4 Cleared Areas

The cleared areas in the east of the study area has been highly disturbed and cleared of all wooded vegetation. It was predominantly comprised of exotic species including *Cynodon dactylon* (Common Couch), *Stenotaphrum secundatum* (Buffalo Grass), *Eragrostis curvula* (African Lovegrass), *Verbena bonariensis* (Purpletop), *Bidens pilosa* (Cobblers Pegs) and *Paspalum dilatatum* (Paspalum). The cleared portion of the site covers approximately 2.37 hectares. **Plate 2** is a photo of the cleared area looking east from the centre of the site.

Plate 2 Photo of cleared area

3.2.3 Significant Flora

A total of 85 flora species have been identified within the site including 22 exotic species as listed in **Appendix 2**. Targeted searches for threatened flora species identified as potentially occurring within the study area (see **Table 4**) were conducted during field surveys. No species listed under the TSC Act or EPBC Act were identified during these searches.

3.3 Fauna Surveys

Survey techniques employed to determine the composition of fauna species within the site resulted in the detection of 35 species. An inventory of fauna species recorded on the site is provided in **Appendix 3**. Significant fauna observations are shown in **Figure 5**.

3.3.1 Weather Conditions

Weather conditions experienced during the 25-29 May 2015 survey period are presented in **Table 5**.

Table 5 Prevailing Weather Conditions (Williamtown)*

	25 May 2015	26 May 2015	27 May 2015	28 May 2015	29 May 2015
Temperature (^{o}C)	9.1-19.4	9.1-19.4	9.0-19.3	9.0-19.3	8.9-19.2
Wind (Max-kilometres/h)	26	26	30	22	37
Cloud (8th at 9am)	7	5	5	1	8
Rain (mm)(24 hrs to 9 am)	3.6	3.2	2.8	2.7	2.8
Sun Rise	6.42	6.42	6.43	6.44	6.44
Sun Set	16.57	16.57	16.56	16.56	16.56

*Sources: http://www.bom.gov.au/climate/dwo/201505/html/IDCJDW2145.201505.shtml
http://www.ga.gov.au/bin/geodesy/run/sunrisenset

3.3.2 Terrestrial Mammal Trapping

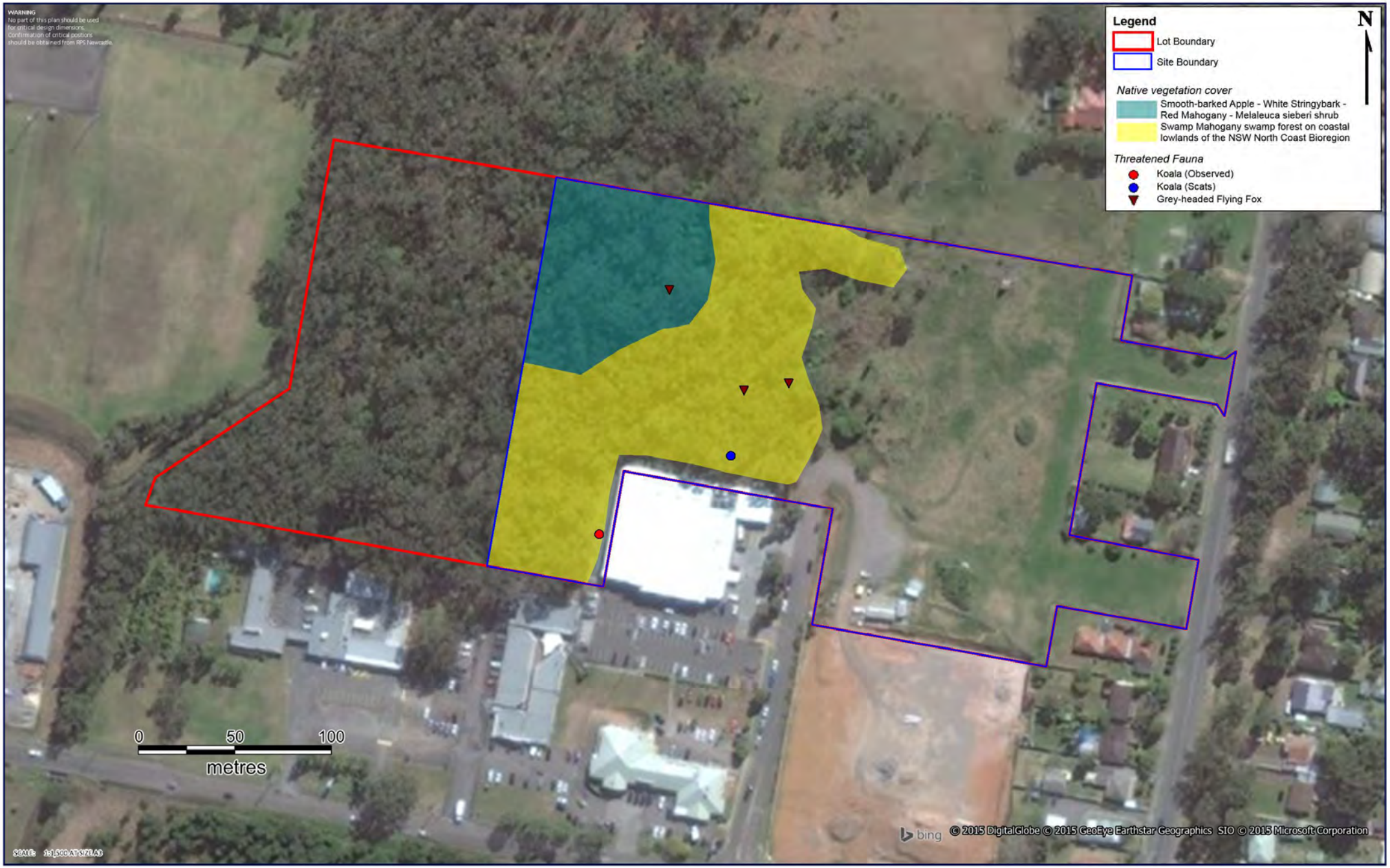
Two species of native mammal were captured in the terrestrial Elliot traps deployed across the study area. These species were frequently encountered, particularly within the more densely vegetated areas of the site, including the Brown Antechinus (*Antechinus stuartii*), illustrated in **Plate 3** and the Bush Rat (*Rattus fuscipes*) illustrated in **Plate 4**. In addition to terrestrial trapping efforts also identified was the Brushtail Possum (*Trichosurus vulpecula*) via IR camera trap and analysis of hair samples. This species is typically arboreal, roosting in tree hollows and constructed dreys high in the canopy, however they are known to occasionally occupy ground roosts.

3.3.3 Arboreal Mammal Trapping

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

3.3.4 Avifauna

A total of 26 bird species were recorded during recent field surveys (**Appendix 3**). Bird species identified predominantly consisted of woodland species such as the Lewin's Honeyeater (*Meliphaga lewinii*), Noisy Friarbird (*Philemon corniculatus*), Rainbow Lorikeet (*Trichoglossus haematodus*), Yellow-faced Honeyeater (*Lichenostomus chrysops*) and Red-browed Finch (*Neochima temporalis*). A Brown Cuckoo-Dove (*Macropygia ambionensis*) was observed drinking from the water body within the study area. None of the identified species are listed as threatened under the TSC and/or EPBC Act.



TITLE: FIGURE 5 - SIGNIFICANT FAUNA OBSERVATIONS

LOCATION: MEDOWIE

DATUM: GDA 94
PROJECTION: MGA ZONE 56

DATE: 27/10/2015
PURPOSE: ECOLOGY

LAYOUT REF: "J:\JOBS\126k\126773 Medowie\10 - Drafting\MapInfo Workspaces\Eco"
VERSION (PLAN BY): A A4 (MA)

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Plate 3 Brown Antechinus (*Antechinus stuartii*) released following capture

Plate 4 Bush Rat (*Rattus fuscipes*) released following capture

3.3.5 Hairtube Results

Hairtube sampling identified four hair samples within the study area. Analysis by Barbara Triggs at "Dead Water" confirmed that the samples came from a Common Brushtail Possum (*Trichosurus vulpecula*), and an *Antechinus* species.

3.3.6 Herpetofauna

Two herpetofauna species were identified during the recent survey, including the Common Garden Skink (*Lampropholis delicata*) and the Common Eastern Froglet (*Crinia signifera*).

3.3.7 Micro-Chiropteran Bats

One microbat species was positively identified via the use of Anabat echolocation call recorders, with an additional four species listed as 'potentially' occurring. The positively identified species, the Little Bentwing Bat (*Miniopterus australis*), is listed as Vulnerable under the TSC Act. The additional species listed as potentially occurring within the study area are provided within the Anabat Report provided in **Appendix 4**.

3.3.8 Koala Surveys

Habitat assessments were carried out in accordance with methodology described in the Port Stephens Councils CKPoM and Phillips and Callaghan (2011). Two Koala SATs were conducted within the study area, with a total of 60 trees surveyed. One adult Koala was observed within the study area in a *Eucalyptus tereticornis* (Forest Red Gum) located adjacent to the Medowie shopping district as illustrated in **Plate 5**. Observations of recent habitat utilisation were confirmed by the presence of Koala scats under several trees including *Eucalyptus robusta* (Swamp Mahogany) and *Eucalyptus tereticornis* (Forest Red Gum). Other non-conclusive evidence in the form of scratches were also observed on the lower trunks of surveyed trees.

Plate 5 Koala observed within the study area

3.3.9 Spotlighting and Call Playback

The Grey-headed Flying Fox was observed foraging within the blossom of several Swamp Mahogany trees on the study area. No other species were observed, and call playback failed to elicit any response from targeted fauna.

3.4 Habitat Survey

3.4.1 Terrestrial

The forested areas of the study area are composed of moist, mostly dense ground cover, with species including *Gahnia*, *Hypolepis* and *Pteridium esculentum* (Bracken Fern) providing ground cover for small mammals, reptiles and frogs. A moderate amount of leaf litter was present, as well as a good coverage of moss, lichen and fungi, suggesting much of the site retain moisture for prolonged periods of time. Some disturbance is apparent along tracks and old mountain bike trails, but otherwise this is considered a continuous patch of intact vegetation. The cleared, open areas of the study area show suitability for larger macropods with a deceased Eastern Grey Kangaroo (*Macropus giganteus*) found within north eastern clearing in the study area.

3.4.2 Arboreal

There is a perceived lack of hollows within the surveyed vegetation, limiting roosting and nesting habitat for arboreal mammals, owls and micro bats. However a high abundance of birds were encountered in the study area, reflecting the availability of foraging resources, most importantly of which was the blossoming Swamp Mahogany, an important winter foraging resource for many species. Species including Brown and Striated Thornbills, Noisy Friarbirds, Scarlet and Lewin's Honeyeaters, White-browed Scrubwrens and Superb Fairy-Wrens were frequently encountered during field surveys (full species list in **Appendix 3**).

3.4.3 Aquatic

Aquatic habitats within the study area are limited to a small dam providing a standing water supply for terrestrial mammals and birds. This may also provide foraging opportunities for waterfowl and microbats including the Southern Myotis (*Myotis macropus*).

3.4.4 Koala Habitat

The remnant vegetation within the study area includes a canopy of Swamp Mahogany and/or Forest Red Gum that is of sufficient density to be considered 'Primary Koala Habitat' as defined under the *Port Stephens Council CKPoM* (2002) and *The Koala Habitat Atlas Project No 6: Port Stephens LGA* (1996). Furthermore, the vegetation may be considered to constitute 'Core Koala Habitat' under SEPP 44 criteria given the recent Koala sighting and historical records of a population within the locality.

4.0 Impact Assessment

4.1 BioBanking Assessment

An impact assessment performed in accordance with the NSW BBAM (OEH 2014) has quantified the impacts of the proposed action in terms of ecosystem and species credits. The following sections outline how the BBAM assessment was performed.

4.1.1 Landscape context

Four key factors were used to evaluate the landscape context in this impact analysis, as listed below:

- Connectivity;
- Adjacent patch size;
- Percent vegetation loss (i.e. loss within assessment circles); and
- PCT cleared status within applicable Mitchell Landscape (NPWS 2003).

These factors are the key pillars for calculating the landscape score in a BioBanking Assessment (OEH 2014). Details regarding each of these factors and how they relate to the study area are provided in the following sections.

4.1.1.1 Connectivity

The primary link through the site is oriented in a north south axis and currently has a width of 240m, which is classified as 'wide' by OEH (2014) (i.e. >100-500m). The condition of this primary link is close to benchmark, although it is noted that the midstorey and groundcover strata comprises a high proportion of exotic plant species.

The future width of the primary link would be narrowed to 101m following development of the site. According to the BBAM connectivity classification scale, this width reduction would not result in a width class change. Similarly, the condition of the width class is also expected to remain constant. As such, it is considered that there would be no quantifiable connectivity loss.

4.1.1.2 Adjacent patch size

Vegetation in 'moderate – good' condition that is not severed by hostile gaps (e.g. roads or cleared lands greater than 100 m width for forested landscapes) is included in a patch size estimate. Locally, this implicates much of the lands north from the site as evidenced by the extensive intact overstorey canopy cover. The only roads identified as hostile gaps are Medowie and Ferodale Roads due to their formation width and the traffic loads experienced (i.e. high change of fauna mortality on these roads). On this basis the adjacent patch size encompasses the rural lands north from the site and west of Medowie Road and is estimated to have an area exceeding 1,000 ha; the largest patch size score available in the BBCC.

4.1.1.3 Percent vegetation loss

Relative vegetation loss arising from the development is calculated by examining the change in vegetation cover for specified assessment circles. A 100/ 1,000 ha assessment circle pair was used to calculate percent vegetation loss in this assessment. The 100 ha circle contains 34.21 ha of native vegetation cover. A loss of 1.73 ha of native vegetation cover is estimated to occur as a consequence

of future development, thus reducing this cover for the 100 ha assessment circle to 32.49 ha. This native vegetation cover loss would not cross any BBAM specified impact thresholds.

The 1,000 ha circle contains 564 ha of native vegetation cover. As found for the 100 ha assessment circle, the loss of 1.73 ha of native vegetation would not cross any BBAM specified impact thresholds.

4.1.1.4 Mitchell Landscape

The site is located within the Newcastle Ramp Mitchell Landscape (NPWS 2003). Neither PCT identified within the site is classed as 'overcleared' within this Mitchell Landscape.

4.1.2 Site values

4.1.2.1 Transect/ Plot Data

Site data was collected in accordance with BioMetric (Gibbons *et al* 2009) to accurately define vegetation type, condition and threatened species habitat areas. Two BioBanking plots were completed in two vegetation zones as described in **Table 6**.

Table 6 Vegetation zones plot requirements

Zone	PCT name	PCT Code	Cleared (%)	Area (ha)	Condition	Minimum Plots	Plots used
1	Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	HU633	55	42.36	Moderate/Good high	1	1
2	Smooth-barked Apple - White Stringybark - Red Mahogany - *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast	HU832	55	11.23	Moderate/Good high	1	1

Plot data is provided in **Table 7**. Values in bold represent within benchmark condition states for the corresponding PCT.

Table 7 Vegetation zones plot requirements

Zone	NPR	NOS	NMS	NGCG	NGCS	NGCO	ES	NTH	OSR	FL	Site value score
1	**25**	**34**	**29**	2	4	**8**	22	**0**	**1**	**9**	88.7
2	31	16	**24.5**	18	**4**	**38**	**0**	1	**1**	**35**	83.3

4.1.2.2 Conservation status of vegetation zones

The conservation status of PCTs mapped within the Site is provided in **Table 8**.

Table 8 NSW Vegetation Types – conservation status

NSW Vegetation Type	TSC Act status	Over cleared Vegetation
Swamp Mahogany swamp forest on coastal lowlands of the NSW North	EEC	No

NSW Vegetation Type	TSC Act status	Over cleared Vegetation
Coast Bioregion and northern Sydney Basin Bioregion		
Smooth-barked Apple - White Stringybark - Red Mahogany - *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast	Not an EEC	No

4.1.2.3 Use of judgement

No use of judgement has been necessary in this part of the assessment.

4.1.3 Threatened Species

Database searches identified 21 threatened flora species, 44 threatened fauna species and eight 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 locality). A likelihood of occurrence for these species is tabulated in **Table 9**.

Table 9 Threatened Species/Communities Assessment Table

Species/Community	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence
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 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 within the study area in current or previous surveys or within the locality. The woodland occurring on the Site is not commensurate with any of the associated vegetation types. Given the extensive survey efforts targeting this species presence on site and the suboptimal habitat present, it is considered **unlikely** to occur.
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 within the study area during previous or current surveys, and Atlas records for the species are limited to areas east and north of the site (NSW Wildlife Atlas data). Given extensive surveys on the site failed to identify the species, it is considered **unlikely** to occur.
Asperula asthenes Trailing Woodruff	V	V	This small herb is restricted to scattered locations in NSW between Bulahdelah to Kempsey, with several records occurring in the Port Stephens LGA. It occurs in damp sites, often along river banks.	The species was not recorded on site during current or previous surveys, and the Atlas record within the vicinity of the site occurs to the west near Raymond Terrace (NSW Wildlife Atlas data). In addition, the damp sites required for the species predominantly occur within the swamp woodlands of the conservation lands. It is therefore considered **unlikely** to occur.
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 that support sheltered forest. The canopy at known sites includes Turpentine (*Syncarpia glomulifera* subsp. *glomulifera*), Smooth-barked Apple (*Angophora costata*), Sydney Peppermint (*Eucalyptus piperita*), Forest Oak (*Allocasuarina torulosa*) and Christmas Bush (*Ceratopetalum gummiferum*).	This species has not been recorded on-site in current or previous surveys or within 10 kilometres of the Site. The site is outside the known distribution of this species. This species is **unlikely** to occur within the site.
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 records do exist for the species within close proximity of the site (NSW Wildlife Atlas data) and potential habitat exists across the site. As this species could have been identified during the survey and was not detected it is considered **unlikely** to occur.
Commersonia prostrata (syn. *Rulingia prostrata*). Dwarf Kerrawang	E	E	A ground-hugging shrub forming mats more than 1m across. Occurs predominantly on the Southern Highlands and Tablelands, with less than 100 plants recorded on the Tomago Sandbeds in the Port Stephens LGA. It occurs on sandy soils and is associated with Scribbly Gum and Swamp Mahogany ecotones at Tomago.	Surveys on site did not detect this species, and Atlas records within 10 kilometres of the site are limited to the Tomago sandbeds south of the site (NSW Wildlife Atlas data). Given the restricted distribution for the species, it is considered **unlikely** to occur.
Corybas dowlingii Red Helmet Orchid	E	-	It is restricted to New South Wales where it is currently known from 4 localities including Port Stephens (2 localities), Bulahdelah and Freemans Waterhole south-west of Newcastle. It prefers sheltered areas such as gullies and southerly slopes in tall open forest on well-drained gravelly soil at elevations of 10-200 m.	The targeted flora surveys were conducted within the flowering period for this cryptic species. Records for the species within the locality are restricted to a lone record within Moffats Swamp Nature Reserve to the south. The species was not recorded and habitat within the site is considered sub-optimal. This species is **unlikely** to occur within the site.
Cryptostylis hunteriana Leafless Tongue-orchid	E	V	This cryptic orchid is 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 the 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 identified during targeted surveys on the site, and no Atlas records exist for the species within the locality. The species was not recorded and habitat within the site is considered sub-optimal. This species is **unlikely** to occur within the site.
Diuris arenaria Sand Doubletail	E	-	This species occurs in coastal heath and dry grassy eucalypt forest on sandy flats. Grows in gently undulating country in eucalypt forest with a grassy understorey on clay soil. This species is known only from the Tomaree Peninsula, occurring in power line easements on the Tomago Sandbeds in regularly slashed sandy heaths.	The targeted flora surveys were conducted outside of flowering period for this cryptic species, however Atlas records within the locality are restricted to areas around Salt Ash to the south of the site. Given the site occurs to the north of known distribution of the species within the Tomaree Peninsula, it is considered **unlikely** to occur.
Diuris praecox Rough Doubletail	V	V	Grows on hills and slopes of near-coastal districts in open forests which have a grassy to fairly dense understorey. Exists as subterranean tubers most of the year. It produces leaves and flowering stems in winter.	The targeted flora surveys were conducted outside of flowering period for this cryptic species, however the few Atlas records within the locality are restricted to areas around Williamtown and Salt Ash to the south of the study area. Given the topography required for the species does not occur, it is considered **unlikely** to occur.
Eucalyptus camfieldii Camfield's Stringybark	V	V	This tree is typically a mallee or straggly tree from 4 to 9m tall, occurring within shallow sandy soils near the boundary of tall coastal heaths and low open woodland. The most northerly distribution of the species centres around Raymond Terrace, with the species extending south to Waterfall.	The species was not detected during current or previous surveys, and the tall heath/low woodland habitat required for the species does not occur. It is considered **unlikely** to occur therein.
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. Extensive records for the species within 10km of the site occur in a band south of Raymond Terrace running east through Williamtown and Salt Ash.	The KSSW community required for the species was not identified within the study area. It is considered **unlikely** to occur.
Grevillea parviflora subsp. parviflora	V	V	A low open to erect shrub. Occurs in light, clayey soils in woodlands. Relatively widespread within the	This species was not detected within the study area during recent surveys; however

Species/Community	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence
Small-flower Grevillea			Cessnock LGA, and is also known from areas from Putty to Wyong and Lake Macquarie on the Central Coast. Sporadic records exist for the species within the Port Stephens LGA (NSW Wildlife Atlas data).	records do exist within 10 kilometres (NSW Wildlife Atlas data). This species is easily identified and as it was not detected within the site it is considered **unlikely** to occur.
Maundia triglochinoides	V	-	This aquatic plant grows in swamps, lagoons, dams and other shallow freshwater on heavy clay, with low nutrients. It extends up the coast of NSW from as far south as Wyong and local records exist within Campvale Drain and Moffats Swamp at Medowie (NSW Wildlife Atlas data).	The species was not detected within the study area during recent surveys, however local records exist within 10 kilometres (NSW Wildlife Atlas data). This species is easily identified and as it was not detected within the site it is considered **unlikely** to occur.
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 conspicuous species was not detected within the study area and limited records exist within 10 kilometres (NSW Wildlife Atlas data). This species is easily identified and as it was not detected within the site it is considered **unlikely** to occur.
Melaleuca groveana Grove's Paperbark	V	-	Widespread, scattered populations in coastal districts north of Port Stephens to southeast Queensland. They prefer to grow in heath and shrubland, often in exposed sites, at high elevations, on rocky outcrops and cliffs.	This species was not detected within the study area, however one record exists within 10 kilometres. The preferred habitat of heath and shrubland does not occur on-site. Therefore, it is considered **unlikely** to occur within the site.
Persicaria elatior Knotweed	V	V	This species normally grows in damp areas including beside streams and lakes, and occasionally in swamp forest. It is known from Raymond Terrace in Port Stephens.	This species was not detected within the study area, and no records exist for the species within 10km of the site. As this species could have been identified during the survey and was not detected it is considered **unlikely** to occur.
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.	The targeted flora surveys were conducted within the flowering period for this cryptic species. No records exist within 10 kilometres and the species is not known to occur south of Foster. As this species could have been identified during the survey and was not detected it is considered **unlikely** to occur.
Pterostylis chaetophora	V	-	This orchid is known from scattered locations in NSW across a relatively small area between Taree and Kurri Kurri. The cryptic species occurs within seasonally moist, dry sclerophyll forest.	Targeted flora surveys were conducted within the flowering period for this cryptic species. One Atlas record exists for the species close to Grahamstown Lake (NSW Wildlife Atlas data), and this population was estimated to include hundreds of individuals within one 100 m^2 area (NSW Scientific Committee Final Determination). As this species could have been identified during the survey and was not detected it is considered **unlikely** to occur.
Streblus pendulinus Siah's Backbone	-	E	This tall shrub or tree that inhabits warmer rainforests along watercourses north from Milton, NSW.	This species does not occur on mainland Australia. This species is considered **unlikely** to occur.
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.	The targeted flora surveys were conducted outside of flowering period for this cryptic species and several records exist within 10 kilometres. As this species could have been identified during the survey and was not detected it is considered **unlikely** to occur.
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. Local records exist to the south of the site close to Williamtown RAAF base and close to Grahamstown Lake.	Multiple records exist for the species to the south of the site and potential habitat does exist. Although the species was not recorded within the study area recently, there is **potential** for it to occur.
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 during surveys and no records within 10 kilometres of the study area exist. Given a lack of records within the locality, it is considered **unlikely** to occur.
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. Breeds 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.	This species has not been recorded within the study area or its locality. No suitable rainforest habitat exists. Therefore, it is **unlikely** to occur.
Birds				
Anthochaera Phrygia Regent Honeyeater	CE	E, M	A 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 within the study area and a lone record exists for the species within 10 kilometres. However, the preferred feed tree *E. robusta* is a dominant species within the remnant vegetation on site and the available habitat could be utilised by this species. It is considered as having **potential** to occur.
Botaurus poiciloptilus Australasian Bittern	E	E	The distribution of this species ranges from south-east 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.	This species was not detected within the study area, and there is a lone record within 10 kilometres. The single dam on site only provides sub-optimal habitat for the species, and the species is considered **unlikely** to occur.

Species/Community	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence
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 within the study area, however records do exist for the species at Karuah and Swan Bay to the north and east. The site provides some sub-optimal habitat. Therefore, this species has limited **potential** of occurring.
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.	Multiple records exist for the species within the locality, and some *Allocasuarina* trees do occur. The species is considered to have potential to occur within the site on an intermittent basis.
Circus assimilis Spotted Harrier	V	-	This species utilises open and wooded habitat, preferring grasslands (natural or cleared) or open woodlands that allow for the ground to be visible from above. Occasionally hunt over open water and swamps. Less common east of the Great Divide in NSW.	The species has not been recorded on the site during current or previous surveys, and only a couple of dated records (1987) exist within the locality around Richardson's Swamp at Raymond Terrace (NSW Wildlife Atlas data). Habitat values are poor and the species has not been detected. The species is considered **unlikely** to occur.
Climacteris picumnus victoriae Brown Treecreeper (eastern subspecies)	V	-	Inhabits forests and woodlands predominantly west of the Great Divide, but do also occur on coastal plains and ranges. Predominantly in grassy woodlands of stringybarks and other rough-barked eucalypts, however may also occur in River Red Gum woodlands bordering wetlands.	The species has not been recorded on the site during recent or previous surveys, however records do exist within the sites locality and potential habitat occurs. The species is considered **unlikely** to occur.
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.	Records exist for the species within close proximity, and potential habitat exists within the study area. It therefore has **potential** to occur.
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 within the study area or within 10 kilometres. 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.
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 records from the Port Stephens area, however recent evidence of the persistence of this population is lacking and it is now considered to have disappeared (NPWS). On the NSW north coast, Emus occur in a range of predominantly open lowland habitats, including grasslands, heathland, shrubland, open and shrubby woodlands, forest, and swamp and sedgeland communities, as well as the ecotones between these habitats. They also occur in plantations of tea-tree and open farmland, and occasionally in littoral rainforest.	This species was not recorded within the study area, and records from the endangered Port Stephens population in the locality are dated (1992). Given the local population of the species is considered to be extinct, it is **unlikely** to occur.
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 within the study area, however multiple records exist for the species within the locality at Grahamstown Lake and within the bays and estuaries of Port Stephens. The species is considered **unlikely** to occur.
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. The species is also observed in open grasslands and sometimes in low shrubs bordering wetland areas. The species is sensitive to human disturbance and is not found in densely populated areas.	This species was not detected within the site, however records exist for the species within Worimi Nature Reserve at Swan Bay to the east. The open, damp habitats required for the species do not occur, and it is considered **unlikely** to occur.
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. Favoured food sources in coastal areas include *C. maculata* (Spotted Gum), *E. fibrosa* (Broad-leaved Ironbark), *E. robusta* (Swamp Mahogany) and *E. pilularis* (Blackbutt). Nesting takes place in hollow bearing trees.	Available habitat exists within the study area and multiple records occur within the locality. It is **likely** to occupy the site intermittently.
Ixobrychus flavicollis Black Bittern	V	-	Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves.	This species has not been recorded within the study area during recent or previous surveys, and a lone record exists for the species south of Medowie from 1998 (NSW Wildlife Atlas data). The species is considered **unlikely** to occur.
Lathamus discolor 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 when food sources are abundant or food sources are lacking in other areas. Food sources include *E. robusta* (Swamp Mahogany) and *C. maculata* (Spotted Gum), *E. fibrosa* (Broad-leaved Ironbark) and *E. crebra* (Narrow-leaved Ironbark).	This species was not detected within the study area, however records exist within 10 kilometres. *E. robusta* is a dominant feature of the canopy, and the species is considered as having **potential** to occur.
Lophoictinia isura Square-tailed Kite	V	-	The species ranges along coastal and subcoastal areas, inhabiting timbered areas including dry woodlands and open forests. Appears to occupy large huntering ranges of more than 100km^2.	Records for the species within the locality occur at Medowie to the south of the site, and potential habitat exists. However, poor habitat values exist within the site. The species is considered **unlikely** to occur.
Neophema pulchella Turquoise Parrot	V	-	The Turquoise Parrot inhabits the edges of eucalypt woodlands, timbered ridges and creeks in farmland. It occurs throughout the coastal plains and western slopes of NSW.	The species was not within the study during recent or previous surveys, but habitat is available for the species. The species is considered **unlikely** to occur.

Species/Community	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence
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 Eucalypt trees, for nesting. Roosts in dense vegetation within such areas.	Potential habitat exists for the species within the study area and local records exist. It is considered to have **potential** to occur on an intermittent basis.
Oxyura australis Blue-billed Duck	V	-	This species prefers deep water in large, permanent wetlands and swamps with dense vegetation. It is completely aquatic, keeping close to edge of dense cover.	The species has not been recorded in current or previous surveys, and no large wetlands or swamps have been recorded within the study area. A lone record in the locality occurs at Grahamstown Lake to the west (NSW Wildlife Atlas data). It is considered **unlikely** to occur.
Pandion cristatus Eastern Osprey	V	M	Ospreys are found right around the Australia 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, and the record for the species within the locality occurs within the marine areas of Port Stephens to the east. Given Ospreys are coastline specialists focusing on reefs, shorelines and islands, it is considered **unlikely** to occur.
Petroica boodang Scarlet Robin	V	-	This species is found in dry eucalypt forests and woodlands, typically with an open and grassy understorey. It occupies both mature and regrowth vegetation, occasionally occupying wetlands and tea-tree swamps.	The species has not been recorded within the study area, but records exist in the locality and sub-optimal habitat is available. It is considered to have **potential** to occur on an intermittent basis.
Rostratula australis Australian Painted Snipe Syn. *Rostratula benghalensis* Painted Snipe	E	V, M	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 10 kilometres and only sub-optimal habitat exists. The species is considered **unlikely** to occur.
Pomatostomus temporalis temporalis Grey-crowned Babbler (eastern subspecies)	V	-	The species inhabits Box woodlands and Box-Cypress-pine woodlands on the coastal and alluvial plains. It occupies woodlands in the Hunter Valley, with records occurring in the Port Stephens LGA at Raymond Terrace (NSW Wildlife Atlas data).	The species was not detected within the study area, and the habitat available is considered marginal. The species is considered **unlikely** to occur.
Stictonetta naevosa Freckled Duck	V	-	This species prefers freshwater swamps and creeks with dense growth of Cumbungi, Lignum or Tea-tree, inhabiting ephemeral breeding swamps and permanent waters such as lakes and farm dams during drier periods.	The species was not recorded within the study area during recent or previous surveys, and there is a lack of recent records within the locality. The limited habitat that occurs on the site is not considered adequate and the species is **unlikely** to occur.
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.	Potential habitat exists for the species within the study area and local records exist. It is considered **likely** to occur within the study area on an intermittent basis.
Mammals				
Cercartetus nanus Eastern Pygmy-possum	V	-	This species is found in a broad range of habitats, but prefers woodlands and heath. They largely feed on the nectar and pollen of banksias, eucalypts and bottlebrushes, sheltering in tree hollows, rotten stumps, abandoned nests or dreys and vegetation thickets.	The species has not been recorded on site during recent or previous surveys and Atlas records are scarce in the locality. Habitat values are poor to absent. The species is considered **unlikely** to occur.
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, frequenting low to mid-elevation dry open forest and woodland close to these features. 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.	This species was not recorded on-site during recent or previous surveys however records exist within 10 kilometres of the site. The site does not comprise or connect with habitat important to the species (e.g. escarpments). The species is considered **unlikely** to occur.
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.	This species was not detected on site; however multiple records exist for the species within the locality. The site supports potential foraging habitat for this species, however its close proximity to human habitation and small patch size substantially limits the potential for incidence. It is considered **unlikely** to occupy the site.
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 >20 m). 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.	This species was not positively identified on the site during recent surveys however foraging and roosting habitat exists and local records do occur. Therefore, it is considered as having **potential** to occur.
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.	This species was recorded on-site during the current survey. It is **known** to occur.
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.	This species was not positively identified on-site during recent or previous surveys, however records exist within 10 kilometres of the site and potential habitat occurs. Therefore, it is considered as having **potential** to occur.
Mormopterus norfolkensis East Coast Free-tailed 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,	This species was not positively identified on-site during recent or previous surveys, however records exist within 10 kilometres of the site and potential habitat occurs. Therefore, it is considered as having **potential** to occur.

Species/Community	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence
			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.	
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 Region and Central Hunter Region.	This species was not positively identified on-site during recent or previous surveys, however records exist within 10 kilometres of the site and potential habitat occurs. Therefore, it is considered as having **potential** to occur.
Petaurus australis Yellow-bellied Glider	V	-	Occurs in tall, mature eucalypt forest in areas of high rainfall and nutrient rich soils. A very mobile species that occupies large home ranges between 20 to 85ha.	This species has not been identified within the study area during recent surveys, but local records exist. The high fragmentation of the site limits the potential for the species however, and it is considered **unlikely** to occur.
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.	Historical records exist for the species within close proximity of the study area, but it was not recorded during recent surveys and the habitat is highly fragmented, limiting its viability. However, there is **potential** for the species to occur.
Petrogale penicillata Brush-tailed Rock Wallaby	E	V	This species occupies rocky escarpments and cliffs along the Great Dividing Range and western slopes, browsing on vegetation in adjacent areas at night and sheltering in associated caves during the heat of the day.	No records exist for the species within the locality and suitable habitat is lacking. It is considered **unlikely** to occur.
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. However, individuals have also been recorded in heath, swamps, rainforest and wet sclerophyll forest. 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. Nesting sites can include hollow tree limbs, rotten stumps and disused bird nests.	This species was not detected within the study area, and a paucity of hollows limits the availability of habitat. Very few hollows exist within the site and the patch size is insufficient to support an individual of this species. The species is considered **unlikely** to occur.
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.	Confirmed sightings and scats of this species were **recorded** within the study area during current surveys.
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 and the Gosford LGA.	This species was not detected within the study area and no records exist within the locality. None of the preferred habitats occur, and it is considered **unlikely** to occur.
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 within the study area, however multiple records exist within the locality. Despite this, suitable heathland and dune vegetation does not exist and the species is considered **unlikely** to occur.
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** within the study area during current survey feeding on blossoming Swamp Mahogany.
Saccolaimus flaviventris Yellow-bellied Sheathtail-bat	V	-	This large species is a wide-ranging species found across northern and eastern Australia. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. This species is known to occur in the Hunter Region.	This species was not positively identified on-site during recent or previous surveys, however records exist within 10 kilometres of the site and potential habitat occurs. Therefore, it is considered as having **potential** to occur.
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.	The species was not positively identified on the site during surveys, however Atlas records exist within close proximity to the site and potential habitat is available. The species is therefore **likely** to occur.
Vespadelus troughtoni Eastern Cave Bat	V		This species is known to exist in dry forests and tropical woodlands of eastern Queensland and North Eastern New South Wales that include rock habitat features. This species is found to roost in small groups utilising rock overhangs, mine tunnels and on occasion buildings. Furthermore, this is a common species when in suitable habitat, although such habitat is restricted	This species was not positively identified on-site during recent or previous surveys, however records exist within 10 kilometres of the site and potential habitat occurs. The species is considered **unlikely** to occur.
Vegetation Communities				
Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (TSC Act) Subtropical and Temperate Coastal	E	V	Coastal Saltmarsh occurs in the intertidal zone on the shores of estuaries and lagoons that are permanently or intermittently open to the sea. It is frequently found as a zone on the landward side of mangrove stands. Characteristic plants include *Baumea juncea*, *Juncus krausii* subsp. *australiensis* (Sea Rush), *Sarcocornia quinqueflora* subsp. *quinqueflora* (Samphire), *Sporobolus virginicus* (Marine Couch), *Triglochin striata* (Streaked Arrowgrass), *Ficinia nodosa* (Knobby Club-rush), *Samolus repens* (Creeping Brookweed), *Selliera radicans* (Swamp Weed), *Suaeda* australis (Seablite) and *Zoysia macrantha* (Prickly Couch). Occasionally	Floristic surveys used to determine the composition of vegetation communities within the study area determined that this community does not occur.

Species/Community	TSC Act	EPBC Act	Habitat Description	Likelihood of Occurrence
Saltmarsh (EPBC Act)			mangroves are scattered through the saltmarsh. Tall reeds may also occur, as well as salt pans.	
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E	-	Associated with coastal areas subject to periodic flooding and in which standing fresh water persists for at least part of the year in most years. Typically occurs on silts, muds or humic loams in low-lying parts of floodplains, alluvial flats, depressions, drainage lines, backswamps, lagoons and lakes but may also occur in backbarrier landforms where floodplains adjoin coastal sandplains. Generally occur below 20 m elevation on level areas. They are dominated by herbaceous plants and have very few woody species. The structure and composition of the community varies both spatially and temporally depending on the water regime.	Floristic surveys used to determine the composition of vegetation communities within the study area determined that this community does not occur.
Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions	E	-	Hunter Lowland Redgum Forest is an open forest where the most common canopy tree species are *Eucalyptus tereticornis* (Forest Red Gum) and *E. punctata* (Grey Gum). Other frequently occurring canopy species are *Angophora floribunda* (Rough-barked Apple), *E. crebra* (Narrow-leaved Ironbark), *E. moluccana* (Grey Box) and *Corymbia maculata* (Spotted Gum). The shrub layer is open and common shrub species include *Breynia oblongifolia* (Coffee Bush), *Leucopogon juniperinus* (Prickly Beard-heath), *Daviesia ulicifolia* (Gorse Bitter Pea) and *Jacksonia scoparia* (Dogwood). The ground cover typically comprises grasses and herbs with common species being *Microlaena stipoides* var. *stipoides* (Forest Weeping Grass), *Pratia purpurascens* (Whiteroot), *Lomandra multiflora* (Many-flowered Mat-rush), *Cymbopogon refractus* (Barbed Wire Grass), *Cheilanthes sieberi* (Poison Rock Fern) and *Dichondra repens* (Kidney Weed).	Floristic surveys used to determine the composition of vegetation communities within the study area determined that this community does not occur.
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia (EPBC Act) Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (TSC Act)	E	CE	Littoral Rainforest is generally a closed forest, the structure and composition of which is strongly influenced by its proximity to the ocean. The plant species of this community are predominantly rainforest species. Several species have compound leaves, and vines may be a major component of the canopy. These features differentiate littoral rainforest from forest or scrub, but while the canopy is dominated by rainforest species, scattered emergent individuals of sclerophyll species, such as *Angophora costata*, *Banksia integrifolia*, *Eucalyptus botryoides* and *Eucalyptus tereticornis* occur in many stands. There is considerable floristic variation between stands and in particular areas, localised variants may be recognised.	Floristic surveys used to determine the composition of vegetation communities within the study area determined that this community does not occur.
Lowland Rainforest of Subtropical Australia	E	CE	This community occurs on basalt and alluvial soils, including sand and old elevated alluvial soils. Generally occurs <300 m above sea level. This community typically occurs in areas with high annual rainfall (>1300 mm). 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.	Floristic surveys used to determine the composition of vegetation communities within the study area determined that this community does not occur.
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E	-	As the name suggests, this EEC is found on the river flats of the coastal floodplains. It has a tall open tree layer of eucalypts, which may exceed 40 m in height, but can be considerably shorter in regrowth stands or under conditions of lower site quality. While the composition of the tree stratum varies considerably, the most widespread and abundant dominant trees include *Eucalyptus tereticornis* (forest red gum), *E. amplifolia* (cabbage gum), *Angophora floribunda* (rough-barked apple) and *A. subvelutina* (broad-leaved apple). *Eucalyptus baueriana* (blue box), *E. botryoides* (bangalay).	Floristic surveys used to determine the composition of vegetation communities within the study area determined that this community does not occur.
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E	-	This community is found on the coastal floodplains of NSW. It has a dense to sparse tree layer in which *Casuarina glauca* (swamp oak) is the dominant species. Other trees including *Acmena smithii* (lilly pilly), *Glochidion spp. (*cheese trees) and *Melaleuca spp.* (paperbarks) may be present as subordinate species, and are found most frequently in stands of the community northwards from Gosford. Tree diversity decreases with latitude, and *Melaleuca ericifolia* is the only abundant tree in this community south of Bermagui.	Floristic surveys used to determine the composition of vegetation communities within the study area determined that this community does not occur.
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 20 m elevation (sometimes up to 50 m). 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 within the study area delineated this EEC as **occurring** on-site.

Notes:

V = Vulnerable CE = Critically Endangered E2 = Endangered Population
E = Endangered M = Migratory species

Surveys were conducted in March 2015 using methods suitable for the detection of species identified as having potential to occur. Surveys resulted in the detection of the Koala near the south eastern corner of the site. High value habitat for the Koala occurs within vegetation zone 1 where preferred feed trees dominate (i.e. Swamp Mahogany). Koala habitat is also associated with vegetation zone 2 where supplementary habitat occurs. No other species have been identified as occurring within the site.

4.1.4 Credit calculations

This section summarises the biodiversity credit calculations for the site. These calculations are based on the information presented in the preceding sections including any use of judgement. Applicable assumptions and limitations are outlined in **Sections 4.4.3**.

4.1.4.1 Ecosystem credits

A total of 118 ecosystem credits were calculated for the loss of vegetation zones contained within the site, as specified in **Table 10**.

Table 10 Vegetation zones plot requirements

Zone	PCT name	PCT Code	Condition	EEC	Area (ha)	Credits
1	Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	HU633	Moderate/Good high	Yes	1.22	85
2	Smooth-barked Apple - White Stringybark - Red Mahogany - *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast	HU832	Moderate/Good high	No	0.51	33

A Red Flag assessment would be required to assess the loss of HU633 within the suite as this is a listed EEC. This assessment is likely to be approved by OEH as the percent loss of HU633 within the region would be negligible (i.e. approximately 0.06%).

Potential exists to reduce the credit requirement for vegetation zone 2 by four credits if OEH approve a 'more appropriate local data report' arguing the exclusion of the large forest owls (Barking Owl, Masked Owl and Powerful Owl) and Spotted-tailed Quoll from the calculation.

4.1.4.2 Species credits

A species credit calculation for the Koala was based on a species polygon comprising all vegetation zones within the BioBank (i.e. 1.73 ha). A total of 45 species credits would be required to meet the offsetting requirements for the Koala if the site was developed in accordance with the proposed land use zoning.

4.1.4.3 Limitations

Application of the BBAM

The assessment is limited by the methods specified in the BBAM operational manual (OEH 2014), BBCC (Version 2.1 accessed October, 2015) and relevant methodological updates.

Survey data

This BioBanking assessment is based on field survey data collected during 17 September 2015. The minimum data requirements specified by the BBAM were met (OEH 2014). Adequate surveys have been completed to determine the species credit requirement for the site.

4.2 Section 5A of the EP&A Act

Section 5A assessments or 'Seven Part tests' were prepared to assess the impacts of the proposed action on the following threatened species, populations, ecological communities and their habitats:

- Wallum Froglet *Crinia tinnula*
- Regent Honeyeater *Anthochaera phrygia*
- Bush Stone-curlew *Burhinus grallarius*
- Glossy Black-Cockatoo *Calyptorhynchus lathami*
- Varied Sittella *Daphoenositta chrysoptera*
- Little Lorikeet *Glossopsitta pusilla*
- Swift Parrot *Lathamus discolour*
- Powerful Owl *Ninox strenua*
- Scarlet Robin *Petroica boodang*
- Masked Owl *Tyto novaehollandiae*
- Eastern False Pipistrelle *Falsistrellus tasmaniensis*
- Little Bentwing Bat *Miniopterus australis*
- Squirrel Glider *Petaurus norfolcensis*
- Koala *Phascolarctos cinereus*
- Grey-headed Flying-fox *Pteropus poliocephalus*
- Greater Broad-nosed Bat *Scoteanax rueppellii*
- Swamp Sclerophyll Forest on coastal floodplains of the NSW north coast, Sydney Basin bioregion and South East Corner bioregions

These assessments, which are provided in **Appendix 6**, have concluded that the proposed action is not likely to have a significant impact on threatened species, populations, ecological communities and their habitats. These assessments indicate that no further assessment of the proposed action is required (i.e. SIS).

4.3 EPBC Act

Significance assessments were prepared in accordance with the MNES Significance Impact Guidelines 1.1 (DoE 2013) to determine if the proposed action would have a significance impact on the following threatened species, populations, ecological communities and their habitats:

- Regent Honeyeater *Anthochaera phrygia*
- Swift Parrot *Lathamus discolour*
- Koala (Qld, NSW, Vic and ACT Populations) *Phascolarctos cinereus*
- Grey-headed Flying-fox *Pteropus poliocephalus*

The assessment concluded that the proposed action is unlikely to have a significant impact on the above listed threatened species. However, analysis in accordance with the EPBC Act Referral Guidelines for the vulnerable Koala (DoE 2014) indicated an uncertain impact outcome. According to these guidelines, habitat impacted by development having a score greater than 5 constitutes an impact on habitat 'critical to the survival' of the Koala. A score of 7 was calculated for the site, as outlined below:

- Evidence of one or more koalas within the last 2 years (+2);
- Has forest or woodland with 2 or more known koala food tree species (+2);
- Area is part of a contiguous landscape ≥ 500 ha (+2);
- Evidence of infrequent or irregular koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence (+1); and
- Habitat is unlikely to be important for achieving the interim recovery objectives for the relevant context (0).

Further guidance is provided for uncertainty in impact outcomes for the Koala, as indicated by Table 2 of the EPBC Act Referral guidelines, with the decision to refer dependant on the nature of the proposed action. Matters to be considered in the evaluation of uncertain impacts are listed below, with matters highlighted in bold considered relevant to the proposed action:

- **The score calculated for the impact area (higher score = greater risk of significant impact)**;
- Amount of koala habitat being cleared (more habitat cleared = greater risk of significant impact);
- **Method of clearing (i.e. clear-felling has greater risk of significant impact than selective felling with understorey and koala food tree retention)**;
- **The density or abundance of koalas (relatively high density or abundance for the region means greater risk of significant impact)**; and
- Level of fragmentation caused by the clearing (greater degree of fragmentation has greater risk of significant impact).

While it is considered that the proposed action is not likely to have a significant impact on an important population of the Koala, refer to **Appendix 7**, a decision to refer would need to be made following due consideration of Section 68(2) of the EPBC Act, viz.:

"A person proposing to take an action that the person thinks is not a controlled action may refer the proposal to the Minister for the Minister's decision whether or not the action is a controlled action".

Referring the proposed action within this context would seek to resolve the uncertainty generated by Table 2 of the EPBC Act Referral Guidelines for the vulnerable Koala (DoE 2014) and in so doing resolve the associated regulatory risk.

4.4 PSC CKPoM

An assessment against the performance criteria specified in Appendix 4 of the CKPoM (2002) is provided in **Table 11**.

Table 11 CKPoM (2002) Performance measures

Performance measure	Response
Minimise removal of preferred Koala habitat	The area of preferred Koala habitat to be impacted by future development is 1.22 ha (i.e. HU633 including Swamp Mahogany). There is limited potential to minimise the removal of preferred Koala habitat within the site as the future land use is likely to involve the complete removal of vegetation cover within the site.
Maximise retention of	Supplementary Koala habitat totalling 0.51 ha would be impacted by the future

Performance measure	Response
supplementary Koala habitat	development within the site. Vegetation characterised as supplementary habitat that occurs within the lot boundary and west of the site would be retained, thus representing the extent of retained supplementary habitat.
Minimise the removal of individual preferred Koala habitat trees (i.e. Swamp Mahogany, Forest Redgum and Parramatta Redgum)	Future land uses arising from the proposed zoning would provide very limited opportunity to retain any Swamp Mahogany and/or Forest Redgum within the site.
Provide for restoration or rehabilitation of Koala habitat including buffers and linkages over cleared land	Where possible, it is recommended that Forest Red gum and Swamp Mahogany are included in the landscape plan with plantings to be restricted to the western and northern boundaries of the site. These plantings would supplement habitat retained within the western parts of the site.
Provide management and protection of Koala habitat	Management options would be restricted to the establishment of barrier fencing preventing Koala movements into developed landscapes. These barriers would be established on the western and northern boundaries of the site. No other management or protection measures would be applicable other than for the provision of a conservation agreement of residual native vegetation in the western part of the lot boundary.
Not compromise the safe movement of Koala	Connectivity width would be reduced to a 100m wide corridor (from a width of approximately 200 m). This loss is not classified as a significant change in connectivity (OEH 2014). Motor vehicle traffic generated by or occurring within the developed precinct is unlikely to have any interaction with Koala individuals as Koala movements would be restricted to lands west of the developed site.
Restrict clearing to identified building areas	The future land use of the site would result in a comprehensive development outcome without prospect for the retention of habitat values.
Include measures to effectively manage known Koala threats	Threats to the Koala as a consequence of future land uses are considered to be low as there is a low likelihood for motor vehicle interactions or deaths arising from dog attack. On this basis there are no specific measures are recommended. In relation to habitat loss, it is recommended that consideration be given to the provision of compensatory outcomes that would minimise the impacts on the Koala. This may involve the management of nearby vegetation for the benefit of the Koala or establishment of formal offsets to protect Koala habitat.

Ideally, the proposed action should seek to minimise the removal of preferred Koala habitat by restricting future development to existing cleared lands. Notwithstanding, the impact of the proposed action on the Port Stephens Koala population is likely to be an isolated impact limited to an area capable of supporting no more than one Koala. Connectivity between habitat areas would not be adversely impacted thus not impeding movements throughout the surrounding areas of large, contiguous vegetation.

Where impact avoidance is not possible, mitigation measures should be used to minimise impacts, as indicated in **Table 11**. High value mitigation measures include the prevention of Koala movements into a developed landscape through the establishment of barrier fences and planting of preferred feed tree species (i.e. Swamp Mahogany) on the western and northern boundaries of the developed precinct. Maintaining a 100 m wide corridor of supplementary habitat adjacent to the western boundary of the site is a high value impact avoidance outcome.

5.0 Conclusion

5.1 Key findings

Ecological constraints for the zoning proposal were identified within the site and include:

- 1.22 hectares of the TSC Act listed Swamp Sclerophyll Forest on Coastal Floodplains EEC;
- The presence of Primary Koala Habitat, as defined under the Port Stephens Council CKPoM (2002) and The Koala Habitat Atlas Project No 6: Port Stephens LGA, and habitat critical to the survival of the Koala (DoE 2014); and
- Potential habitat for 20 threatened fauna species listed under the TSC Act and/or EPBC Act.

5.2 Section 5A Assessment (Seven Part Tests)

The proposed rezoning is not likely to have a significant impact on threatened species, populations, ecological communities and their habitats listed under the TSC Act. It is considered that a Species Impact Statement prepared under the TSC Act is not required as the proposed action is not likely to have a significant impact on listed threatened species, populations, ecological communities and their habitats.

5.3 Significance Assessments (EPBC Act)

Future actions arising from the proposed rezoning would result in the loss of habitat for MNES, notably Koala habitat. It is considered that these impacts are not likely to have a significant impact on MNES as:

- The area of habitat loss is small;
- Connectivity will be maintained; and
- Habitat availability within the locality will remain relatively unaffected.

However, the EPBC Act Referral guidelines for the vulnerable Koala (DoE 2014) indicate an uncertain impact outcome. In determining if the proposed action should be referred under the EPBC Act, it is recommended that due consideration be given to Section 68(2) of the EPBC Act in light of the conclusion reached in the Significance Assessment (i.e. not likely to have a significant impact on MNES).

5.4 PSC CKPoM

Future actions arising from the proposed rezoning would result in the removal of preferred Koala habitat. The PSC CKPoM recommends the avoidance of such habitat loss to minimise impacts on the Koala. Should the avoidance of this habitat not be possible, it is recommended that connectivity to the west be maintained with a minimum width of 100m, thus having the dual benefit of maximising the retention of supplementary habitat. Barrier fencing on the western and possibly northern boundaries is recommended to limit the likelihood of Koala misadventure in the developed landscape (e.g. vehicle strike). The planting of preferred feed tree species, specifically Swamp Mahogany, along the western and northern boundaries is also recommended.

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Appendix 1

Staff Qualifications

Curriculum Vitae

MARK AITKENS

Senior Ecologist

Newcastle, NSW

Bachelor of Science (Environmental Biology), UTS Sydney

Accredited Biobanking Assessor

AREAS OF EXPERTISE:

Mark is a professional consulting ecologist with 19+ years experience in the delivery of terrestrial and aquatic ecology services to the private and public sectors. As a consulting ecologist, Mark is experienced in all aspects of project delivery including design and implementation of seasonally based flora and fauna surveys, identification of terrestrial and aquatic species and ecological communities, impact assessment, biodiversity offsetting under State and Commonwealth policies and design and implementation of monitoring programs.

SELECTED PROJECT EXPERIENCE:

Mining

- **Wambo** – As the project manager for the 2013 and 2014 monitoring periods, Mark oversaw the production of aquatic ecosystems monitoring, flora and habitat complexity monitoring, indicator species monitoring (birds), riparian ecosystem function analysis for three streams, Landscape Function Analysis for riparian and overburden rehabilitation areas.
- **Caroona Coal** – Prepared a draft Biodiversity Offset Strategy for the BHP Caroona Coal project involving the sourcing and analysis of prospective offset sites compatible with the impacts identified within the Caroona Coal precinct.
- **Whitehaven Coal** – Designed and performed targeted threatened species surveys for the endangered vine *Tylophora linearis* and shrub *Pomaderris queenslandica* within Leard State Forest and Maules Creek Mine offset lands.
- **Spur Hill Coal Project** – Designed and performed seasonal fauna surveys for the proposed Spur Hill Coal mine at Denman in the Upper Hunter Valley.
- **Peabody Coal** – Project managed the supply of the Upper Hunter Strategic Assessment for Wambo Coal operations, designed and performed fauna surveys for the South Wambo underground project, ecological impact assessments for South Wambo underground, advice regarding environmental incidents, monitoring for the rehabilitation of North Wambo Creek diversion, monitoring of subsidence impacts, and preparation of the Wilpinjong Coal Biodiversity Management Plan.
- **Shenhua Watermark Coal Project** – Provided expert ecology skills in the servicing of exploration programs involving bore hole clearances and analysis of threatened species constraints including, but not limited to, the endangered vine *Tylophora linearis*.
- **Moolarben Coal Mine** – Project managed the supply of ecological impact assessments for Stages 1 and 2 of the Moolarben Coal Project. Designed and performed flora and fauna surveys over six consecutive seasons for an application area of 10,000 ha involving the validation of vegetation and habitat condition mapping.

Linear Projects

- **Oxley Highway to Kempsey Pacific Highway Upgrade** (approvals) – Preparation of supplementary documentation to assist the Project's State and Commonwealth assessments. Prepared Preliminary Documentation to support a Referral under the EPBC Act, including the design and performing of specific

targeted surveys for listed MNES such as *Mixophyes iteratus*. Actively participated in consultation and liaison with the Commonwealth Department.

- **Oxley Highway to Kempsey Pacific Highway Upgrade** (monitoring) – Performed monitoring surveys for the State listed *Maundia triglochinoides* and the State and Commonwealth listed Giant Barred Frog (*Mixophyes iteratus*) in accordance with a Before Impact Control After monitoring design. Analysed results and reported findings including an evaluation of Project impacts and performance of mitigation measures.
- **Kempsey Bypass Pacific Highway Upgrade** – Performed monitoring surveys for the Green-thighed Frog including the evaluation of project impacts on the species and effectiveness of mitigation measures.
- **Frederickton to Eungai Pacific Highway Upgrade** – Performed monitoring surveys for the State and Commonwealth listed Hairy Joint Grass (*Arthraxon hispidus*) and State listed *Maundia triglochinoides* including the evaluation of project impacts on the species and effectiveness of mitigation measures.
- **Hunter Expressway** – Prepared the Biodiversity Offset Strategy for the offsetting of 'regrowth' not assessed in the original environmental impact statement. Assessed candidate offset sites and provided justifications for their suitability as offsets for the HEX project.
- **Maitland to Minimbah Third Track Upgrade (rail)** – Project managed the implementation of the Flora and Fauna Management Plan. Prepared a site specific management / monitoring plan for the eviction of a colony of Eastern Bentwing Bats (*Miniopterus schriebersii*) located within the impact area. Located and assessed the projects biodiversity offsets including the preparation of a Biodiversity Offset Strategy using the NSW BioBanking methodology covering both State and Commonwealth conditions of consent.

BioBanking Statements

- **Marys Mount Quarry** – Project managed the assessment of the Mary's Mount blue metal quarry at Gunnedah involving the preparation of a red flag assessment for Semi-evergreen Vine Thicket.
- **Emerald Beach** – Performed field surveys and preliminary BioBanking assessment for a residential development at Emerald Beach, Coffs Harbour LGA.
- **Mullaway** – Performed field surveys and preliminary BioBanking assessment for a seniors living development at Emerald Beach, Coffs Harbour LGA.
- **Bonville** – Performed field surveys and preliminary BioBanking assessment for a residential development at Emerald Beach, Coffs Harbour.

BioBanking Agreements

- **Valley Arm** – Performed field surveys and preliminary BioBanking assessment for land owned by the Mindarriba LALC resulting in an approved BioBanking agreement at Payne's Crossing, Singleton LGA.
- **Butterwick** – Sourced and project managed a BioBanking assessment for privately owned land resulting in an approved BioBanking agreement at Butterwick, Port Stephens LGA.
- **Dunns Creek** – Designed and performed a BioBanking assessment for privately owned land resulting in an approved BioBanking agreement at Dunn's Creek, Port Stephens LGA.
- **Karuah** – Designed and performed a BioBanking assessment for Council owned land resulting in an approved BioBanking agreement at Karuah, Port Stephens LGA.
- **Mullaway** – Performed field surveys and preliminary BioBanking assessment for a seniors living development at Emerald Beach, Coffs Harbour LGA.

EPBC Act Assessments

- **Marys Mount Quarry** – Project managed and prepared Preliminary Documentation for a 'controlled action' declared under the EPBC Act. Assessment involved the consideration of MNES impacted by the quarry

including, but not restricted to Semi-evergreen Vine Thicket EEC and the Koala. Calculated and report biodiversity offset requirements within a Biodiversity Offset Strategy.

- **Rosewood Estate** – Project managed and prepared Preliminary Documentation for a 'controlled action' declared under the EPBC Act. Assessment involved a detailed consideration of White Box Yellow Box Blakely's Redgum Grassy Woodland and Derived Native Grasslands, a critically endangered ecological community.

Management/ Monitoring Plans

- **Marys Mount Quarry** – Project managed and prepared a Koala Plan of Management for an important population impacted by the Marys Mount Blue Metal Quarry at Gunnedah. Involved obtaining State and Commonwealth approval of the Plan.
- **Biodiversity Management Plan, Wilpinjong Coal** – Prepared the OEH endorsed Biodiversity Management Plan for the Wilpinjong Coal mine including management action, time and cost specifications for management zones. Defined completion criteria for management zones including interim performance targets. Devised a specific BACI style monitoring program including design and methodological elements.

PREVIOUS EXPERIENCE:

Senior Ecologist – Niche Environment and Heritage Pty Ltd **(2012 – 2015)**

Senior accredited BioBanker involved in preparation and review of BioBanking assessments. Senior ecologist responsible for the preparation and review of ecological/ biodiversity assessment reports for State Significant Development or designated development. Preparation and implementation on monitoring programs. Preparation or review of EPBC Act Referrals and Preliminary Documentation. Preparation of Biodiversity Offset Strategies.

Senior Ecologist – GHD Pty Ltd **(2010 – 2012)**

Senior accredited BioBanker involved in preparation and review of BioBanking assessments. Senior ecologist responsible for the preparation of ecological/ biodiversity assessment reports for State Significant Development or designated development.

Manager / Principal Ecologist – Ecovision Consulting **(2003 – 2010)**

Preparation of flora and fauna impact assessments, threatened species management, monitoring plans and offset strategies. Preparation of Species Impact Statements and assessments under Part 3A of the EP&A Act (now Part 4.1).

Ecologist – HLA-Envirosciences Pty Limited **(2001 – 2003)**

Ecologist responsible for the provision of flora and fauna impact assessments, statement of environmental effects and environmental impact statements.

Ecologist – Conacher Travers **(1999 – 2000)**

Ecologist responsible for the provision of flora and fauna impact assessments, statement of environmental effects and environmental impact statements.

Manager / Ecologist – Ecovision Consulting **(1996 – 1998)**

Ecologist responsible for the provision of flora and fauna impact assessments, statement of environmental effects and environmental impact statements.

Curriculum Vitae

RHYS OSBORNE

Ecologist

Newcastle, NSW

Bachelor of Science (Biology), University of Newcastle, 2014

Certificate in GIS, TAFE NSW

AREAS OF EXPERTISE:

Rhys has a passion for environmental awareness, conservation and sustainable solutions. He has proven to be highly resourceful and adaptive and has excellent organisational and time management skills. He is able to juggle multiple responsibilities and work under high pressure whilst meeting demanding deadlines. He has shown outstanding communication skills with excellent interpersonal skills with an ability to establish strategic relationships with people on all levels across social, professional and cultural boundaries. He is a highly responsible corporate representative when working within a public environment and understands the importance in maintaining a positive corporate image.

PREVIOUS EXPERIENCE:

Environmental Field Ecologist – Ecotone Environmental Consultants Pty Ltd (2013 – 2014)

Assisted in ecological investigations for the proposed Lake Macquarie Transport Interchange at Glendale as well as fauna survey work for small residential proposals and flora and fauna survey work under the Biobanking Methodology for large rural residential subdivision. Skills acquired included; vegetation mapping, GPS, vegetation surveys and soil sampling and assessment.

Curriculum Vitae

JOEL STIBBARD

Ecologist

Newcastle, New South Wales

Masters of Environmental Management, University of Queensland, 2009 - Present

Bachelor of Science, University of Queensland, 2001 - 2004

AREAS OF EXPERTISE:

I have over seven years of ecological experience around the world in both aquatic and terrestrial environments. The last 4 years have been spent working as a consulting ecologist in Queensland and New South Wales, where I have gained extensive experience in project management and client liaison, flora and fauna survey methodologies and identification, GIS mapping and environmental planning and legislation.

SELECTED PROJECT EXPERIENCE:

Consultancy Sector

- Centennial Coal Clarence Extension Project – As Project Manager I was solely responsible for the background research, field studies and reporting that was required to produce the flora and fauna assessment for the proposed 636 hectare extension of Clarence underground mining works.
- Centennial Coal Clarence REA VI – I was Project Manager for this project, and was responsible for managing the ecological assessment of the proposed Reject Emplacement Area VI at Clarence Colliery. Required works included client liaison, field surveys, vegetation mapping and reporting.
- Centennial Coal Land Holdings Strategic Assessment – This desktop assessment involved the analysis of the potential conservation and biodiversity values of Centennial off-tenement land holdings to determine potential benefits of alternative land uses. I was directly responsible for the assessment of 258 individual lots as well as producing the associated GIS datasets, user guide and assessment report.
- Centennial Coal Angus Place and Springvale Extension Projects – These projects are located within the Newnes Plateau and immediate surrounds just north of Lithgow, NSW. I have been involved in the extensive flora and fauna field surveys required for these large projects, and I was responsible for all GIS requirements for the ecological works including finalised vegetation maps and EIS figures.
- Centennial Coal Airly Extension Project – A flora and fauna assessment was conducted for this large project over nearly 4000 hectares of remote bushland north of Capertee in NSW. I was involved in the flora and fauna surveys required for this project along with analysis GIS data and producing finalised maps for the EIS.
- Rose Group: Gwandalan – I have been responsible for strategic planning and installation of nest boxes as a part of the approval conditions for a residential development at Gwandalan. The project will involve ongoing nest box installations and monitoring on a biannual basis.
- Huntlee Pty Ltd – I have been responsible for several ecological projects as part of the Huntlee residential development at North Rothbury. Such projects include nest box planning and installations, clearing supervision, GIS and targeted threatened species surveys.
- Hancock Coal Pty Ltd: Alpha Coal Project – The site of a well known thermal coal deposit in the Galilee Basin of Queensland, I was involved in terrestrial and aquatic flora and fauna surveys, habitat assessments and reporting.

- Hancock Coal Pty Ltd: Kevins Corner Project – Situated to the north of the Alpha Coal Project, I was involved in flora and fauna surveys as well as ecological assessment reporting.

Research Sector

- Kalahari Meerkat Project – This project was collaboratively run by the University of Cambridge in the UK and the University of Zurich in Switzerland. I was an ecological researcher on this project in the Northern Cape of South Africa for 1.5 years, assessing the behavioural and reproductive ecology of the Meerkat *Suricatta suricatta*.
- Great Barrier Reef Monitoring Program – I was a Project Officer for Reef Check Australia in Townsville throughout 2009. I was primarily responsible for organising and implementing monitoring surveys, data collection and reporting to the Great Barrier Reef Marine Park Authority on the health of reefs across the entire GBR.
- Meso-American Barrier Reef Monitoring Program – I was a volunteer surveyor for Global Vision International in the Yucatan Peninsula of Mexico during 2008, primarily involved in dive surveys, data collection and ecotourism as a part of a long-term monitoring program.

PREVIOUS EXPERIENCE:

Ecologist – Australasian Resource Consultants — 1 year

I was employed at AARC as an ecologist at the beginning of 2011. My role primarily involved ecological field surveys, EIA reporting and GIS mapping within a consultancy role that required initiative, efficiency and innovation. A valued member of the team, I left AARC to pursue a similar role with RPS in my hometown of Newcastle.

Lab Technician – Fisheries Resource Consultants — 0.5 years

My role in the laboratory for FRC in 2010 involved the sorting and identification of macro-invertebrates as an indication of aquatic waterway health. This was a casual position that ended upon gaining employment full-time at AARC.

Ecologist – Environmental, Ground & Water Consultants — 0.5 years

I was employed at EGC whilst completing my Masters at the University of Queensland in 2010. This was a project-based role on Curtis Island off of Gladstone in Central Queensland. My role involved ecological surveys, identification of fauna habitat and assessment reporting prior to the development of the QCG LNG plant on Curtis Island.

MEMBERSHIPS & ACHIEVEMENTS:

Ecological Consultants Association – Active Member 2012 – Present

Curriculum Vitae

ROB DWYER

Planning Manager

Newcastle, NSW

Bachelor of Science, University of Newcastle NSW, 1990

Graduate Diploma Urban and Regional Planning, University of New England NSW, 1995

AREAS OF EXPERTISE:

Rob has over 23 years experience in land use planning, policy development, strategic planning, development assessment and project management. He has extensive experience in managing urban release areas, major industrial and infrastructure proposals and the like. His areas of expertise include Project Management of major rezoning and major developments including preparation of Planning Proposals, development of strategic land use plans, policies and strategies; preparation of Development Control Plans (DCPs), Master Plans and Local Area Plans; management and preparation of major residential, commercial and industrial projects; along with town planning with particular interest in urban form and environmentally sustainable neighbourhood design.

Prior to joining RPS in May 2004, Rob worked for 10 years in Senior and Manager positions within Local Government, including the role of Land Use Planning Manager at Port Stephens Council. During this period he was involved in aspects of land use planning including the co-ordination on rezoning, review of the LGA wide settlement strategy, development control planning and community consultation. Rob is a committee member of the Hunter Chapter of the NSW Property Council.

SELECTED PROJECT EXPERIENCE:

Strategic Planning and Planning Proposals

- **Medowie Town Centre Planning Proposal** – Co-ordination of a Planning Proposal for commercial land at Medowie on behalf of Port Stephens Council;
- **Box Hill North (Sydney) Planning Proposal** – Co-ordination of a Planning Proposal on behalf of Flow Systems for the establishment of a Local Water Centre (Water Recycling Plant) for the reticulation of recycled to almost 4,000 dwellings.
- **Cooranbong Planning and Environmental studies** – Co-ordination of a Planning Proposal for residential subdivision at Cooranbong on behalf of private land owners;
- **Failford Road, Nabiac** – Co-ordination of a Planning Proposal and Project Management for a Large Residential Lot rezoning on behalf of Great Lakes Council;
- **Bolwarra Urban Area** – Co-ordination of a combined Planning Proposal and development application for residential development on behalf of private land owners;
- **North Shearwater Estate, Tea Gardens** – Co-ordination of a Planning Proposal and Project Management of the Urban Release Area on behalf of Great Lakes Council;
- **Bulahdelah Residential and Brewery site** – Co-ordination of a Planning Proposal and Project Management for a brewery and ancilliary residential development on behalf of Great Lakes Council;
- **Williamtown Business Support lands** – Preparation of a Planning Proposal for Business Support lands in Williamtown on behalf of private land owners;
- **North Hawks Nest and Tea Gardens** – Performed the role of Release Area Co-ordinator, including Planning Proposal works for these large Urban Release Areas on behalf of Great Lakes Council;

- **Speers Point and Killingworth, Lake Macquarie** - Project Director and co-ordinator for the successful delivery of local environmental studies of these key sites on behalf of Lake Macquarie City Council.
- **Freeway North Business Park** – Project Director for the successful rezoning and Part 3A concept and project apporval of a 60 hectare business park at Thornton.
- **Minmi East Development Control Plan** – Prepared a development control for the first stages of the Northern Estates Urban Release Area in accordance with the approved Part 3A Concept Plan on behalf of the land owner.

PREVIOUS EXPERIENCE:

Land Use Planning Manager – Port Stephens Council **1999 - 2004**
Managed the Land Use Planning Team within Council and oversaw the preparation and implementation of LGA wide LEPs, DCPs and planning policies. Role also included the co-ordination of approvals associated with major urban land releases and the LGA wide settlement strategy.

Senior Strategic Planner – Lake Macquarie City Council **1995 - 1999**
Project managed major urban land releases through the preparation of LEPs, DCPs and the Lifestyle 2020 Project.

Senior Strategic Planner – Port Stephens Council **1991 - 1995**
Project managed a range of LEPs and DCPs and participated in the initial comprehensive Koala Plan of Management and state Government interaction.

MEMBERSHIPS & ACHIEVEMENTS:

- Member Planning Institute of Australia (MPIA)
- Member of the Hunter Chapter Committee of the Property Council Australia
- Committee Member of the Hunter Branch of the PIA (NSW)

Appendix 2

Flora Species List

Scientific Name	Common Name	Forest	Cleared
Acacia irrorata	-	x	x
*Andropogon virginicus**	Whisky Grass		x
Angophora costata	Smooth-barked Apple	x	
*Asparagus virgatus**	Asparagus Fern	x	
*Axonopus fissifolia**	Carpet Grass	x	x
*Bidens pilosa**	Cobbler's Pegs		x
Blechnum indicum	Swamp Water Fern	x	
Breynia oblongifolia	Breynia	x	
Caladenia catenata	Lady Fingers	x	
Calochlaena dubia	Soft Bracken	x	
Centella asiatica	-	x	
*Cinnamomum camphora**	Camphor Laurel	x	x
Clematis sp.			x
Commelina cyanea		x	
*Conyza sumatrensis**	Tall Fleabane		x
Cynodon dactylon	Common Couch	x	x
Daviesia ulicifolia	Gorse Bitter Pea	x	
Desmodium varians	Slender Tick-trefoil	x	
Dianella caerulea	Spreading Flax Lily	x	
Dianella revoluta var. revoluta	Spreading Flax Lily	x	
Digitaria parviflora	Small-flowered Finger Grass	x	
Echinopogon caespitosus	Bushy Hedgehog-grass	x	
Echinopogon ovatus	Forest Hedgehog Grass	x	
Entolasia stricta	Wiry Panic	x	
*Eragrostis curvula**	African Lovegrass		x
Eucalyptus acmenoides	White Mahogany	x	
Eucalyptus pilularis	Blackbutt	x	
Eucalyptus piperita	Sydney Peppermint	x	
Eucalyptus punctata	Grey Gum	x	
Eucalyptus resinifera	Red Mahogany	x	
Eucalyptus robusta	Swamp Mahogany	x	x
Eucalyptus tereticornis	Forest Red Gum	x	
Eustrephus latifolia	Wombat Berry	x	
Gahnia clarkei	Tall Saw-sedge	x	

Scientific Name	Common Name	Forest	Cleared
Gallium migrans		x	
Geitonoplesium cymosum	Scrambling Lily	x	
Glochidion ferdinandi var. ferdinandi	Cheese Tree	x	
*Gomphocarpus fruiticosus**	Narrow Leaf Cotton Bush		x
Glycine microphylla			x
Hardenbergia violacea		x	
*Hydrocotyle bonariensis**	Kurnell Curse / Pennywort		x
*Hypochaeris glabra**	Flatweed		x
*Hypochaeris radicata**	Flatweed		x
Hypolepis muelleri	Harsh Ground Fern	x	
Imperata cylindrica	Blady Grass	x	x
Isolepis sp.		x	
Juncus usitatus		x	
Kennedia rubicundra		x	
*Lantana camara**	Lantana	x	x
Leptomeria acida	Native Currant	x	
*Ligustrum sinense**	Small-leaved Privet	x	x
Livistona australis	Cabbage Tree Palm	x	
Lobelia anceps	Swamp Lobelia	x	
Lomandra longifolia	Spiky-headed Mat-rush	x	
*Lonicera japonica**	Japanese Honeysuckle		x
Melaleuca ericifolia	Swamp Paperbark	x	
Melaleuca linariifolia	Snow in Summer	x	
Melaleuca nodosa	Ball Honey Myrtle	x	
Melaleuca quinquenervia	Broad-leaved Paperbark	x	
Melaleuca sieberi	-	x	
Microlaeana stipoides	Weeping Grass	X	
Oplismenus imbecillis	-		x
*Panicum maximum var. maximum**			x
Parsonsia straminea	Common Silkpod	x	
Paspalidium distans	-	x	
*Paspalum dilatatum**	Paspalum		x
Phragmites australis	Common Reed		x
*Pinus sp.**	-	x	x

Scientific Name	Common Name	Forest	Cleared
Pittosporum undulatum	Sweet Pittosporum	x	
*Plantago lanceolata**	Ribwort		x
Pratia purpurascens	Whiteroot	x	x
Pteridium esculentum	Bracken	x	
*Rosa rubiginosa**	Sweet Briar		x
*Senecio madagascariensis**	Fireweed		x
*Senna pendula var. glabrata**	-		x
*Setaria spp.**			x
*Sida rhombifolia**	Paddy's Lucern	x	
Sporobolus creber	Slender Rat's Tail Grass		x
*Stenotaphrum secundatum**	Buffalo Grass		x
*Taraxacum officinale**	Dandelion		x
Thelymyptra sp.	Sun Orchid	x	
*Trifolium repens**	White Clover		x
Vernonia cinerea		x	
*Verbena bonariensis**	Purpletop		x
Viola hederacea	Ivy-leaved Violet	x	

* Exotic species

Appendix 3

Fauna Species List

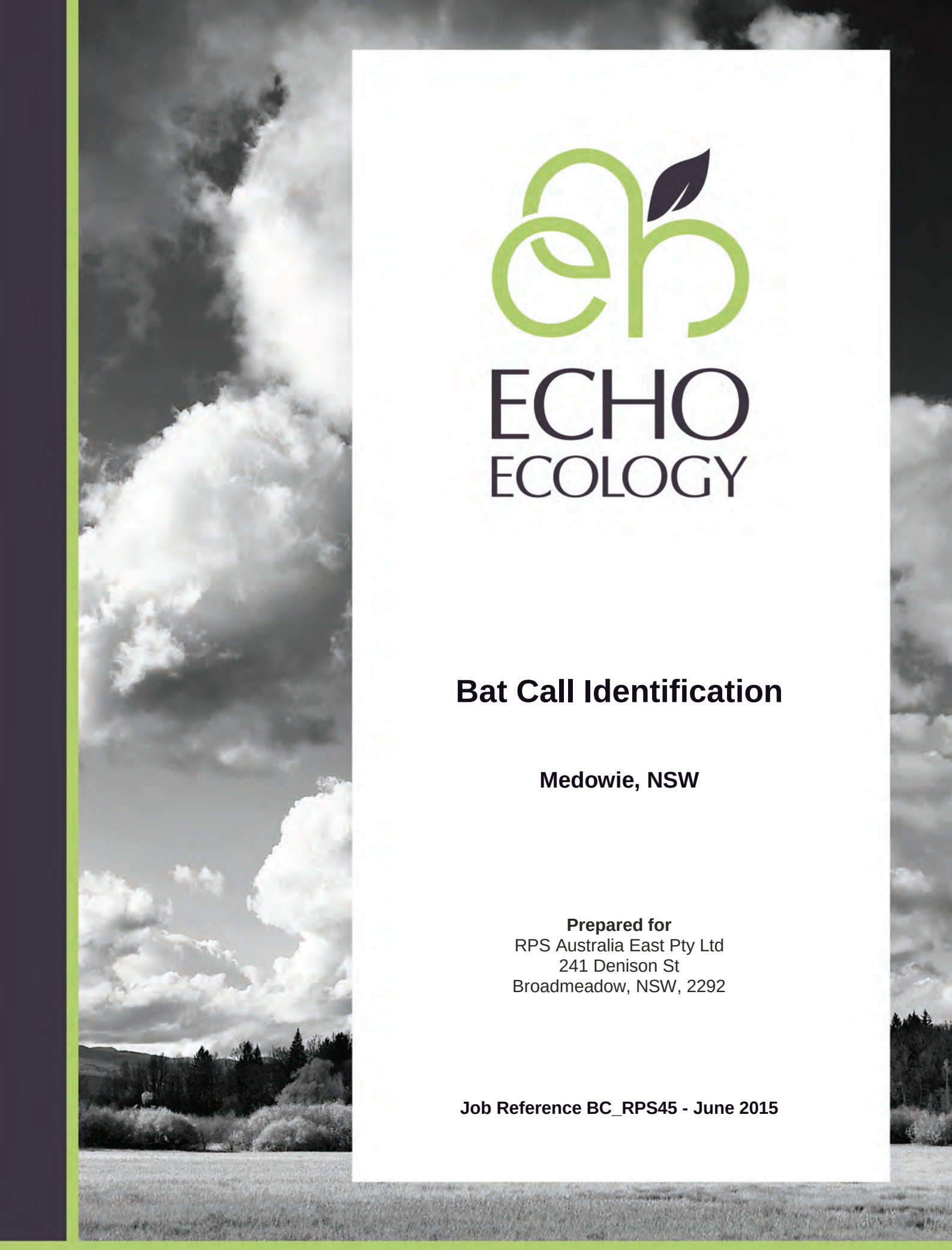
Family	Common Name	Scientific Name	TSC Act	EPBC Act	Trapping	Opportunistic
Amphibia	Common Eastern Froglet	*Crinia signifera*	P		x	
Aves	Striated Thornbill	*Acanthiza lineata*	P		x	x
Aves	Brown Thornbill	*Acanthiza pusilla*	P		x	x
Aves	White-browed Scrubwren	*Sericornis frontalis*	P			x
Aves	Pied Currawong	*Strepera graculina*	P			x
Aves	Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	P		x	x
Aves	White-browed Treecreeper	*Climacteris affinis*	P		x	
Aves	Brown Cuckoo-Dove	*Macropygia amboinensis*	P			
Aves	Red-browed Finch	*Neochmia temporalis*	P			x
Aves	Superb Fairy-wren	*Malurus cyaneus*	P			x
Aves	Eastern Spinebill	*Acanthorhynchus tenuirostris*	P		x	x
Aves	Yellow-faced Honeyeater	*Lichenostomus chrysops*	P		x	x
Aves	Lewin's Honeyeater	*Meliphaga lewinii*	P		x	x
Aves	Scarlet Honeyeater	*Myzomela sanguinolenta*	P			
Aves	Noisy Friarbird	*Philemon corniculatus*	P		x	
Aves	Golden Whistler	*Pachycephala pectoralis*	P		x	
Aves	Eastern Yellow Robin	*Eopsaltria australis*	P			x
Aves	Eastern Rosella	*Platycercus eximius*	P		x	
Aves	Scaly-breasted Lorikeet	*Trichoglossus chlorolepidotus*	P		x	
Aves	Rainbow Lorikeet	*Trichoglossus haematodus*	P		x	x
Aves	Grey Fantail	*Rhipidura albiscapa*	P			
Aves	Silvereye	*Zosterops lateralis*	P		x	
Mammalia	Brown Antechinus	*Antechinus stuartii*	P			
Mammalia	Eastern Grey Kangaroo	*Macropus giganteus*	P		x	x
Mammalia	Koala	*Phascolarctos cinereus*	V,P	V	x	x
Mammalia	Bush Rat	*Rattus fuscipes*	P			
Mammalia	Brushtail Possum	*Trichosurus sp.*	P		x	x

Family	Common Name	Scientific Name	TSC Act	EPBC Act	Trapping	Opportunistic
Mammalia	Grey-headed Flying-fox	*Pteropus poliocephalus*	V,P	V		x
Reptilia	Dark-flecked Garden Sunskink	*Lampropholis delicata*	P		x	x

V – Vulnerable
M - Migratory

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_RPS45 - June 2015

Echo Ecology Pty Ltd ABN 73 162 118 710 • PO Box 4132 Crescent Head, NSW 2440 Australia • P: 0423 801 779 • E: info@echoecology.com.au • W: echoecology.com.au

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

This report was authored by

Dr Anna McConville
PhD, B.Env.Sc.

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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 4.1t) software. The identification of calls was undertaken with reference to Pennay *et al*. (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

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

3.0 RESULTS

A total of 481 call sequences were recorded, of which seven call sequences were able to be analysed (ie were not 'noise' files or bat calls of short length). Of the bat calls, one call sequence (14 %) were able to be confidently identified (those classified as either definite or probable identifications) to species level (Table 3-1). Species recorded confidently within the site include:

- *Miniopterus australis* (Little bentwing bat)

Additionally, the following bat species potentially occurred within the site, but could not be confidently identified (those calls classified as possible or as a species group):

- *Chalinolobus morio* (Chocolate wattled bat)
- *Vespadelus pumilus* (Eastern forest bat)
- *Vespadelus troughtoni* (Eastern cave 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 3-1 below summarises the results of the bat call analysis.

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

IDENTIFICATION	Anabat 3 24/05/2015	Anabat 3 25/05/2015	Anabat 3 26/05/2015	Anabat 3 27/05/2015	Anabat 3 28/05/2015	Anabat 4 24/05/2015	Anabat 4 25/05/2015	Anabat 4 26/05/2015	Anabat 4 27/05/2015	Anabat 4 28/05/2015
PROBABLE										
Miniopterus australis	-	-	-	-	-	-	-	-	1	-
SPECIES GROUPS										
Chalinolobus morio / Vespadelus pumilus / Vespadelus vulturnus / Vespadelus troughtoni	-	-	-	-	1	-	-	-	-	-
Miniopterus australis / Vespadelus pumilus	-	-	-	-	-	-	4	-	1	-
UNKNOWN										
'Noise' files	41	164	72	134	-	8	15	13	12	8
Unknown	-	-	-	-	1	-	4	1	1	-
TOTAL	**41**	**164**	**72**	**134**	**2**	**8**	**23**	**14**	**15**	**8**

4.0 SAMPLE CALLS

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

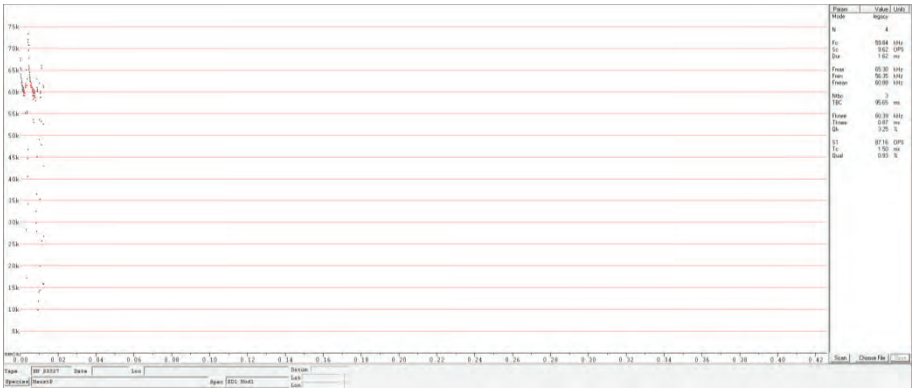

Figure 4-1: *Miniopterus australis* probable call

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Appendix 5

BioBanking Credit Report

BioBanking credit report

This report identifies the number and type of credits required at a DEVELOPMENT SITE.

Date of report: 20/11/2015 Time: 5:42:17PM Calculator version: v4.0

Development details

Proposal ID:	101/2015/2248D
Proposal name:	Medowie Town Centre
Proposal address:	Medowie Road Medowie NSW 2318
Proponent name:	Port Stephens Council
Proponent address:	116 Adelaide Street Raymond Terrace NSW 2324
Proponent phone:	0249495555
Assessor name:	Mark Aitkens
Assessor address:	PO Box 428 Hamilton NSW 2303
Assessor phone:	02 4940 4200
Assessor accreditation:	101

Improving or maintaining biodiversity

An application for a red flag determination is required for the following red flag areas

Red flag	Reason
Smooth-barked Apple - White Stringybark - Red Mahogany - Melaleuca sieberi shrubby open forest on lowlands of the lower North Coast	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	Vegetation type being > 70% cleared; or it contains an endangered ecological community;

The application for a red flag determination should address the criteria set out in the BioBanking Assessment Methodology. Please note that a biobanking statement cannot be issued unless the determination is approved.

Additional information required for approval:

- ☐ Change to percent cleared for a vegetation type/s
- ☐ Use of local benchmark
- ☐ Change negligible loss
- ☐ Expert report...
- ☐ Request for additional gain in site value
- ☐ Predicted threatened species not on site
- ☐ Change threatened species response to gain (Tg value)

Ecosystem credits summary

Plant Community type	Area (ha)	Credits required	Red flag
Smooth-barked Apple - White Stringybark - Red Mahogany - Melaleuca sieberi shrubby open forest on lowlands of the lower North Coast	0.51	33.00	No
Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	1.22	85.00	Yes
Total	1.73	118	

Credit profiles

1. Smooth-barked Apple - White Stringybark - Red Mahogany - Melaleuca sieberi shrubby open forest on lowlands of the lower North Coast, (HU832)

Number of ecosystem credits created	33
IBRA sub-region	Karuah Manning

Offset options - vegetation types	Offset options - CMA sub-regions
Smooth-barked Apple - White Stringybark - Red Mahogany - Melaleuca sieberi shrubby open forest on lowlands of the lower North Coast, (HU832) Smooth-barked Apple - Blackbutt heathy open forest of the Tomaree Peninsula, (HU862)	Karuah Manning and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion, (HU633)

Number of ecosystem credits created	85
IBRA sub-region	Karuah Manning

Offset options - vegetation types	Offset options - CMA sub-regions
Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion, (HU633) Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion, (HU591) Prickly-leaved Paperbark forest on coastal lowlands of the Central Coast and Lower North Coast, (HU930) Broad-leaved Paperbark - Swamp Mahogany - Swamp Oak - Saw Sedge swamp forest of the Central Coast and Lower North Coast, (HU931) Swamp Mahogany - Flax-leaved Paperbark swamp forest on coastal lowlands of the Central Coast, (HU932) Paperbarks - Woollybutt swamp forest on coastal lowlands of the Central Coast, (HU933) Melaleuca biconvexa - Swamp Mahogany - Cabbage Palm swamp forest of the Central Coast, (HU937) Swamp paperbark - Baumea juncea swamp shrubland on coastal lowlands of the Central Coast and Lower North Coast, (HU944) Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley, (HU945)	Karuah Manning and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Species credits summary

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Koala	Phascolarctos cinereus	1.72	45

Appendix 6

Seven Part Test of Significance

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, ecological communities or their habitats and, thus, whether a Species Impact Statement (SIS) is required. **Section 4.2** identified the following species as requiring assessment via 7-part Tests under the TSC Act.

TSC Act Listed Species	
Critically Endangered Species	
Regent Honeyeater	
Endangered Species	
Bush Stone-curlew	Swift Parrot
Vulnerable Species	
Wallum Froglet	Squirrel Glider
Little Lorikeet	Eastern Bentwing Bat
Glossy-black Cockatoo	Little Bentwing Bat
Varied Sittella	Southern Myotis
Turquoise Parrot	Eastern False Pipistrelle
Powerful Owl	East Coast Free-tailed Bat
Masked Owl	Greater Broad-nosed Bat
Scarlet Robin	Koala
Grey-headed Flying-fox	
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.

Woodland/Forest Birds

- Regent Honeyeater

The main foraging resource targeted by this species within the region is *Eucalyptus robusta* (Swamp Mahogany), which occurs within the site. This habitat is used in winter and is generally not associated with breeding activity. Potential foraging habitat totalling 1.22 ha would be removed through the development of the site, representing no more than 0.06% of similar habitat available in the region. The potential for incidence within the site is considered low due to the scant number of records of this species within the locality. Given the low potential for the species to occur, the small habitat area and the negligible adjustment in similar foraging resources occurring within the region, it is considered that the proposed rezoning and future land use is not likely to effect the life cycle of the species such that a viable local population is likely to be placed at risk of extinction.

- Swift Parrot

The main foraging resource targeted by this species within the region is *Eucalyptus robusta* (Swamp Mahogany), which occurs within the site. This habitat is used in winter and is generally not associated with breeding activity. Potential foraging habitat totalling 1.22 ha would be removed through the development of the site, representing no more than 0.06% of similar habitat available in the region. The potential for incidence within the site is considered low due to the scant number of records of this species within the

locality. Given the low potential for the species to occur, the small habitat area and the negligible adjustment in similar foraging resources occurring within the region, it is considered that the proposed rezoning and future land use is not likely to effect the life cycle of the species such that a viable local population is likely to be placed at risk of extinction.

- Bush Stone-curlew

This species would be a vagrant visitor using the site for foraging purposes and is unlikely to breed. Potential foraging habitat totalling 1.73 ha would be removed through the development of the site, representing no more than 0.06% of similar habitat available in the region. The potential for incidence within the site is considered infrequent and foraging related (i.e. no breeding opportunities). Given the low potential for breeding within the site, the incidental reliance on foraging resources, the small habitat area and the negligible adjustment in similar foraging resources occurring within the region, it is considered that the proposed rezoning and future land use is not likely to effect the life cycle of the species such that a viable local population is likely to be placed at risk of extinction.

- Little Lorikeet

This species would use the site primarily in winter and spring when Swamp Mahogany and Forest Redgum are flowering. Potential foraging habitat totalling 1.22 ha would be removed through the development of the site, representing no more than 0.06% of similar habitat available in the region. The potential for incidence within the site is considered infrequent and foraging related due to the few hollows present within the site (i.e. breeding opportunities). Given the low potential for breeding within the site, the incidental reliance on foraging resources, the small habitat area and the negligible adjustment in similar foraging resources occurring within the region, it is considered that the proposed rezoning and future land use is not likely to effect the life cycle of the species such that a viable local population is likely to be placed at risk of extinction.

- Glossy-black Cockatoo

Within the region, the main foraging resource targeted by this species is *Allocasuarina littoralis*, which occurs in very low numbers within the site. Potential foraging habitat totalling 1.22 ha would be removed through the development of the site, representing no more than 0.06% of similar habitat available in the region. The potential for incidence within the site is considered low due to the scant number of *Allocasuarina littoralis* individuals present within the site and absence of suitable nesting hollows. Given the low potential for the species to occur, the small habitat area and the negligible adjustment in similar foraging resources occurring within the region, it is considered that the proposed rezoning and future land use is not likely to effect the life cycle of the species such that a viable local population is likely to be placed at risk of extinction.

- Varied Sittella

This species would infrequently use the site for foraging purposes and is unlikely to breed due to the absence of hollow bearing trees. Potential foraging habitat totalling 1.73 ha would be removed through the development of the site, representing no more than 0.06% of similar habitat available in the region. The potential for incidence within the site is considered infrequent and foraging related due to the few hollows present within the site (i.e. breeding opportunities). Given the low potential for breeding within the site, the incidental reliance on foraging resources, the small habitat area and the negligible adjustment in similar foraging resources occurring within the region, it is considered that the proposed rezoning and future land use is not likely to effect the life cycle of the species such that a viable local population is likely to be placed at risk of extinction.

- Scarlet Robin

This species would infrequently use the site as a winter vagrant for foraging purposes and is unlikely to breed. Potential foraging habitat totalling 1.73 ha would be removed through the development of the site, representing no more than 0.06% of similar habitat available in the region. The potential for incidence within the site is considered infrequent and foraging related (i.e. no breeding opportunities). Given the low potential for breeding within the site, the incidental reliance on foraging resources, the small habitat area and the negligible adjustment in similar foraging resources occurring within the region, it is considered that the

proposed rezoning and future land use is not likely to effect the life cycle of the species such that a viable local population is likely to be placed at risk of extinction.

Forest Owls

- Powerful Owl

This species would be a vagrant visitor infrequently using the site for foraging purposes and is unlikely to breed due to the absence of suitable hollows. Potential foraging habitat totalling 1.73 ha would be removed through the development of the site, representing no more than 0.06% of similar habitat available in the region. Patch size and connectivity would not be adversely impacted by this highly mobile species. The potential for incidence within the site is considered infrequent and foraging related (i.e. no breeding opportunities). Given the low potential for breeding within the site, the incidental reliance on foraging resources, the small habitat area and the negligible adjustment in similar foraging resources occurring within the region, it is considered that the proposed rezoning and future land use is not likely to effect the life cycle of the species such that a viable local population is likely to be placed at risk of extinction.

- Masked Owl

This species would be a vagrant visitor infrequently using the site for foraging purposes and is unlikely to breed due to the absence of suitable hollows. Potential foraging habitat totalling 1.73 ha would be removed through the development of the site, representing no more than 0.06% of similar habitat available in the region. Patch size and connectivity would not be adversely impacted by this highly mobile species. The potential for incidence within the site is considered infrequent and foraging related (i.e. no breeding opportunities). Given the low potential for breeding within the site, the incidental reliance on foraging resources, the small habitat area and the negligible adjustment in similar foraging resources occurring within the region, it is considered that the proposed rezoning and future land use is not likely to effect the life cycle of the species such that a viable local population is likely to be placed at risk of extinction.

Mammals

- Squirrel Glider

The main foraging resources occurring within the site that are used by this species within the region is *Eucalyptus robusta* (Swamp Mahogany) and *Melaleuca quinquenervia* (Broad-leaved Paperbark) in winter and *Eucalyptus tereticornis* (Forest Redgum) in spring/ summer. The site contains few hollows suitable for denning (breeding). Potential foraging habitat totalling 1.73 ha would be removed through the development of the site, representing no more than 0.06% of similar habitat available in the region. It is considered that the small habitat area loss and negligible adjustment in similar foraging resources occurring within the region is not likely to effect the life cycle of the species such that a viable local population is likely to be placed at risk of extinction.

- Grey-headed Flying-fox

The main foraging resources occurring within the site that are targeted by this species within the region is *Eucalyptus robusta* (Swamp Mahogany) and *Melaleuca quinquenervia* (Broad-leaved Paperbark) in winter and *Eucalyptus tereticornis* (Forest Redgum) in spring/ summer. The site is not currently used as a camp location and as such is not an important location for breeding. Potential foraging habitat totalling 1.73 ha would be removed through the development of the site, representing no more than 0.06% of similar habitat available in the region. Despite being observed within the site it is considered that the small habitat area loss and negligible adjustment in similar foraging resources occurring within the region is not likely to effect the life cycle of the species such that a viable local population is likely to be placed at risk of extinction.

- Koala

The main foraging resources occurring within the site that are targeted by this species within the region is *Eucalyptus robusta* (Swamp Mahogany) and *Eucalyptus tereticornis* (Forest Redgum). A single individual

Koala was observed adjacent to the site and is likely to use resources found within the site. Suitable habitat contained within the site is unlikely to support more than one Koala individual assuming an average home range of approximately 2 ha for this species within the locality (Dr Rod Kavanagh pers. com.). Connectivity between areas of habitat and supplementary habitat would be retained. Foraging habitat totalling 1.73 ha would be removed through the development of the site, representing no more than 0.06% of similar habitat available in the region. Despite being species being observed it is considered that the small habitat area loss, negligible adjustment in similar foraging resources occurring within the region and retention of movement pathways is not likely to effect the life cycle of the species such that a viable local population is likely to be placed at risk of extinction.

Cave-roosting bats

- Little Bentwing Bat
- Eastern Bentwing Bat

These insectivorous bats commonly inhabit wet and dry sclerophyll forests as well as rainforests as part of their wide range of occupied habitats. Both species require caves or similar structures with specific characteristics for roosting purposes and have been known to occupy communal roosts comprising both species. Only foraging habitat exists within the site for these species (i.e. roosting, hence breeding habitat is absent). These species are highly mobile able to move across developed and undeveloped landscapes where they will freely range within a large arc of roost sites. Despite having a high potential to occur within the site for foraging purposes only, it is considered that the small habitat area loss and negligible adjustment in similar foraging resources occurring within the region is not likely to effect the life cycle of the species such that a viable local population is likely to be placed at risk of extinction.

- Southern Myotis

This species was not detected on the site during recent or previous surveys, however approximately 0.03 hectares of potential foraging habitat is likely to be impacted by future development (i.e. small dam). It is considered that the small habitat area loss and negligible adjustment in similar foraging resources occurring within the region is not likely to effect the life cycle of the species such that a viable local population is likely to be placed at risk of extinction.

Hollow-roosting Bats

- Eastern False Pipistrelle
- East Coast Free-tailed Bat
- Greater Broad-nosed Bat

These insectivorous bats commonly inhabit wet, dry and swamp sclerophyll forests as well as rainforests as part of their wide range of occupied habitats. They require tree hollows for roosting hence breeding activity. Foraging habitat exists within the site for these species with a limited availability of roosting/ breeding habitat. These species are highly mobile and able to move across developed and undeveloped landscapes where they will freely range within a large arc of roost sites. Despite having a high potential to occur within the site, it is considered that the small habitat area loss and negligible adjustment in similar foraging resources occurring within the region is not likely to effect the life cycle of the species such that a viable local population 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,

No endangered populations were considered to be of risk of extinction as a result of the proposal.

(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**

The Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion is commensurate with 'Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions' EEC listed under the TSC Act. Approximately 1.22 hectares of this community is likely to be directly impacted by future land uses.

Regional mapping identifies 1,991.73 hectares of vegetation commensurate with the Swamp Sclerophyll Forest EEC listing (NPWS 2002), much of which occurs within the conservation lands of the nearby Medowie SCA. This represents a loss of approximately 0.06%; a minor inconsequential alteration in the extant cover of this EEC. Given the minimal loss of the community and representation within nearby conservation reserves, it is considered that the proposal is not likely to have an adverse effect on the extent or 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,**

Regional mapping identifies approximately 1,991.73 hectares of vegetation commensurate with the Swamp Sclerophyll Forest EEC listing (NPWS 2002), much of which occurs within the conservation lands of the nearby Medowie SCA. No more than 0.06% of regional habitat similar to that occurring within the site would be removed as a consequence of future land uses consistent with the proposed rezoning. This represents a minor alteration in the extant cover of habitat occurring within the site. Given the minimal habitat loss representation within nearby conservation reserves, it is considered that the action proposed is not likely to cause a significant or substantial change in habitat extent within the region.

(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**

Future land uses arising from the proposed rezoning have the potential to reduce connectivity from a corridor width of approximately 200m to 101m. According to OEH (2014), this reduction in corridor width is not considered significant as there would be no crossing of corridor thresholds (i.e. maintaining a wide corridor status). On this basis it is considered that the proposed rezoning and associated future development potential is not likely to result in the fragmentation or isolation of other areas of habitat as a result of the proposed action.

(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**

The habitat present on site represents no more than 0.06% of the available habitat within the region for the species identified as requiring assessment in **Section 4.2** of this report, as listed below:

- Regent Honeyeater
- Swift Parrot
- Bush Stone-curlew
- Little Lorikeet

- Glossy-black Cockatoo
- Varied Sittella
- Scarlet Robin
- Powerful Owl
- Masked Owl
- Squirrel Glider
- Grey-headed Flying-fox
- Koala
- Eastern Bentwing Bat
- Little Bentwing Bat
- Large-eared Pied Bat
- Southern Myotis
- Eastern Freetail Bat
- Eastern False Pipistrelle
- Greater Broad-nosed Bat.

The loss of these habitat values from the site is not considered to be of importance to the long-term survival of the above listed species as the habitat is not identified or consistent with habitat important to the recovery of these species.

(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

- Regent Honeyeater

The proposal is not considered inconsistent with the objectives and actions of the Regent Honeyeater Recovery Plan 1999-2003.

- Swift Parrot

The proposal is not considered inconsistent with the objectives listed within the Swift Parrot Recovery Plan (Saunders and Tzaros 2011).

- Bush Stone-curlew

The proposal is not considered inconsistent with the objectives listed within the Bush Stone-curlew Recovery Plan (DEC 2006a).

- Little Lorikeet
- Glossy-black Cockatoo
- Varied Sittella
- Turqouise Parrot
- Scarlet Robin

No recovery or threat abatement plans have been developed for the above species at this stage.

- Powerful Owl
- Masked Owl

The proposal is not considered inconsistent with the Large Forest Owl Recovery Plan (DEC 2006b). No removal of nesting/ breeding hollows is proposed, nor is there a substantive change in patch size or connectivity.

- Squirrel Glider

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

- Grey-headed Flying-fox

Given the site is not considered to provide critical habitat for the species or provide important key winter and spring foraging habitat for the species. The proposal is not considered inconsistent with the Grey-headed Flying Fox Recovery Plan (DECCW 2009a).

- Koala

Considering the proposal is likely to result in indirect impacts upon 'Preferred Koala Habitat' within the study area, and the site is known to provide habitat for the species, the proposal is likely to be inconsistent with Objective 1 of the Koala Recovery Plan (DEC 2008) that seeks to: '*conserve Koalas in their existing habitat*'.

- Eastern Bentwing Bat
- Little Bentwing Bat
- Southern Myotis

No recovery or threat abatement plans have been developed for the Eastern Bentwing Bat, Little Bentwing Bat or Southern Myotis at this stage.

- Eastern Freetail Bat
- Eastern False Pipistrelle
- Greater Broad-nosed Bat

No recovery or threat abatement plans have been developed for any of the above listed species 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 eight KTPs that have the potential to affect the site as a consequence of the proposal, being:

- Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners *Manorina melanocephala*

The proposal will increase the extent of woodland/grassland edge habitat favourable for the Noisy Miner and is therefore likely to facilitate the increase in impact of this KTP.

- Anthropogenic climate change.

Potential changes to land use as a result of the proposal will result in the removal of vegetation as carbon sinks and an increase in human activity or changes to ground cover and is likely to increase the rate of anthropogenic climatic change, albeit by a very small amount.

- Clearing of native vegetation

Up to 1.73 hectares of native vegetation will be removed as a result of the proposal. The proposal will therefore contribute to this KTP. The loss of vegetation represents no more than 0.06% of similar habitats within the region. This loss is not considered significant in terms of this KTP.

- Infection of native plants by *Phytophthora cinnamomi*

The proposal has the potential to contribute to this KTP due to the regular occurrence of vehicles on the site during construction that could be carrying and spreading the fungus. Appropriate mitigation measures involving vehicles on-site will provide an opportunity to negate the impact of the proposal on this KTP.

- Invasion, establishment and spread of *Lantana camara*

The proposal has potential to contribute to this KTP considering the likely increase in favoured habitat along disturbed edges of the construction footprint and exposure of previously protected habitat, and the presence of this species within previously disturbed areas of the study area. The implementation of an effective weed control program would provide an opportunity to negate the impact of the proposal on this KTP.

- Invasion of native plant communities by exotic perennial grasses

The proposal has potential to contribute to this KTP considering the likely increase in favoured habitat along disturbed edges of the construction footprint and exposure of previously protected habitat, and the presence of exotic grasses within previously disturbed areas of the study area. The implementation of an effective weed control program would provide an opportunity to negate the impact of the proposal on this KTP.

- Loss of hollow-bearing trees

The proposal will require the removal of hollow-bearing trees and will therefore contribute to the impacts of this KTP. Few hollows are to be removed, with none indicative of important habitat for threatened species.

- Removal of dead wood and dead trees

Potential exists for removal of dead standing and fallen timber within the proposed development, however the nature of the large lot developments may allow for many areas that include this habitat feature to be conserved.

Appendix 7

EPBC Act Significance Assessments

Potential impacts on Matters of National Environmental Significance must be considered in accordance with *EPBC Act Policy Statement 1.1 Significant Impact Criteria.* Endangered, Vulnerable and Migratory species are assessed in accordance with significant impact criteria specific to their listing under the EPBC Act.

Endangered Species

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 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 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 an endangered species becoming established in the endangered species' habitat;
- Introduce disease that may cause the species to decline; or
- Interfere substantially with the recovery of the species.

Regent Honeyeater

Lead to a long-term decrease in the size of a population of a species

The main foraging resource targeted by this species within the region is *Eucalyptus robusta* (Swamp Mahogany), which occurs within the site. This habitat is used in winter and is generally not associated with breeding activity. Potential foraging habitat totalling 1.22 ha would be removed through the development of the site, representing no more than 0.06% of similar habitat available in the region. The potential for incidence within the site is considered low due to the scant number of records of this species within the locality. Given the low potential for the species to occur, the small habitat area and the negligible adjustment in similar foraging resources occurring within the region, it is considered that the proposed rezoning and future land use is unlikely to lead to a long-term decrease in the size of a population of this species.

Reduce the area of occupancy of a population

Given the small adjustment in potential foraging habitat (i.e. 0.06%), it is unlikely that the proposal will reduce the area of occupancy for a population of Regent Honeyeater.

Fragment an existing population into two or more populations

Given the highly mobile and wide-ranging nature of the species, it is unlikely that the proposal will fragment an existing population of Regent Honeyeater.

Adversely affect habitat critical to the survival of a species

The habitat on the site is not considered critical to the survival of the species.

Disrupt the breeding cycle of a population

The site is not included within known breeding habitat for the Regent Honeyeater, and the habitat on site is not considered important to the breeding cycle of the species.

Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The habitat on the site is not considered important for the species such that its removal or modification will lead to a decline of the species.

Result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat

The proposal is not considered likely to result in the establishment of an invasive species within potential Regent Honeyeater habitat that is harmful to the species.

Introduce disease that may cause the species to decline, or

The impacts that may occur upon the habitat within the site are unlikely to result in the introduction of disease that may cause the species to decline.

Interfere substantially with the recovery of the species

The impacts of the proposal upon sub-optimal habitat are not considered likely to substantially interfere with the recovery of the species.

Swift Parrot

Lead to a long-term decrease in the size of a population of a species

The main foraging resource targeted by this species within the region is *Eucalyptus robusta* (Swamp Mahogany), which occurs within the site. This habitat is used in winter and is generally not associated with breeding activity. Potential foraging habitat totalling 1.22 ha would be removed through the development of the site, representing no more than 0.06% of similar habitat available in the region. The potential for incidence within the site is considered low due to the scant number of records of this species within the locality. Given the low potential for the species to occur, the small habitat area and the negligible adjustment in similar foraging resources occurring within the region, it is considered that the proposed rezoning and future land use is unlikely to lead to a long-term decrease in the size of a population of this species.

Reduce the area of occupancy of a population

Given the highly mobile and wide-ranging nature of the species, it is unlikely that the proposal will reduce the area of occupancy for a population of Swift Parrot.

Fragment an existing population into two or more populations

Given the highly mobile and wide-ranging nature of the species, it is unlikely that the proposal will fragment an existing population of Swift Parrot.

Adversely affect habitat critical to the survival of a species

The habitat on the site is not considered critical to the survival of the species.

Disrupt the breeding cycle of a population

Given the Swift Parrot is only known to breed within Tasmania, the site is not considered important to the breeding cycle of the species.

Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The habitat on the site is not considered important for the species such that its removal or modification will lead to a decline of the species.

Result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat

The proposal is not considered likely to result in the establishment of an invasive species within potential Swift Parrot habitat that is harmful to the species.

Introduce disease that may cause the species to decline, or

The impacts that may occur upon the habitat within the site are unlikely to result in the introduction of disease that may cause the species to decline.

Interfere substantially with the recovery of the species

The impacts of the proposal upon sub-optimal habitat are not considered likely to substantially interfere with the recovery of the species.

Vulnerable Species

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.

Koala

Lead to a long-term decrease in the size of an important population of a species

Koala habitat mapping by both PSC (2006) and the AKF include a large area of 'Preferred Koala Habitat' within the core areas of Riparian Melaleuca Swamp Woodland within the conservation lands of the site, and opportunistic records of *Eucalyptus tereticornis* were collected in this area during the recent survey. This area totals approximately 7.1 hectares, with the remaining 60.09 hectares of forested habitat within the conservation lands considered to provide supplementary/secondary habitat for the Koala that will be conserved in perpetuity as a result of the proposal.

The 'Preferred Koala Habitat' found within the study area occurs as an outlier from other areas of similar quality habitat, with the closest areas of preferred habitat existing outside the site occurring approximately 500 metres to the east (see PSC 2006). An analysis of regional records also shows that the majority of Koala records for the region occupy a narrow band (~5 kilometres wide) running east from Tomago and Raymond Terrace to Nelson Bay and Lemon Tree Passage, incorporating conservation lands that include Tomaree National Park, Tilligerry Nature Reserve, Tilligerry SCA and Worimi National Park (NSW Wildlife Atlas data 2015). The site is considered to occupy the far northern extent of this clump of records, with the link between the site and the band of records to the south now compromised by the urban development of Medowie. Records are also scant within areas east of the site within the Medowie SCA and beyond, suggesting the habitat of the area that includes the site is only utilised intermittently by the Koala, which is supported by the low density of scats collected on the site, the majority of which were considered several seasons old. Considering the location and relatively small numbers of records for the Koala in areas on and around the site, the small area of habitat that will be indirectly impacted upon, the retention of suitable habitat within conservation lands and the wide distribution of the species in the region, it is considered unlikely that the proposed action will lead to a long-term decrease in the size of an important population of the species.

Reduce the area of occupancy of an important population

An important population is defined under the MNES Significant impact guidelines 1.1 (DEWHA 2009) as '*a population that is necessary for a species' long term survival and recovery*'. Although the proposal may result

in a reduction in the area of occupancy for the Medowie Koala population that constitutes part of the larger Port Stephens population, this population is not considered to be important for the long term survival and recovery of the species, and therefore the proposal is not considered likely to reduce the area of occupancy of an important population of Koalas.

Fragment an existing important population into two or more populations

The proposed action would not diminish access to peripheral habitat areas through the retention of a 100m wide vegetated corridor west of the site. As such, the proposed action would not fragment an existing important population into two or more populations.

Adversely affect habitat critical to the survival of a species

The guidelines define critical habitat as areas that are necessary:

- For activities such as foraging, breeding, roosting, or dispersal;
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- To maintain genetic diversity and long term evolutionary development; or
- For the reintroduction of populations or recovery of the species or ecological community.

Habitat critical to the survival of the Koala has been identified within the site, which would be removed as a consequence of the proposed action. The loss of this habitat is estimated to be no more than 0.06% of similar habitat found within the region. While affecting habitat critical to the survival of the Koala, it is considered that the loss is negligible and would be of minor consequence.

Disrupt the breeding cycle of an important population

Habitat loss within the site would reduce the availability of foraging resources for no more than one member of the Port Stephens important population. The loss represents no more than 0.06% of similar habitat within the region. This habitat loss would not disrupt the breeding cycle of an important population as a whole.

Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The proposed action would destroy 1.22 ha of preferred Koala habitat representing no more than 0.06% of similar habitat within the region. This habitat loss would not 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

Although not typically referred to as 'invasive species', the proposal is likely to increase the population of domestic animals within the site. Dogs are known to be particularly harmful to Koalas, and therefore adequate protection of the habitat retained within the site will need to be enforced to ensure they do not become established within remaining Koala habitat.

Introduce disease that may cause the species to decline, or

The impacts that may occur upon the habitat within the site are unlikely to result in the introduction of disease that may cause the species to decline.

Interfere substantially with the recovery of the species

The removal of supplementary habitat and potential indirect impacts to a small amount of primary habitat is not considered likely to substantially interfere with the recovery of the species.

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

Lead to a long-term decrease in the size of an important population of a species

The habitat on site provides foraging habitat for this species that is not considered of any importance to the long-term survival of the species and is therefore unlikely to lead to a long-term decrease in the size of an important population of this species.

Reduce the area of occupancy of an important population

The widespread distribution of the species and limited impacts relative to the regional extent of available habitat indicate that the proposal is unlikely to reduce the area of occupancy for an important population of this species.

Fragment an existing important population into two or more populations

This species has high mobility and large home range. Habitat loss within the site is unlikely to result in fragmentation of an important population of this species into two or more populations.

Adversely affect habitat critical to the survival of a species

Habitat considered critical to the survival of the Grey-headed Flying-fox has been defined within the Draft National Recovery Plan (DECCW 2009). The recovery plan provides five criteria by which potential foraging habitat can be defined as critical to the survival of the species:

- Productive during winter and spring, when food bottlenecks have been identified;
- Known to support populations of > 30 000 individuals within an area of 50 kilometres radius (the maximum foraging distance of an adult);
- Productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (September to May);
- Productive during the final stages of fruit development and ripening in commercial crops affected by Grey-headed Flying-foxes (months vary between regions); or
- Known to support a continuously occupied camp.

The potential foraging habitat in the study area does not meet these five criteria in the recovery plan for habitat critical to the survival of the Grey-headed Flying-fox. Therefore, the proposal is unlikely to adversely affect habitat critical to the Grey-headed Flying-fox.

Disrupt the breeding cycle of an important population

The nearest known permanent maternity colony of the species is approximately 30 kilometres south-west of the site at Blackbutt Reserve, Newcastle. The proposal is unlikely to 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

No known potential foraging or roosting habitat available to the species in the locality will be removed or isolated to an extent whereby the species is likely to decline.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The proposal is unlikely to result in the establishment of an invasive species that is harmful to the Grey-Headed Flying-fox or that may cause the Grey-Headed Flying-fox to decline.

Introduce disease that may cause the species to decline

The action is unlikely to introduce disease that is harmful to the Grey-Headed Flying-fox or that may cause the Grey-Headed Flying-fox to decline.

Interfere substantially with the recovery of the species

Given the large amounts of habitat conserved on site and existing within the surrounds, the impacts upon habitat within the site are not considered likely to interfere substantially with the recovery of the species.