Appendix E

Biodiversity assessment report

EPS

BIODIVERSITY ASSESSMENT REPORT
NEW ENGLAND HIGHWAY UPGRADE
BELFORD TO GOLDEN HIGHWAY

Prepared for Arup (on behalf of Roads and Maritime Services)
Prepared by Environmental Property Services

ENVIRONMENTAL PROPERTY SERVICES
Reference No. 11232
November 2016

Contact Information and Declaration		
Declaration:	Submission of the Biodiversity Assessment prepared under the *Environmental Planning and Assessment Act 1979* in respect of a proposed highway upgrade. The opinions and declarations in this Biodiversity Assessment Report are ascribed to Environmental Property Services (EPS) and are made in good faith and trust that such statements are neither false nor misleading. In preparing this Biodiversity Assessment Report, EPS has considered and relied upon information obtained from the public domain, supplemented by discussions between key EPS staff, representatives from governing agencies and independents.	
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EXECUTIVE SUMMARY

Environmental Property Services (EPS) was engaged by Arup to prepare a Biodiversity Assessment Report (BAR) for Roads and Maritime Services (Roads and Maritime). This report details the ecological assessment for the proposed upgrade of the New England Highway between Belford and the Golden Highway.

The road upgrade will improve traffic flow, travel times and safety for motorists along a busy section of the New England Highway. The project involves providing a divided road with two travel lanes in each direction between Belford and the Golden Highway and a flyover for vehicles turning right from the Golden Highway towards Maitland and Newcastle.

Desktop assessments were undertaken in the first instance, which involved database searches, and stratification of predicted vegetation and fauna habitats. Field surveys were conducted to obtain an understanding of the biodiversity occurring within the study area. Flora surveys included BioBanking surveys, vegetation mapping and condition assessment and random meander surveys (including targeted flora surveys). Fauna surveys included arboreal trapping, bird surveys, targeted Green and Golden Bell Frog surveys, herpetofauna searches, microbat surveys, nocturnal surveys, opportunistic surveys, hollow-bearing tree surveys and fauna habitat assessment. In addition to these surveys aquatic habitat assessment and culvert inspections were undertaken.

This BAR has reviewed and assessed the ecological attributes of the study area. The assessment revealed that:

- Four vegetation communities were recorded within the study area and include the following:
    - Spotted Gum – Narrow-leaved Ironbark – Red Ironbark shrub – grass open forest of the central hunter and lower hunter;
    - Swamp Oak Weeping grass grassy riparian forest of the Hunter Valley;
    - Cleared Land; and
    - Farm Dams and cleared riparian areas.

- Three threatened ecological communities were recorded in the study area:
    - Central Hunter Valley Eucalypt Forest and Woodland listed as critically endangered on the *Environment Protection and Biodiversity Act 1999* (EPBC Act);
    - Central Hunter Ironbark Spotted Gum Grey Box Forest listed as endangered on the *Threatened Species Conservation Act* 1995 (TSC Act); and
    - Swamp Oak Floodplain Forest listed as endangered on the TSC Act.

- Six species of threatened fauna listed on the TSC Act were recorded including Speckled Warbler, Grey-crowned Babbler, Grey-headed Flying Fox, Squirrel Glider, Eastern Bent-wing Bat and

Eastern Freetail-bat. The Grey-headed Flying Fox is also listed as threatened under the EPBC Act. A further 31 species of threatened fauna have a moderate or higher likelihood of occurrence but were not recorded during the surveys;

- No threatened species of flora or endangered populations listed on either the TSC Act or EPBC Act were recorded or have good quality habitat within the study area;
- One migratory species was recorded and a further three species listed on the EPBC Act have habitat within the study area; and
- A total of 40 hollow-bearing trees with 151 hollows were recorded in the study area.

The project proposes to affect a total of 27.73 ha, which includes native and non-native vegetation (16.20 ha already cleared). The proposal is anticipated to impact upon 0.83 ha of Swamp Oak Floodplain Forest (Swamp Oak Weeping grass grassy riparian forest of the hunter valley) and 10.40 ha of Central Hunter Ironbark Spotted Gum Grey Box Forest (Spotted Gum – Narrow-leaved Ironbark – Red Ironbark shrub – grass open forest of the Central Hunter and Lower Hunter). The two aforementioned communities are listed as endangered on the TSC Act.

Seven of the nine patches of the Spotted Gum – Narrow-leaved Ironbark – Red Ironbark shrub – grass open forest of the Central Hunter and Lower Hunter meets the criteria for listing as the critically endangered community of Central Hunter Valley Eucalypt Forest and Woodland listed under the EPBC Act. The proposal is anticipated to impact upon 8.20 ha of this critically endangered community.

Non-native vegetation includes 0.3 ha of cleared riparian areas and 16.20 ha of cleared land is likely to be impacted.

The project is likely to result in the removal of 18 hollow-bearing trees and retain 22 hollow-bearing trees within the study area.

Impact assessment under the EPBC Act conducted for the critically endangered community Central Hunter Valley Eucalypt Forest and Woodland determined that the project is likely to result in a significant impact upon this community. Assessment under the Strategic Assessment pathway is therefore required.

The project is unlikely to have a significant impact on the remaining recorded or predicted threatened, flora, fauna, migratory species, endangered populations or ecological communities, providing the mitigations measures outlined in this report are implemented.

Key mitigation measures to minimise the impact to biodiversity include the following:

- Construction Management Plan is prepared (CEMP);
- Pre-clearing surveys;
- Minimisation of the removal of vegetation;
- Vegetation clearing procedures;

- Retention of hollow-bearing trees and installation of nest boxes;
- Aquatic habitat protection;
- Improvement to wildlife connectivity to assist movement of arboreal mammals (particularly Squirrel Glider) through the installation of canopy bridge/s; and
- A Biodiversity Offset Strategy will be developed to compensate for impacts from the project.

As outlined in the credit report, a preliminary credit requirement of 520 credits of Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter, (HU815) is required to be retired to offset the impacts of the project. The strategic assessment recommends that biodiversity offsets can be calculated using the FBA methodology. The preliminary biodiversity offsets have been calculated using the FBA methodology. The project will impact upon 8.2 ha of the federally listed community and proportionally this means 410 credits of the total 520 credits have been calculated to be required to offset this community. As outlined above the Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter, (HU815) is the like for like community that is required to offset residual impacts from the project.

The future Biodiversity Offset Strategy will outline the methodology for finalising a biodiversity offset for the project, including refining credit requirements if project design is further refined leading to alteration of project impacts. Such offsets will provide suitable compensation for the biodiversity impacts of the project.

ABBREVIATIONS AND ACRONYMS

Abbreviation	Description
API	Aerial Photographic Interpretation
BAR	Biodiversity Assessment Report
Biodiversity	Biodiversity is the genetic diversity, species diversity and ecosystem diversity. Biodiversity includes plants, animals, micro-organisms.
Bioregion	Division of Australia into bioregions based on dominant landscape attributes as defined by Thackway and Cresswell (1995)
Critical Habitat	Critical Habitat is an area containing threatened ecological communities, populations, species that is listed on the TSC Act and/or the EPBC Act
CMA	Catchment Management Authority
Construction Footprint	The direct impact area as a result of the project
DPI	Department of Primary Industries
DoEE	Federal Department of the Environment and Energy
DPE	NSW Department of Planning and Environment
Ecological Community	A set of species occupying a specific area
EEC	Endangered Ecological Community
EPS	Environmental Property Services
EIS	Environmental Impact Statement
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EP&A Act	*Environmental Planning and Assessment Act 1979*
FBA	Framework for Biodiversity Assessment
FM Act	*Fisheries Management Act 1994*
GDE	Groundwater Dependent Ecosystems
IBRA	Interim Biogeographic Regionalisation of Australia
KTP	Key Threating Process as listed under the TSC Act and/or the EPBC Act
LGA	Local Government Area
Likely	A chance of possibility of occurring within the study area (OEH, 2004)
Locality	The area within 10km of the study area
Local Population	Population of plants or animals within the study area, or within continuous habitat or enables exchange of genes
Migratory Species	Listed migratory species under the EPBC Act
MNES	Matters of National Environmental Significance as listed under the EPBC Act

Abbreviation	Description
Noxious Weed	Plant species listed on the *Noxious Weed Act 1993* for the study areas control area
NPW Act	*National Parks and Wildlife Act 1974*
NW Act	*Noxious Weed Act 1993*
OEH	Office of Environment and Heritage
PCT	Plant Community Type
PEI	Preliminary Environmental Assessment
Project	The Duplication of the New England Highway Belford to Golden Highway
RAMSAR Wetland	Internationally Important Wetlands
REF	Review of Environmental Factors
Roads and Maritime	Roads and Maritime Services
Significant	Important as defined by the Threatened Species Assessment Guidelines (DEC, 2007)
SSI	State Significant Infrastructure
Study Area	Incudes the construction footprint and surrounding agreed area in which the field surveys were to be conducted (generally 50 m from Construction Footprint and 5 m from construction compounds).
SEPP14	State Environmental Planning Policy - Wetland
Threatened Biodiversity	Species, populations, communities that are listed under the TSC Act and/or the EPBC Act
TSC Act	*Threatened Species Conservation Act 1995*
Weed	Plant species that is not native to Australia and/or is a native species that is growing outside of its normal geographic range

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1 INTRODUCTION

Environmental Property Services (EPS) was engaged by Arup on behalf of Roads and Maritime Services (Roads and Maritime) to prepare a Biodiversity Assessment Report (BAR) for the upgrade of the New England Highway from Belford to the Golden Highway (known as the project). This BAR provides a detailed assessment of the biodiversity issues for the project.

A Preliminary Environmental Investigation (PEI) was prepared for the project (Hills Environmental, 2014) to determine the general environment constraints and issues for the project. This BAR is to further assess in detail the biodiversity issues identified within the PEI and also consider other potential biodiversity impacts as a result of the project.

1.1 Background

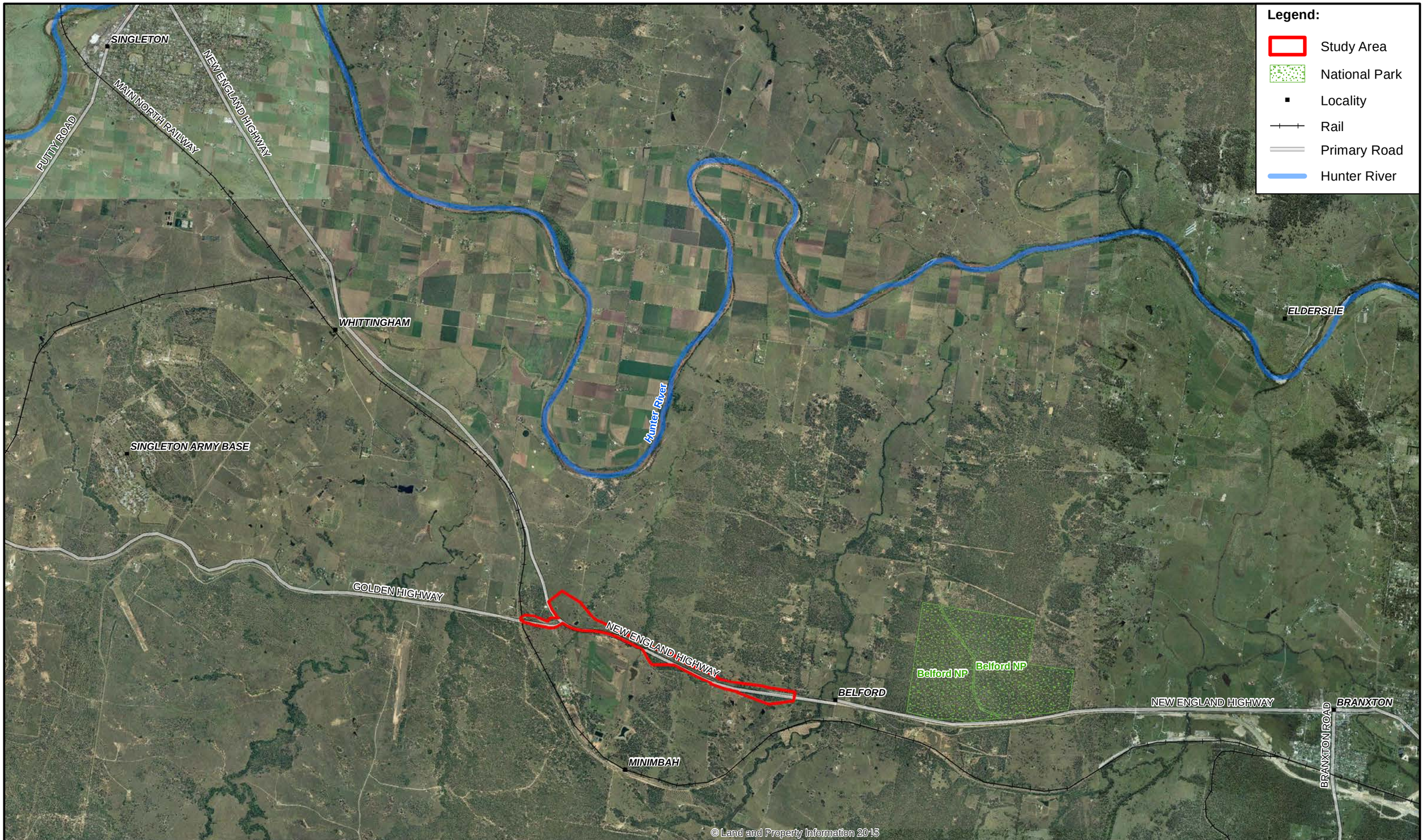
Roads and Maritime Services (Roads and Maritime) has undertaken further planning and design for the proposed upgrade of the New England Highway between Belford and the Golden Highway (Figure 1.1). The road upgrade will improve traffic flow, travel times and safety for motorists along a busy section of the New England Highway. The project involves providing a divided road with two travel lanes in each direction between Belford and the Golden Highway and a flyover for vehicles turning right from the Golden Highway towards Maitland and Newcastle.

Potential impacts on Endangered Ecological Communities (EECs) listed under the TSC Act and EPBC Act were identified in the PEI as one of the main environmental constraints in the study area.

1.2 Project Description

Key features of the project include:

- Widening the New England Highway to provide a divided road with two travel lanes in each direction between Belford and the Golden Highway. This is the last section of the route between Newcastle and the Golden Highway intersection to be upgraded to a four-lane divided road;
- Replacing the existing right turn movement from the Golden Highway to the New England Highway with a right turn flyover; and
- Establishing a road corridor for future development of the New England Highway towards Singleton.



Author:	K. Lee
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A3 Scale:	1:50,000
Job Ref:	11232

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0 625 1,250 2,500 Metres

Map Projection: GDA 1994 MGA Zone 56

Figure 1-1

LOCATION MAP

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Major benefits of the project include:

- Increase capacity and connectivity of the New England Highway and Golden Highway for the efficient and reliable movement of freight;
- Improve safety at the New England Highway and Golden Highway intersection by reducing the risk of crashes, particularly for motorists turning right from the Golden Highway; and
- Increase capacity at the New England Highway and Golden Highway intersection to cater for the predicted increase in traffic movements due to future growth in the Hunter.

A Review of Environmental Factors (REF) is being prepared by Roads and Maritime for the proposed upgrade.

1.3 Purpose of the Biodiversity Assessment

The purpose of this BAR is to describe the existing environment and the extent of the impact of the project on biodiversity within the study area. This BAR assesses the impact of the project under the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The aims of this report are as follows:

- Describe the existing biodiversity and existing environment;
- Identify and assess threatened biodiversity under TSC Act, FM Act and/or EPBC Act;
- Identify ecological constraints within the study area;
- Provide mitigation measures to reduce the impacts from the project upon biodiversity wherever possible; and
- Where impacts are unavoidable consider compensatory measures that might be appropriate for the project.

1.4 Definitions

The study area encompasses the section of the New England Highway from Bell Road, Belford to New Freugh Lane, Whittingham. Figure 1-2 shows the extent of the study area. The proposed alignment, overpass and construction compound impact area is referred to as the construction footprint.

The following definitions are referred to within this BAR and shown in Figure 1-2:

- The construction footprint – includes the direct impact area as a result of the project; including the proposed road upgrade, overpass and associated construction compound footprint; and
- The study area – includes the construction footprint and generally a 50m buffer around the construction footprint (five metres around construction compounds and variable in other areas due to evolution of the project design).

The locality refers to a 10km radius around the study area.

1.5 Personnel and Licensing

The field surveys and reporting completed for this BAR was conducted by a qualified biodiversity team. The personnel and their qualifications and role are as follows:

- Toby Lambert (Principal Ecologist), Project Manager, Technical Review, BEnvSc;
- Debbie Landenberger (Senior Ecologist), Reporting, BSc (Hons);
- Dr David Tierney (Senior Ecologist), Botanical technical input, PhD;
- Nicholas Everitt (Ecologist), Field surveys, reporting, BEnvSc;
- Alina Tipper (Environmental Consultant / Ecologist), field survey assistance, BSc&Mgmt, MEnvMgmt&Sust (current); and
- Amanda Lo Cascio (Ecologist), Bat Call Analysis, BSc, MEnv.

All personnel are licensed to conducted field surveys in accordance with a *National Parks and Wildlife Act 1974* (NP&W Act) Section 132 (c) Scientific Licence (SL100772) and the Department of Industries Animal Research Authority.

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Map Projection: GDA 1994 MGA Zone 56

Figure 1-2

AERIAL PHOTO & PROPOSED CONSTRUCTION FOOTPRINT

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2 LEGISLATIVE CONTEXT

2.1 Commonwealth

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The primary objective of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is to 'provide for the protection of the environment, especially those aspects of the environment that are Matters of National Environmental Significance' (MNES). Environmental approvals under the EPBC Act may be required for an 'action' that is likely to have a significant impact on Matters of NES being:

- World Heritage Areas;
- National Heritage Places;
- Ramsar wetlands of international importance;
- Nationally listed threatened species and ecological communities;
- Listed migratory species;
- Commonwealth marine areas;
- Nuclear actions;
- Great Barrier Reef Marine Park; and
- A water resource in relation to coal seam gas development and large coal mining development.

Of potential relevance to the study area are nationally listed threatened species, ecological communities and listed migratory species. The MNES are assessed using the Department of Environment and Energy (DoEE) Matters of National Environmental Significance Significant impact guidelines 1.1 (Department of the Environment 2013) and the Environmental Impact Assessment Practice Note *Environment Protection and Biodiversity Conservation Act 1999* – Strategic Assessment (Roads and Maritime Services 2015).

2.2 State

2.2.1 Environmental Planning and Assessment Act 1979

Under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), public authorities are the determining body and ensure that all environmental issues are considered to the fullest extent before undertaking any construction works, (e.g. roads, rail and energy). Under the EP&A Act an assessment is required to determine if a significant impact may occur on threatened species, population or communities listed on the TSC Act. A seven-part test is undertaken to determine if a significant impact is likely to occur.

2.2.2 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) aims to protect and encourage the recovery of threatened species, populations and communities listed under the Act. The TSC Act is integrated with the EP&A Act and requires consideration of whether a development (Part 4 of the EP&A Act) or an activity (Part 5 of the EP&A Act) is likely to significantly affect threatened species, populations and ecological communities or their habitat.

The potential impact of the proposed works on any threatened species, populations or communities is assessed using Assessments of Significance under Section 5A of the EP&A Act (also known as a seven-part test). If the impacts are found to be 'significant', a Species Impact Statement (SIS) and concurrence from the Secretary of the Office of Environment and Heritage (OEH) is required.

2.2.3 Noxious Weed Act 1993

The *Noxious Weed Act 1993* (NW Act) declares weeds that are invasive and difficult to control. These weeds reduce diversity of native plant and animal species. The NW Act is implemented and enforced by the Local Control Area for the Local Government Area (LGA).

A weed control order was issued in 2014 to provide details of declared noxious weeds within NSW. The declared noxious weeds are classified into control classes and control requirements for each species within an LGA.

2.2.4 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) aims to conserve, develop and share the fisheries resources for the benefit of the state. These include conserving of key fish habitats, threatened aquatic species, populations and communities listed on the FM Act including Marine vegetation. The aims also include to promote ecologically sustainable development, viable commercial and recreational fishing, share fish resources and provide social and economic benefits for the wider community.

If a project is likely to harm or damage threatened species, populations or ecological communities and its habitat or damage critical habitat a licence is required under Section 220ZW of the FM Act.

2.2.5 SEPP 44 – Koala Habitat Protection

SEPP 44 applies to each LGA listed in Schedule 1 of the SEPP. Part 2 of SEPP 44 outlines development control of koala habitats only applies to the following land:

> *(a) that is land to which this Policy applies, and*
> *(b) that is land in relation to which a development application has been made, and*
> *(c) that:*
> > *(i) has an area of more than 1 hectare, or*
> > *(ii) has, together with any adjoining land in the same ownership, an area of more than 1 hectare, whether or not the development application applies to the whole, or only part, of the land.*

The suite of Koala feed trees available is the most important factor influencing Koala habitat and occurrence (NSW National Parks and Wildlife Service 2002a). Primary feed trees are those tree species that exhibit a level of use that is higher than that of other *Eucalyptus* species, independent of tree density, and make up the bulk of a Koala's diet (NSW National Parks and Wildlife Service 2002a). Secondary or supplementary feed trees are species that provide a seasonal or supplementary dietary resource (NSW National Parks and Wildlife Service 2002a). Schedule 2 of the SEPP lists the primary and secondary feed trees that apply to the SEPP.

If the SEPP applies to the land, then an assessment of the type of Koala habitat within the site should be undertaken to determine the impact upon the Koala. The definitions of types of habitat are outlined below:

- **Core Koala Habitat** – areas of land with a resident population of Koalas, which includes evidence of breeding females and/or recent sighting of koalas; and
- **Potential Koala Habitat** – areas of native vegetation where feed trees listed in Schedule 2 constitute at least 15% of the total number of trees in the canopy in the upper or lower strata of the tree component.

3 METHODOLOGY

3.1 Overview

The methods undertaken to complete the assessment were generally in accordance with the following:

- Office of Environment and Heritage "*Field survey methods*" www.threatenedspecies.environment.nsw.gov.au;
- Draft "*Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft,* (Department of Environment and Conservation (NSW) 2004);
- Threatened species survey and assessment guidelines: field survey methods for fauna, Amphibians (Office of Environment and Heritage 2009);
- BioBanking / FBA Plots were conducted in accordance with guidelines in the BioBanking Assessment Methodology (Office of Environment and Heritage 2014); and
- Survey Guidelines for Nationally Threatened Species by the Commonwealth Department of the Environment, as relevant to the site.

The field survey was primarily conducted over the periods as follows:

- 4 January to 13 January 2016 (mainly vegetation and flora);
- 25 January to 27 January 2016 (mainly fauna);
- 2 February to 12 February 2016 (mainly fauna trapping); and
- June – August (weekly winter bird surveys).

Survey effort is outlined in the following sections.

3.2 Database Review

A list of threatened species, populations and ecological communities that had been previously reported or modelled to occur within a defined radius of the study area was obtained by undertaking a search of the following online and publicly accessible databases. Preliminary database searches were undertaken on 12 and 19 October 2015, with updated searches undertaken on 11 April 2016.

3.2.1 Commonwealth

The investigation area or defined radius in which the federal search was undertaken included a 20km radius of the study area. The raw data is provided in Appendix 1.

- Commonwealth Department of the Environment Protected Matters search tool http://www.environment.gov.au/epbc/pmst/index.html; and
- Review of Weeds of National Significance (WONS) http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html.

3.2.2 State

The investigation area, or defined radius in which the state search was undertaken included an entire search of all 'known', 'predicted' and 'recorded' species surrounding the study area. As a result, the 'recorded' species information includes sightings/records from this entire search area. The searches included threatened communities, Key Threating Processes (KTPs) and critical habitat. The raw data is provided in Appendix 1. The following database searches were conducted for the Project:

- NSW BioNet, 20km search - http://www.bionet.nsw.gov.au/;
- PlantNet 25 km buffer around Branxton - http://plantnet.rbgsyd.nsw.gov.au/search/spatial.htm;
- OEH Critical habitat register http://www.environment.nsw.gov.au/criticalhabitat/criticalhabitatprotectionbydoctype.htm; and
- Department of Primary Industries aquatic records viewer for Singleton LGA - http://www.dpi.nsw.gov.au/fisheries/species-protection/records/viewer.

Figures 3-1 and 3-2 show the closest records (within 10km) for information purposes.

3.3 Literature Review

The following literature and reports were reviewed to inform this BAR:

- Review of the Department of Primary Industries Noxious weed for Upper Hunter Control (2016b) Area http://weeds.dpi.nsw.gov.au/WeedDeclarations?RegionId=153;
- Threatened Species, Populations, and Ecological Communities of NSW - http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/index.aspx;
- SIX Spatial Information Exchange - http://maps.six.nsw.gov.au/apps/channels_3.5/?config=vegetation;
- The Vegetation of the Central Hunter Valley (Peake 2006);
- The Greater Hunter Native Vegetation Mapping Guide (Version 4) (Sivertsen, et al. 2011);
- OEH Vegetation Information System: Classification database (2012);

- New England Highway upgrade Belford to Golden Highway – Preliminary Environmental Investigation (Roads and Maritime Services 2014); and
- New England Highway Upgrade - Belford to Golden Highway, Flora and Fauna Impact Assessment (Advitech 2013).

The main important biodiversity considerations that these documents identified were the potential presence of the following threatened species and communities:

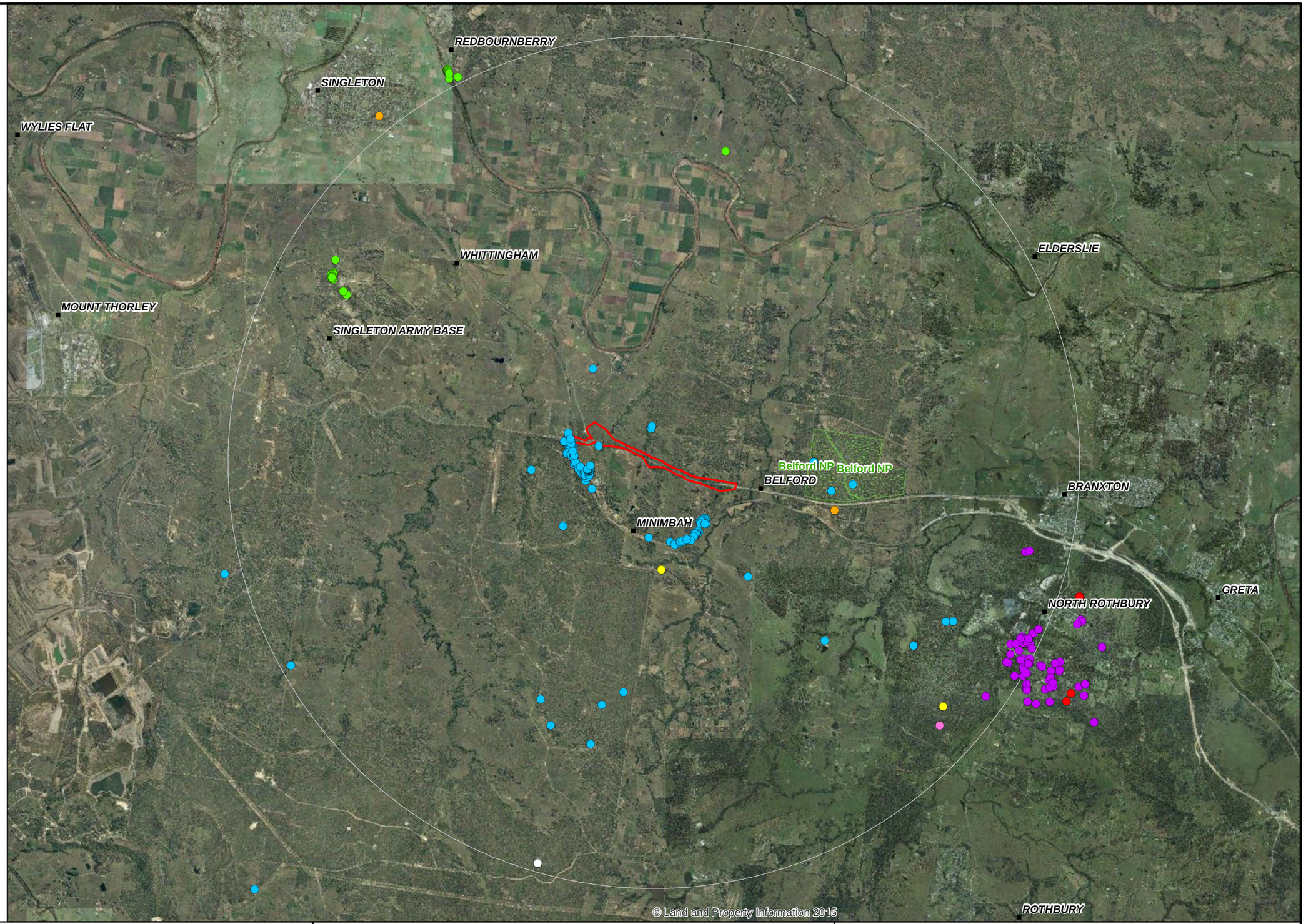
- *Eucalyptus glaucina* (Slaty Red Gum), which has been previously recorded next to the intersection of the New England Highway and Golden Highway in numerous locations;
- Potential occurrence of Central Hunter Ironbark - Spotted Gum - Grey Box Forest / Central Hunter Valley eucalypt forest and woodland;
- Potential for impacts to threatened fauna species, particularly:
    - Woodland birds, including Brown Treecreeper, Speckled Warbler, Painted Honeyeater, Black-chinned Honeyeater, Grey-crowned Babbler, Varied Sittella, Hooded Robin, Scarlet Robin and Diamond Firetail;
    - Threatened migratory birds including Regent Honeyeater and Swift Parrot;
    - Mammals including Spotted-tailed Quoll, Brush-tailed Phascogale, Koala, Squirrel Glider and Grey-headed Flying Fox and numerous microchiropteran bats; and
    - Green and Golden Bell Frog.

- Potential habitat for other threatened flora, including *Cynanchum elegans, Acacia bynoeana, Acacia pendula, Cymbidium canaliculatum, Cryptostylis hunteriana, Grevillea parviflora, Pterostylis gibbosa* and *Thesium australe*.

These species and communities were considered as part of the detailed studies undertaken for this BAR.

Legend:

- Study Area
- National Parks Reserve
- Locality
- 10km Radius
- *Acacia bynoeana*
- *Acacia pendula*
- *Cymbidium canaliculatum*
- *Eucalyptus camaldulensis*
- *Eucalyptus glaucina*
- *Eucalyptus parramattensis subsp. decadens*
- *Persoonia pauciflora*
- *Prostanthera cineolifera*



Author:	K. Lee
Reviewer:	T. Lambert
A3 Scale:	1:90,000
Job Ref:	11232

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Map Projection: GDA 1994 MGA Zone 56

Figure 3-1

LOCAL THREATENED FLORA RECORDS

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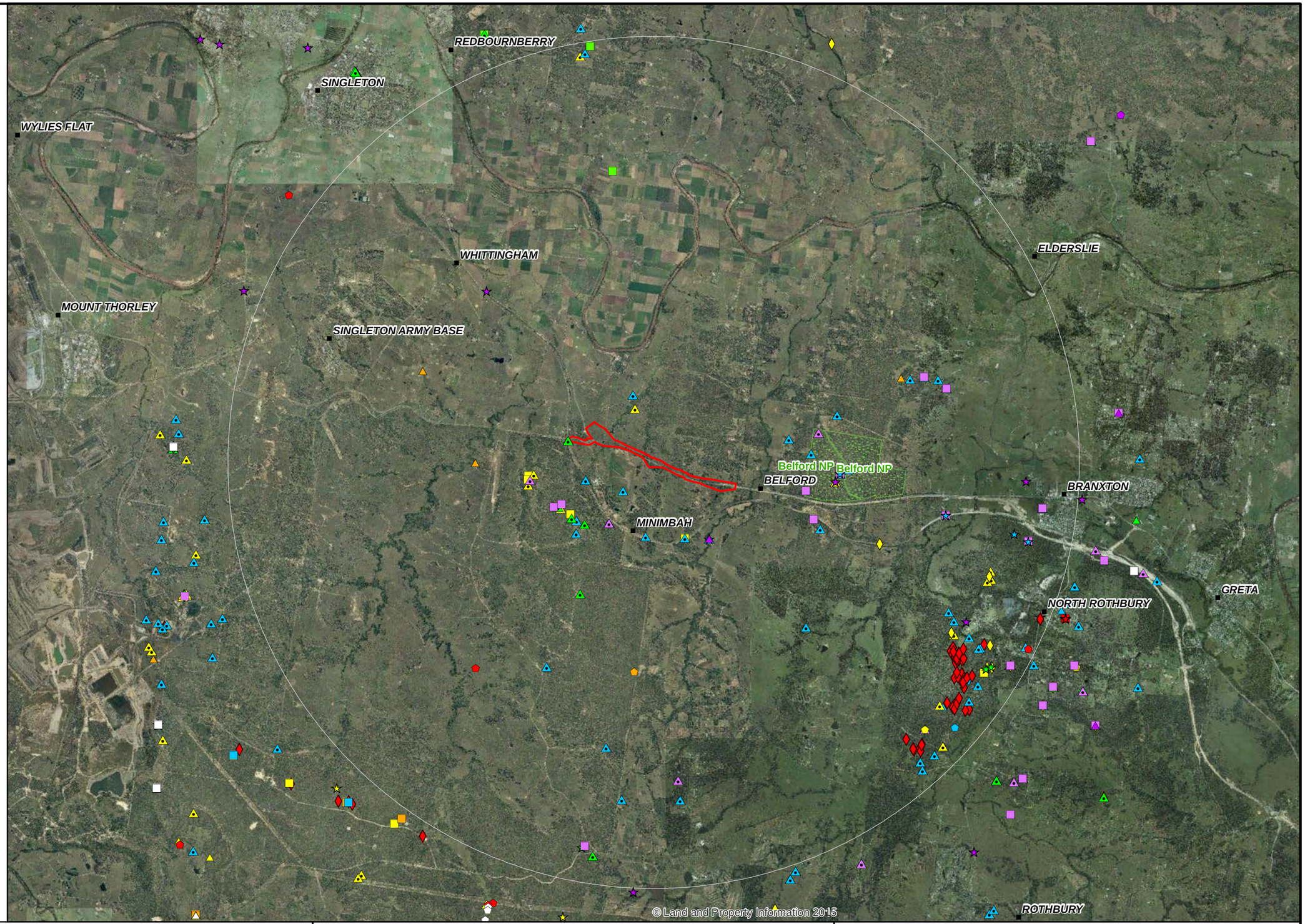
Legend:

- Study Area
- National Parks Reserve
- 10km Radius
- Locality
- Barking Owl
- Black-chinned Honeyeater (eastern subspecies)
- Brown Treecreeper (eastern subspecies)
- Brush-tailed Phascogale
- Diamond Firetail
- Eastern Bentwing-bat
- Eastern Cave Bat
- Eastern False Pipistrelle
- Eastern Freetail-bat
- Gang-gang Cockatoo
- Giant Burrowing Frog
- Glossy Black-Cockatoo
- Greater Broad-nosed Bat
- Grey-crowned Babbler (eastern subspecies)
- Grey-headed Flying-fox
- Hooded Robin (south-eastern form)
- Koala
- Large-eared Pied Bat
- Little Bentwing-bat
- Little Eagle
- Little Lorikeet
- Masked Owl
- New Holland Mouse
- Painted Honeyeater
- Powerful Owl
- Regent Honeyeater
- Scarlet Robin
- Southern Myotis
- Speckled Warbler
- Spotted-tailed Quoll
- Square-tailed Kite
- Squirrel Glider
- Swift Parrot
- Turquoise Parrot
- Varied Sittella
- Yellow-bellied Sheathtail-bat



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Job Ref:	11232

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Map Projection: GDA 1994 MGA Zone 56

Figure 3-2

LOCAL THREATENED FAUNA RECORDS

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3.4 Flora

The flora surveys were conducted using a number of methodologies as outlined below:

- Random Meander surveys were conducted in accordance with Cropper (1993). These surveys consisted of walking in a random manner recording all plant species observed across the study area;
- Review of the broad scale mapping project of Vegetation of the Central Hunter Valley (Peake 2006). This review assisted in stratifying the study area into preliminary vegetation types to inform the field survey;
- Review of the Greater Hunter Native Vegetation Mapping;
- Review of aerial photographs to assist in stratifying the study area into vegetation types;
- BioBanking plots in accordance with the BioBanking Assessment methodology (Office of Environment and Heritage 2014);
- Assigning vegetation communities into Plant Community Types (PCTs) in accordance with the Office of Environment and Heritage VIS classification database version 2.1; and
- Threatened flora species field surveys.

3.4.1 Vegetation Zone Delineation and BioBanking Plots

The entire study area was initially inspected during one day via vehicle to provide a preliminary assessment of the vegetation and the potential number of vegetation zones and their condition in accordance with the BioBanking Assessment Methodology (Office of Environment and Heritage 2014). After an extensive site walk over, the vegetation was mapped with each community assigned to PCTs in accordance with VIS Classification database (2015). The condition of the vegetation within the study area was assigned in accordance with the BioBanking Assessment Methodology (Office of Environment and Heritage 2014). Table 3-1 outlines the vegetation zones for each PCT and number of BioBanking plots completed.

Table 3-1: PCTs, Zones and number of BioBanking Plots Completed

PCT Type	Vegetation Zone (ha)	No of BioBanking plots required by BBAM	BioBanking Plots Completed
Spotted Gum – Narrow-leaved Ironbark – Red Ironbark shrub – grass open forest of the central hunter and lower hunter (1601)	Zone 1 – moderate to good 17.4 ha	3	6
Spotted Gum – Narrow-leaved Ironbark – Red Ironbark shrub – grass open forest of the central hunter and lower hunter (1601)	Zone 2 – moderate to good (poor) 4.8 ha	2	2
Swamp Oak Weeping Grass Grassy Riparian Forest of the Hunter Valley (1731)	Zone 3 – moderate to good 1.9 ha	2	2

The locations of the BioBanking plots are shown in Figure 3-3 and Table 3-2 below, summarises the BioBanking, random meanders and opportunistic survey effort.

Table 3-2: BioBanking and random meander survey effort

Date	Flora survey Type	Approximate person hours	Orientation of plot (degrees)	Eastings GDA56	Northings GDA56
Entire Survey Period	Random meanders and vegetation mapping	65	Entire study area	-	-
4/01/2016	initial site assessment	4	Entire Study area	-	-
08/01/2016	BioBanking Plot 1	3	148 °	334497	6387124
11/01/2016	BioBanking Plot 2	3	27 °	335555	6386583
11/01/2016	BioBanking Plot 3	3	294 °	337608	6385949
12/01/2016	BioBanking Plot 4.	3	116 °	336867	6386046
12/01/2016	BioBanking Plot 5.	3	300 °	336422	6386205
13/01/2016	BioBanking Plot 6	3	255 °	337399	6385840
03/02/2016	BioBanking Plot 7	3	79 °	335742	6385842
10/02/2016	BioBanking Plot 9	3	263 °	334205	6386983
11/02/2016	BioBanking Plot 10	3	332 °	334700	6386974
11/02/2016	BioBanking Plot 11	3	170 °	335582	6386492

3.4.2 Threatened flora survey effort

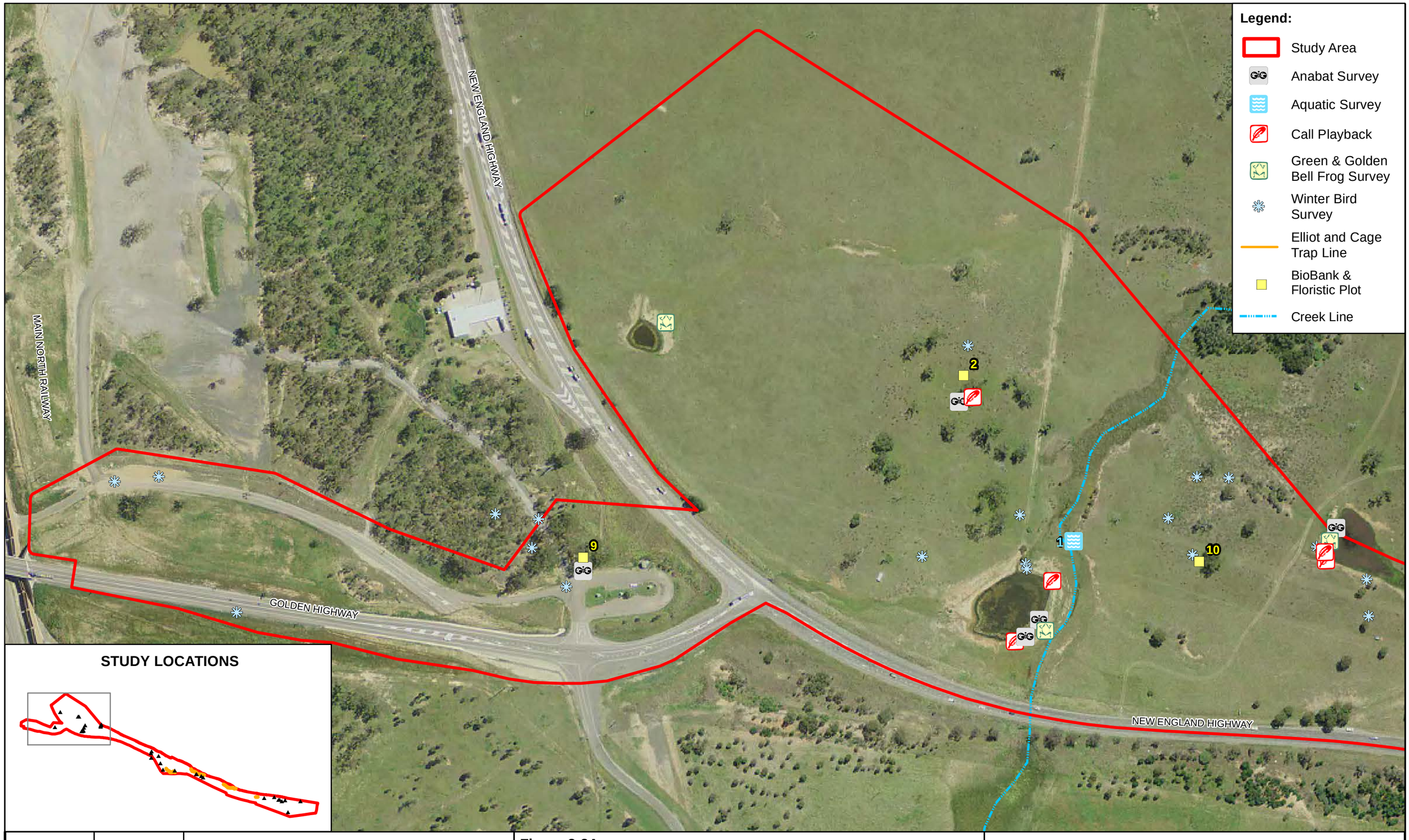
A number of threatened flora species listed on the TSC Act and/or the EPBC Act have habitat within the study area.

Threatened flora species were searched for during the random meander surveys covering the entire study area. Three endangered flora populations also have habitat within the study area. Threatened flora species surveys were conducted on 12 January, 3 February, 10 February and 11 February 2016. Table 3.3 below outlines the flora species targeted, flowering period and survey effort.

Opportunistic surveys were also conducted during all other survey periods throughout the study area.

Table 3-3 Targeted threatened flora species and endangered populations survey effort

Flora Species	Common Name	TSC Act Status	EPBC Act Status	Flowering Period	Surveyed during flowering period	Survey Effort
Acacia pendula	Weeping Myall	Endangered Population	-		No, easily detected outside of the flowering period	30 hours
Cymbidium canaliculatum	Tiger Orchid	Endangered Population	-	September to November	No, easily detected outside of the flowering period	30 hours
Eucalyptus camaldulensis	River Red Gum	Endangered Population	-	Spring to Summer	Yes	16 hours
Eucalyptus glaucina	Slaty Red Gum	Vulnerable	Vulnerable	August to December	No, easily detected outside of the flowering period	30 hours
Grevillea parviflora subsp. parviflora	Small Flowered Grevillea	Vulnerable	Vulnerable	July to December and April to May	No, however no Grevillea sp were identified within the study area.	30 hours
Rutidosis heterogama	Heath Wrinklewort	Vulnerable	Vulnerable	Autumn	Yes	30 hours
Thesium australe	Austral Toadflax	Vulnerable	Vulnerable	Spring to summer	Yes	30 hours



Author:	K. Lee
Reviewer:	T. Lambert
A3 Scale:	1:2,800
Job Ref:	11232

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Map Projection: GDA 1994 MGA Zone 56

Figure 3-3A

ECOLOGICAL SURVEY LOCATIONS

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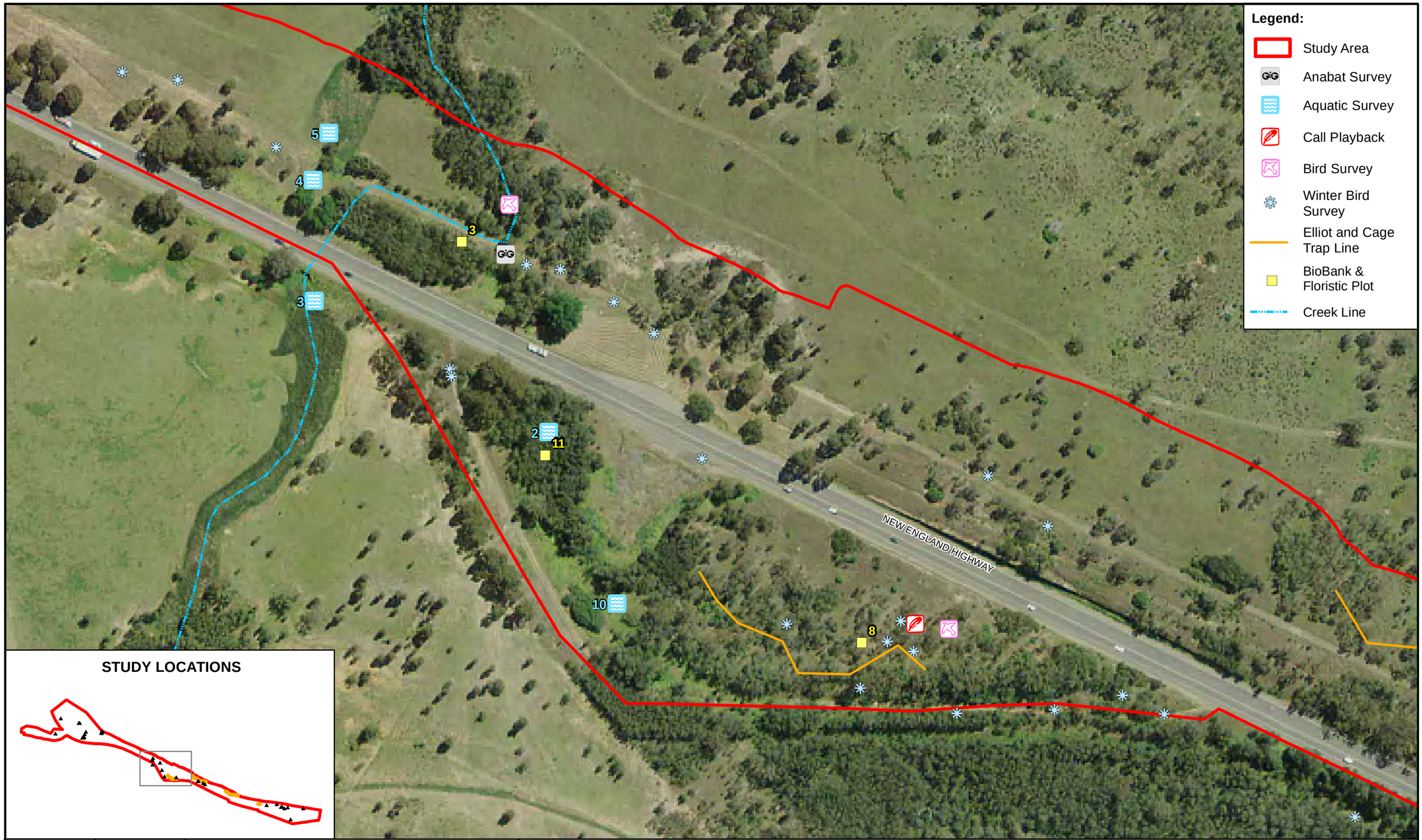

Author:	K. Lee
Reviewer:	T. Lambert
A3 Scale:	1:1,800
Job Ref:	11232

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Map Projection: GDA 1994 MGA Zone 56

Figure 3-3B

ECOLOGICAL SURVEY LOCATIONS

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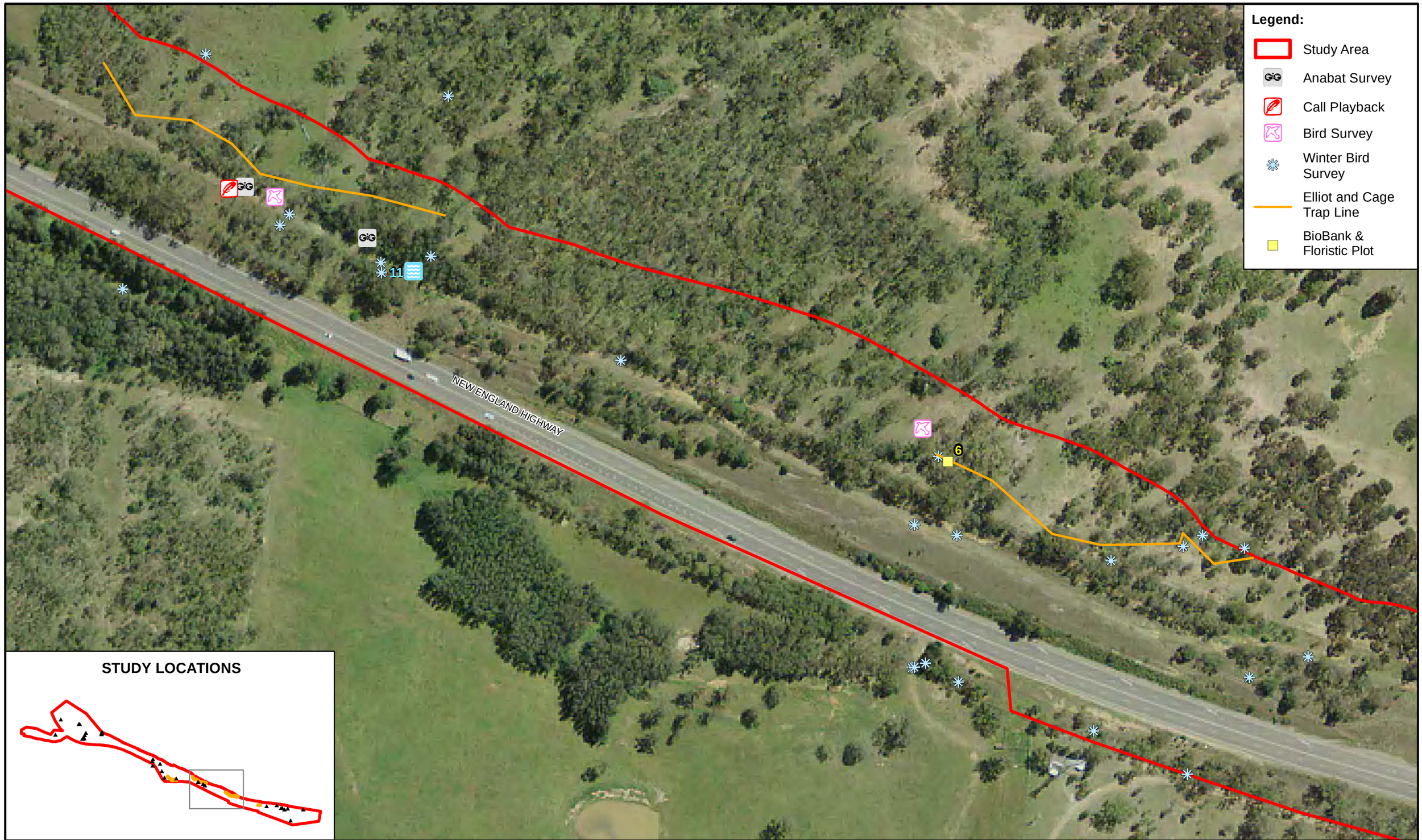

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Job Ref:	11232

Figure 3-3C

ECOLOGICAL SURVEY LOACTIONS

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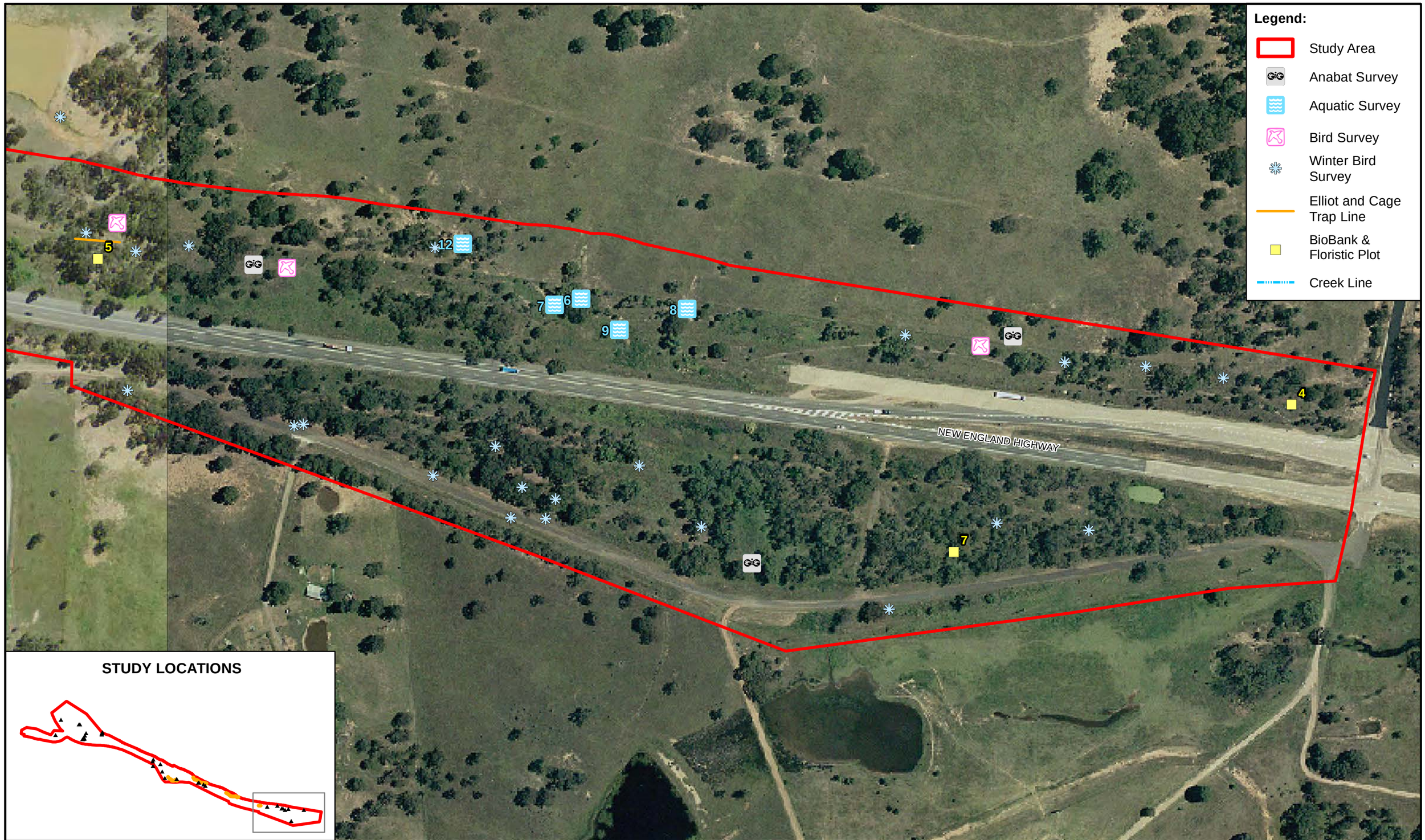

Author:	K. Lee
Reviewer:	T. Lambert
A3 Scale:	1:2,200
Job Ref:	11232

Figure 3-3D

ECOLOGICAL SURVEY LOCATIONS

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3.5 Fauna

3.5.1 Guidelines

The terrestrial fauna field surveys consisted of a combination of habitat assessment and targeted field surveys to identify the fauna habitat and/or recorded species within the study area. Fauna surveys included fauna habitat assessment, trapping, bird census, spotlighting, Anabat surveys, call playback, targeted Green and Golden Bell Frog surveys, herpetofauna surveys and opportunistic surveys. These surveys were generally conducted in accordance with the following guidelines:

1. NSW Threatened Biodiversity Survey and Assessment Guidelines – Working Draft (Department of Environment and Conservation 2004);
2. Survey Guidelines for Australia's Threatened Birds (Department of Environment Water, Heritage and the Arts 2010a);
3. Threatened species survey and assessment guidelines: field survey and methods for fauna - amphibians (NSW Department of Environment and Climate Change 2009);
4. Survey guidelines for Australia's threatened frogs - guidelines for detecting frogs listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999* (Department of the Environment Water, Heritage and the Arts 2010b)
5. Survey guidelines for Australia's threatened mammals (Department of Sustainablility, Environment, Water, Populations and Communities, 2011); and
6. Significant impact assessment guidelines for the vulnerable Green and Golden Bell Frog (*Litoria aurea*) (Department of the Environment, Water, Heritage and the Arts 2009).

3.5.2 Fauna Survey Effort Summary

Fauna survey locations are provided in Figure 3-3. A summary of the fauna survey effort is provided in Table 3-4.

Table 3-4: Fauna Survey Effort

Dates	Survey Type	Survey effort
04, 08, 11-13 January 2016 26 – 27 January 2016 02, 08-12 February 2016	Opportunistic surveys throughout study area	12 days
27 January 2016 02, 03, 08, 10-12 February 2016	Fauna habitat assessment and herpetofauna searches throughout study area	7 person hours
25 – 27 January 2016 2, 3, 9-12 February	Diurnal Bird census – more than one bird survey conducted each day	23, 30 minutes each 11.5 person hours
08-12 February 2016	Elliott B arboreal trapping 4 trap transects 20 set for 4 nights	80 Elliott B trap nights

Dates	Survey Type	Survey effort
08-12 February 2016	Cage traps – 6 cages set for 4 nights	24 cage trap nights
25-27 January 2016 02 February 2016	Spotlighting throughout study area	16.5 person hours
25-27 January 2016 02 February 2016	Call playback	19 person hours
25-27 January 2016 02 February	Green and Golden Bell Frog and general frog surveys	10 person hours
25, 27 January 2016	Mobile Anabat surveys	4 hours
26 January – 11 February 2016	Stationary Anabat surveys	84 hours
25 January 2016 2 – 3 February 2016	Hollow-bearing Tree surveys and opportunistic surveys	2.5 days
11 February 2016	Aquatic habitat assessment Ten riparian sites	5 person hours
3 February 2016 11 February 2016	Culvert Inspections	3 person hours
09, 17, 24, 30 June 2016 08, 15, 28 July 2016 02, 05, 12 August 2016	Winter Swift Parrot and Regent Honeyeater bird surveys and opportunistic surveys	25 person hours

3.5.3 Weather Conditions

Table 3-5 provides a summary of the weather conditions encountered during the fauna surveys. Survey weather conditions during the surveys consisted of moderate to hot temperatures, with high rainfall events in January. The Bureau of Meteorology recorded high rainfall at the Singleton weather station before surveys commenced on 5 January (22mm) and 6 January (67 mm) 2016. Heavy rainfall of 39 mm was recorded on 23 January three days before the targeted Green and Golden Bell Frog surveys which provided optimal weather conditions for detection.

Table 3-5: Weather Conditions

Date	Temperate (C0)	Cloud Cover	Rain	Wind Km/hr
04/01/2016	23ºC,	8/8 cloud	light rain	no wind
08/01/2016	27ºC,	3/8 cloud	no rain	no wind
11/01/2016	38ºC	2/8 cloud	no rain	no wind
12/01/2016	38	2/8 cloud	no rain	no wind
13/01/2016	33	2/8 cloud	no rain	no wind
25/01/2016	23	8/8 cloud full moon	light rain	11-15kph Easterly

Date	Temperate (C0)	Cloud Cover	Rain	Wind Km/hr
26/01/2016	23-27	3/8 cloud full moon	no rain	11-15kph Easterly (afternoon) Maximum 16-20kph easterly (after sunset)
27/01/2016	22-26	8/8 cloud	no rain	Max. 11 – 15kph E wind
02/02/2016	24-28	0/8 cloud	no rain	11-15kph E wind
03/02/2016	25-28	6/8 cloud	no rain	no wind
08/02/2016	30	1/8 cloud	no rain	no wind
09/02/2016	25-29	2/8 cloud	no rain	no wind
10/02/2016	24-29	0/8 cloud	no rain	5 – 10kph E wind
11/02/2016	25-28	0/8 cloud	no rain	no wind
12/02/2016	18	2/8 cloud	no rain	no wind
09/06/2016	16	3/8-7/8 cloud	no rain	6-10kph South-westerly
17/06/2016	6-10	3/8-6/8 cloud	no rain	5kph North-easterly
24/06/2016	13-16	1/8 cloud	no rain	20-35kph Westerly
30/06/2016	0-1	0/8 cloud	no rain	5kph Westerly
08/07/2016	12-14	8/8 cloud	Light rain	no wind
15/07/2016	3-9	0/8 cloud	no rain	5-20kph North-westerly
28/07/2016	6-13	0/8 cloud	no rain	5-20kph South-westerly
02/08/2016	9-13	4/8-7/8 cloud	no rain	no wind
05/08/2016	9-12	2/8-6/8 cloud	no rain	no wind
12/08/2016	5-8	0/8 cloud	no rain	0-5kph westerly

3.5.4 Fauna Habitat Assessment

To assess the fauna habitat present within the study area, habitat data was collected to determine the range of fauna that may utilise the area for roosting, breeding and/or foraging. Throughout the study area habitat searches involved opportunistic searches plus eleven habitat searches at each BioBanking plot location. At each of the fauna survey sites habitat attributes the following habitat attributes were recorded:

1. Presence of burrows, whitewash, owl pellets, nests/drays and chewed *Casuarina* cones (which may indicate the presence of species such as Glossy Black Cockatoo);
2. Floristic structure of the canopy, mid stratum and ground layer;
3. Depth and composition of leaf litter;
4. Presence of rocks and rock shelves;
5. Presence of fallen timber; and
6. Aquatic habitat such as depressions, farm dams and riparian vegetation.

3.5.5 Mammal Survey Methods

Mammal survey methods included a combination of trapping, opportunistic and nocturnal spotlighting and call playback surveys. Trapping surveys consisted of Elliott B arboreal traps and terrestrial cage traps. Three primary trapping transects were set throughout the study area in the highest quality woodland habitat most likely to be impact by the project. The locations of the trapping transects are shown in Figure 3-3. The three primary trapping transects were approximately 100 m in length with 10 m between each arboreal trap. Cage traps were generally placed at the beginning of each transect. The fourth transect made use of spare traps. The number of traps per trap transects are outlined below:

- Transect one – six Elliott B arboreal traps and two cage traps;
- Transect two – six Elliott B arboreal traps and two cage trap;
- Transect three – six Elliott B arboreal traps and two cage trap; and
- Transect four – two Elliott B arboreal traps.

The Elliott B traps targeted threatened arboreal mammals, such as the Squirrel Glider, Brush-tailed Phascogale and other common arboreal mammals. The state guidelines require 24 trap nights per stratification unit and the completed survey resulted in 80 trap nights.

Cage traps were used to target medium size terrestrial mammals such as Spotted-tailed Quoll. The state survey guidelines (Department of Environment and Conservation 2004) requires 24 trap nights using six cage traps for a minimum of four nights for detection of the Spotted-tailed Quoll. The federal guidelines (Department of Sustainablility, Environment, Water, Populations and Communities 2011) recommend a mixture of habitat searches for den sites, scats and latrine sites and cage trapping. Ten cage traps in parallel lines for four consecutive nights, are recommended. Habitat assessments were conducted in accordance with the federal guidelines. The slightly smaller cage trapping survey effort which is in accordance with the state guidelines is considered adequate.

Spotlighting surveys were conducted over four nights for four hours per night targeting arboreal mammals, including the Squirrel Glider and Koala. Spotlighting of the study area was conducted by a combination of vehicle and walking throughout the study area. LED head lamps and spotlights were used for these surveys. Spotlighting was used to identify nocturnal species such as arboreal and ground dwelling mammals, targeting threatened species including the Squirrel Glider, Brush-tailed Phascogale and Koala. During spotlighting surveys call playback targeting the Koala was used at four locations. At each location after the call was played a 10 to 15-minute listening period was undertaken followed by a spotlight search for the targeted species. Spotlighting was undertaken throughout the entire study area.

3.5.6 Microchiropteran Bat Surveys

Microchiropteran bat surveys consisted of a combination of stationary and mobile surveys using an ultrasonic Anabat detector (Anabat SD1 CF Bat Detector - Titley Electronics, Ballina). Stationary Anabat

recorders were place at eleven sites throughout the study area (Figure 3-3) in locations of potential habitat to increase the potential of detection. These included adjoining riparian areas, farm dams, at the edge of forested vegetation / flyways and cleared land. Mobile Anabat surveys were undertaken on foot while completing the spotlighting surveys in various locations.

Analysis of Anabat echolocation calls were completed by Amanda Lo Cascio. The call identification for the data was based on the call keys and descriptions for New South Wales (Pennay et al 2004) with reference to descriptions published for southern Queensland (Reinhold et al 2001)

The reliability of call identification was categorised as:

- Definite – one or more calls were there was no doubt on the identification of the species;
- Probable – most likely to be the species named, low probability of confusion with species that use similar calls; and
- Possible – call is comparable with the named species, with a moderate to high probability of confusion with species of similar calls.

3.5.7 Seasonal Bird Surveys

A total of twenty-three morning and afternoon summer diurnal bird surveys were undertaken. These consisted of area searches for 20 minutes each. Birds were identified either by call and/or observation. All birds observed and heard were recorded. Opportunistic observations and identification of calls were recorded during all other field surveys throughout the study area.

Nocturnal birds were also targeted using calls playback and spotlighting. Call playback targeted Powerful Owl, Barking Owl, Masked Owl and Bush Stone-curlew. Call playback was in accordance with standard methods (Debus 1995, Kavanagh & Debus 1994). At each location after the call was played a 10 to 15-minute listening period was undertaken followed by a spotlight search for the targeted species. The location of the bird survey points is shown in Figure 3-3.

A total of ten morning winter bird surveys were conducted throughout June / July / August targeting the critically endangered Swift Parrot and Regent Honeyeater, using area search methodology in accordance with the Commonwealth guidelines.

Continual check of local records of Swift Parrot and Regent Honeyeater were made during the winter survey period. Numerous records of the Swift Parrot were recorded in surrounding areas (such as Singleton Army Base and Kurri Kurri) during the survey period. Regent Honeyeater observations in the Hunter Valley were very few during the survey period.

Habitat targeted included flowering trees, specifically the winter-flowering *Corymbia maculata* (Spotted Gum) which is known as a preferred feed tree for these species. Birds were identified either by call and/or observation. All birds observed and heard were recorded.

Swift Parrot and Regent Honeyeater were also targeted using call playback in areas of blossoming Spotted Gum, typically in the presence of other feeding lorikeet species.

3.5.8 Targeted Green and Golden Bell Frog Surveys

The Green and Golden Bell Frog surveys were conducted in accordance with the Commonwealth Survey Guidelines for Australia's threatened frogs (Department of the Environment, Heritage and the arts, 2010b) and the NSW Threatened species and assessment guidelines for Amphibians (Department of Environment and Climate Change, 2009).

The above two guidelines are similar (Table 3.6) however the Commonwealth guidelines recommend a specific climatic conditions and additional survey effort.

Table 3-6 Comparison of State and Federal Green and Golden Bell Frog Guidelines

Survey Method	NSW Guidelines	Commonwealth Guidelines
Season	August to February	September to March
Climatic Conditions	Preferably after rain	Warm, windless weather conditions following heavy rainfall
Survey Effort includes: diurnal basking surveys, Spotlighting, Call playback, Call detection and tadpole surveys	Three nights under ideal conditions	Four diurnal and nocturnal surveys under ideal conditions
Reference Site	Yes, in close proximity to survey site where possible	Yes, where feasible
Area to be covered	Habitat (< 0.5 ha) one hour on three separate occasions Habitat (> 0.5 ha) three separate four hourly searches during ideal conditions.	Small wetland (<50 m) one hour Large wetlands (>50 m) multiple units in systematic manner

Habitat for the Green and Golden Bell Frog occurred within three farm dams within the study area. These farm dams flow into a tributary of the Hunter River. Green and Golden Bell Frog surveys were conducted in late January and early February during the September to March seasonal survey period over four nights at the three sites. The Bureau of Meteorology recorded high rainfall at the Singleton weather station during late December 2015 of 45 mm. Three days before the Green and Golden Bell Frog surveys heavy rainfall of 39 mm was recorded on the 23 January 2016 with temperatures being mild to hot (23°C to 28°C). Whilst rainfall was slightly below the recommended in the Commonwealth Guidelines of 50mm over seven days, the survey was conducted after the rainfall to optimise the detection of this species. The remaining weather components were optimal for the detection of the Green and Golden Bell Frog and were in accordance with both the state (NSW Department of Environment and Climate Change, 2009) and federal guidelines (Department of Environment, Water, Heritage and the Arts, 2009, 2010b). The location of the survey sites is shown on Figure 3-3 whilst Table 3-4 outlines the survey effort. The targeted surveys were conducted at each farm dam included the following:

- Basking surveys;
- Four nights call playback and spotlighting surveys;
- Habitat searches; and
- Tadpole surveys where required.

No reference site was surveyed as no immediately accessible site was available. Activity levels of other frogs was noted as being high during the targeted surveys, suggesting survey conditions were appropriate.

3.5.9 Herpetofauna Active Searches

Herpetofauna searches were conducted during habitat assessments throughout the study area. These included searches in habitat such as overturning rocks, fallen timber, racking debris, peeling bark or other structures man made that provide habitat such as carpet and corrugated iron. Opportunistic observations of any frogs and/or reptiles were also recorded throughout the field surveys. Frogs were identified either by observation and/or calls.

3.5.10 Hollow-bearing Tree Survey

A comprehensive hollow bearing tree survey was conducted throughout the entire study area. All hollow bearing trees were recorded. For each tree the following attributes were recorded:

- Location recorded on GPS;
- Tree tagged and id number recorded;
- Tree species;
- Location of the hollow as follows:
    - Broken trunk;
    - Branch;
    - Trunk;
    - Spilt; and
    - Peel back.
- Hollow size and number:
    - Small hollow <10 cm;
    - Medium hollow 10 to 30 cm; and
    - Large hollow >30 cm.
- Diameter at breast height in cm;
- Percentage of tree dead;
- Height in metres;
- Presence of any scratches;
- Presence of any sap feeding scars; and
- Presence of any nests.

3.5.11 Riparian and Aquatic Habitat Methodology

The aquatic surveys included general observations rather than detailed investigations such as AUSRIVAS due to the limited aquatic habitat within the study area being restricted to disturbed creek lines and farm

dams. No chemical analysis of water quality or macro invertebrate surveys were conducted as part of this field survey. Aquatic surveys were however conducted at ten sites within the study area with the following data collected in accordance with the Aquatic Habitat description requirements of the Roads and Maritime Services (2012) Environmental Impact Assessment Practice Note: Biodiversity Assessment.

- GPS Location;
- Depth (m);
- Flow / drainage filtration;
- Bed substrate;
- Aquatic habitat features;
- Infrastructure / barriers to fish movement;
- Width (m);
- Observed water quality (no chemical analysis); and
- Species of flora and fauna present.

Refer to Figure 3-3 for aquatic habitat survey locations.

3.5.12 Culvert Inspections

Nine culverts were present within the study area under the New England Highway (Figure 3-3). All of the culverts were inspected to identify any roosting bats and/or nesting birds or other fauna that may have been present. The inspections were conducted on the 3 and 11 February 2016. The following data was collected:

- GPS Location;
- Culvert size; and
- Type of fauna present (if any).

3.5.13 General Opportunistic Surveys

Opportunistic records were taken throughout the study area survey for all species. This included incidental records of both habitat features and fauna species throughout the study area. Incidental fauna records include scats, scratches and chewed cones. These surveys were also undertaken during floristic surveys.

3.6 Likelihood of Occurrence

To determine if threatened biodiversity has habitat within the study area four categories have been utilised as follows:

1. Low – no habitat within study area;
2. Moderate – Moderate quality habitat, within the study area, likely to be disturbed with limited amount of breeding, foraging and roosting habitat;
3. High – high quality habitat within the study area including breeding, foraging and roosting habitat. Previous records in close proximity or within the site; and
4. Recorded – Species recorded during current field surveys.

3.7 Field Survey Limitations

Field surveys are conducted over a small period of time, and not all species can be detected. These include mobile fauna species, migratory birds and fauna that utilise the resources on a seasonal basis. Flora species that are difficult to detect include cryptic, annuals and species present in the seed bank. Therefore, the results in this report are a result of the time when the field surveys were completed.

The majority of field surveys were conducted during summer with moderate to high temperatures with rainfall varying from low to high rainfall events. The detectability of reptiles and frogs were likely to be high due to warm temperatures. Surveys for Green and Golden Bell Frog were conducted in optimal conditions during January as a rainfall event before the surveys of 39 mm of rain, and moderate to high temperatures occurred. The surveys were conducted during the flowering periods for the threatened flora species that have habitat within the study area. The exceptions were *Eucalyptus glaucina* and *Grevillea parviflora* subsp. *parviflora.* These two species are easily identified outside of their flowering period. Surveys for endangered flora populations for *Eucalyptus camaldulensis* was conducted during the Summer flowering period. The remaining two species, *Acacia pendula* and *Cymbidium canaliculatum* were surveyed outside of their flowering period however these species are easily detected outside of the flowering period on vegetative features alone.

4 EXISTING ENVIRONMENT

4.1 Landscape Context

The study area occurs approximately 8 km west of Branxton along the New England Highway. The study area is surrounded by a combination of agricultural land and remnant native vegetation. The Hunter River is approximately 2 km to the north and the study area occurs on the floodplain. The majority of the actual study area also consists of agricultural land with remnant native vegetation. Two degraded drainage lines occur within the study area and three farm dams.

The study area occurs within the following landscape context:

- Singleton Shire Council LGA;
- Sydney Basin Bioregion;
- Hunter Land Services Hunter Region (formerly Hunter Catchment Management Authority);
- Hunter / Central Rivers CMA sub region;
- North Coast Botanical sub region;
- Central Hunter Foothills Mitchell Landscape (Department of Environment and Climate Change, 2008a); and
- Upper Hunter Noxious Weed Control Area.

4.2 Surrounding Land Use

The majority of the surrounding land use consists of agricultural uses such as cattle grazing and cropping.

The Singleton abattoir and sewerage works occur 800m to the south of the study area whilst the Singleton Army Base occurs to the south west.

A large expanse of native remnant vegetation occurs to the north which provides connectivity to the Hunter River.

A large expanse of native vegetation occurs to the south east and extends to a distance of approximately 20km south to Wollemi National Park.

4.3 Vegetation Communities

4.3.1 Regional Mapping

The Greater Hunter Native Vegetation Mapping (Sivertsen et al, 2011) has mapped the following vegetation communities in the study area, being:

- Spotted Gum Narrow-leaved Ironbark Red Ironbark Shrub grass open forest of the Central and Lower Hunter;
- Narrow-leaved Ironbark Bulloak Grey Box shrub grass open forest of the Central and Lower Hunter;
- Narrow-leaved Ironbark Grey Box Spotted gum shrub grass open forest of the Central and Lower Hunter; and
- Swamp Oak Weeping Grass grassy riparian forest of the Hunter Valley.

Refer to Figure 4-1 for the Greater Hunter mapping.

The broad scale mapping project of the Central Hunter Vegetation mapping (Peake, 2006) has mapped two vegetation communities within the study area (Figure 4-2). These include:

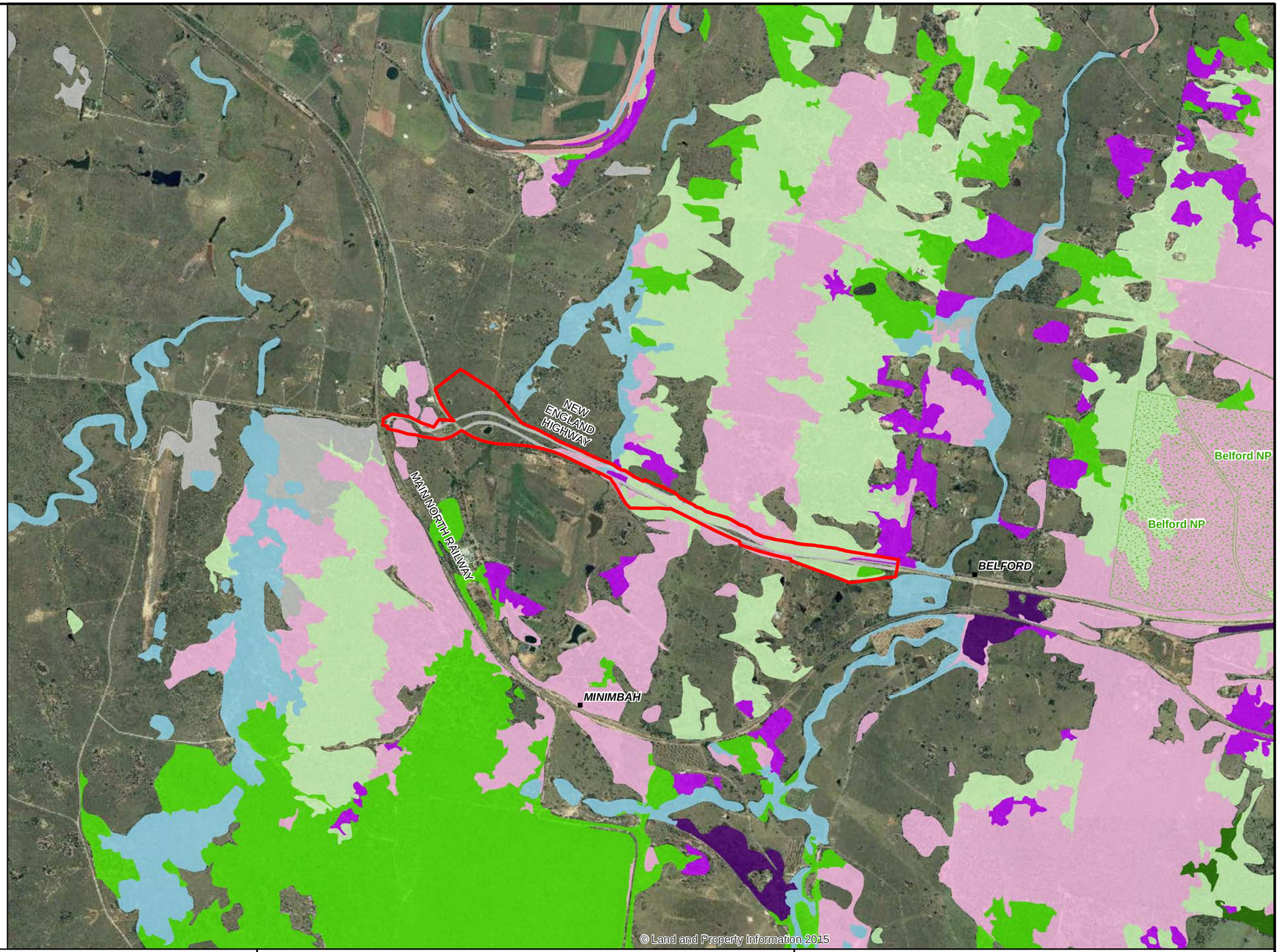
- Central Hunter Spotted Gum Ironbark Grey Box Forest; and
- Central Hunter Swamp Oak Forest.

4.3.2 Study Area Mapping Results

Two native vegetation communities and two non-native vegetation communities were identified during the field surveys within the study area and are shown in Figure 4-3. Description of the vegetation communities are provided in the following sections. It is considered that in a local and regional sense, the Peake (2006) mapping appears to be more accurate than the Greater Hunter mapping.

Legend:

- Study Area
- Proposed Road Upgrade
- Locality
- National Parks Reserve
- Bull Oak grassy woodland of the central Hunter Valley
- Cabbage Gum/ Rough-barked Apple grassy woodland on alluvial floodplains of the lower Hunter
- Narrow-leaved Ironbark/ Bull Oak/ Grey Box shrub/ grass open forest of the central and lower Hunter
- Narrow-leaved Ironbark/ Grey Box/ Spotted Gum shrub/ grass open forest of the central and lower Hunter
- River Red Gum/ River Oak grassy riparian woodland of the Hunter Valley
- Spotted Gum/ Narrow-leaved Ironbark / Red Ironbark shrub/ grass open forest of the central and lower Hunter
- Spotted Gum/ Narrow-leaved Ironbark shrub/ grass open forest of the central and lower Hunter
- Spotted Gum/ Red Ironbark/ Narrow-leaved Ironbark/ Grey Box shrub/grass open forest of the lower Hunter
- Swamp Oak/ Weeping Grass grassy riparian forest of the Hunter Valley



Author:	K. Lee
Reviewer:	T. Lambert
A3 Scale:	1:30,000
Job Ref:	11232

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Map Projection: GDA 1994 MGA Zone 56

Figure 4-1

REGIONAL VEGETATION MAPPING (GREATER HUNTER)

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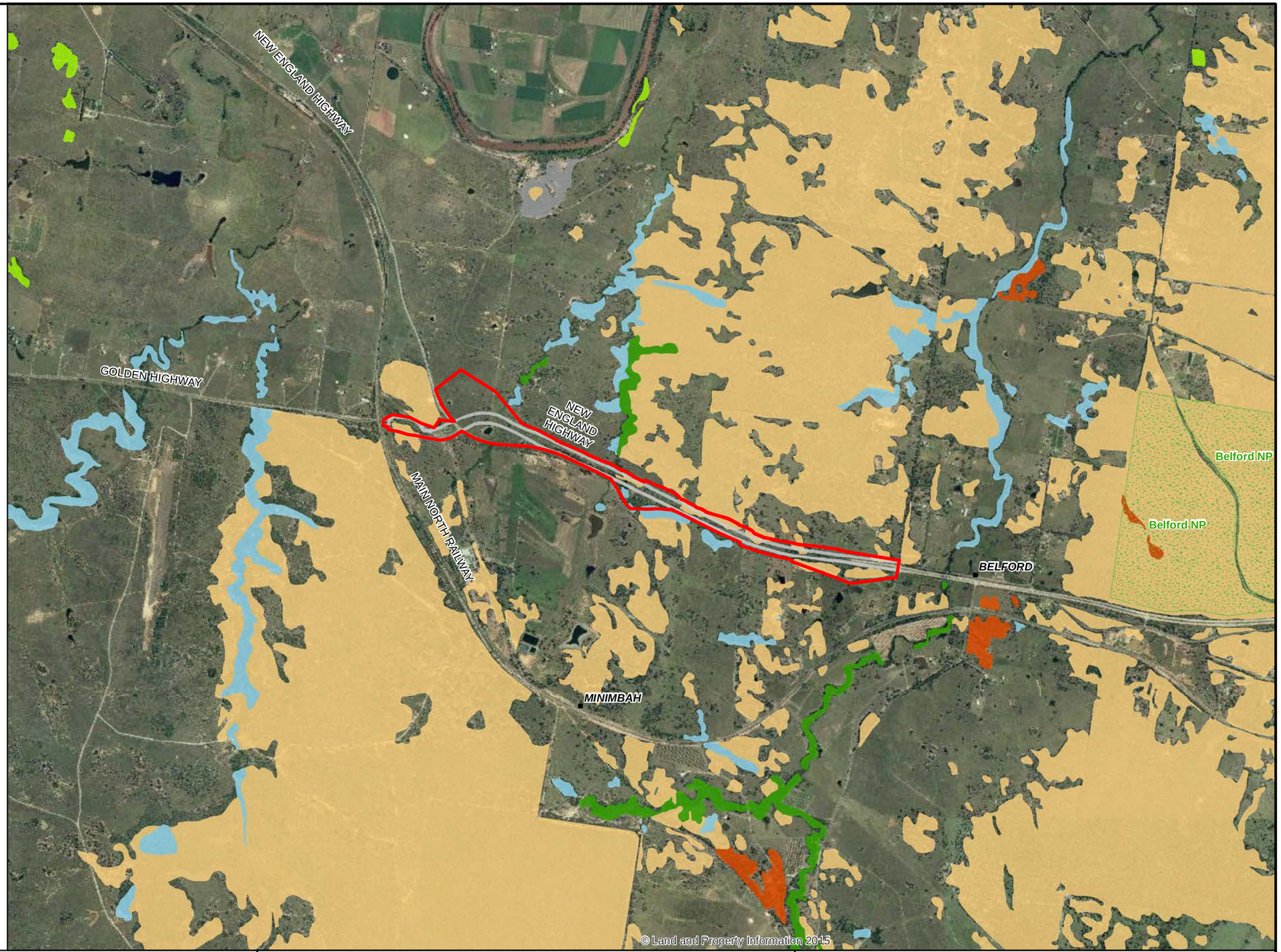
ENVIRONMENTAL PROPERTY SERVICES

Legend:

- Study Area
- Proposed Road Upgrade
- Locality
- National Parks Reserve
- Central Hunter Box - Ironbark Woodland
- Central Hunter Bulloak Forest Regeneration
- Central Hunter Ironbark - Spotted Gum - Grey Box Forest
- Central Hunter Swamp Oak Forest
- Hunter Lowlands Red Gum Forest
- Hunter Valley River Oak Forest



Author:	K. Lee
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Map Projection: GDA 1994 MGA Zone 56

Figure 4-2

REGIONAL VEGETATION MAPPING (PEAKE)

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Legend:

- Study Area
- Proposed Road Upgrade
- Proposed Construction Compounds
- Cleared Riparian Area
- Dam Vegetation
- Drainage Line
- Creek Line

Central Hunter Ironbark - Spotted Gum - Grey Box Forest (Endangered - TSC Act)

- PCT 1601 (HU815) Spotted Gum - Narrow-leaved Ironbark - Red Ironbark shrub - grass open forest of the central and lower Hunter (Moderate to Good - Zone 1)
- PCT 1601 (HU815) Spotted Gum - Narrow-leaved Ironbark - Red Ironbark shrub - grass open forest of the central and lower Hunter (Moderate to Good (Poor) - Zone 2)

Central Hunter Valley Eucalypt Forest / Woodland (Critically Endangered - EPBC Act)

- EPBC Category Class B High Quality Condition
- EPBC Category Class C Moderate Quality Condition

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Map Projection: GDA 1994 MGA Zone 56

Figure 4-3A

PLANT COMMUNITY TYPE AND CONDITION MAP

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ENVIRONMENTAL PROPERTY SERVICES

Legend:

- Study Area
- Proposed Road Upgrade
- Cleared Riparian Area
- Riparian Area
- Creek Line

Central Hunter Ironbark - Spotted Gum - Grey Box Forest (Endangered - TSC Act)

PCT 1601 (HU815)
Spotted Gum - Narrow-leaved Ironbark - Red Ironbark shrub - grass open forest of the central and lower Hunter
(Moderate to Good - Zone 1)

Swamp Oak Floodplain Forest (Endangered - TSC Act)

PCT 1731 (HU945)
Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley
(Moderate to Good - Zone 3)

Central Hunter Valley Eucalypt Forest / Woodland (Critically Endangered - EPBC Act)

- EPBC Category Class A
  High Quality Condition (>5 ha)
- EPBC Category Class B
  High Quality Condition
- EPBC Category Class C
  Moderate Quality Condition

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Reviewer:	T. Lambert
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Job Ref:	11232

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Map Projection: GDA 1994 MGA Zone 56

Figure 4-3B

PLANT COMMUNITY TYPES AND CONDITION MAP

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ENVIRONMENTAL PROPERTY SERVICES

Legend:

- Study Area
- Proposed Road Upgrade
- Cleared Riparian Area
- Riparian Area

Central Hunter Ironbark - Spotted Gum - Grey Box Forest (Endangered - TSC Act)

PCT 1601 (HU815)
Spotted Gum - Narrow-leaved Ironbark - Red Ironbark shrub - grass open forest of the central and lower Hunter
(Moderate to Good - Zone 1)

Swamp Oak Floodplain Forest (Endangered - TSC Act)

PCT 1731 (HU945)
Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley
(Moderate to Good - Zone 3)

Central Hunter Valley Eucalypt Forest / Woodland (Critically Endangered - EPBC Act)

- EPBC Category Class A
  High Quality Condition (>5 ha)
- EPBC Category Class B
  High Quality Condition
- EPBC Category Class C
  Moderate Quality Condition

Author:	K. Lee
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A3 Scale:	1:4,000
Job Ref:	11232

N

0 50 100 200
Metres

Map Projection: GDA 1994 MGA Zone 56

Figure 4-3C

PLANT COMMUNITY TYPES AND CONDITION MAP

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ENVIRONMENTAL PROPERTY SERVICES

4.3.3 Spotted Gum – Narrow-leaved Ironbark – Red Ironbark Shrub – Grass Open Forest of the Central Hunter and Lower Hunter [PCT 1601]

The floristic structure of this community is of an open forest to woodland structure canopy layer with the shrublayer generally absent and a grassy ground layer. This community is located on Permian sediments and the extent of the community is approximately 24.4 ha within the study area and as mapped in Figure 4-3.

This community is listed as endangered on the TSC Act and critically endangered on the EPBC Act. Further details of the breakdown of each type is provided in Section 5.5.

- **Canopy height** ranged from 14 to 18 m with percent foliage cover of 15-35%;
- **Mid stratum** height ranged from 1 to 6 m with percent foliage cover of 0-70%; and
- **Groundcover** height ranged from 0.1 to 0.8 m with percent foliage cover of 60-80%.

Dominant species were:

- ***Canopy*** *Corymbia maculata, Eucalyptus crebra, Eucalyptus moluccana and occasional occurrences of Eucalyptus fibrosa* and *Eucalyptus tereticornis;*
- ***Mid stratum*** *Daviesia ulicifolia, Pultenaea cunninghamii, Cassinia uncata, Indigophora australis, Acacia parvipinnula, Lantana camara** and *Olea europaea* subsp. *cuspidata*; and*
- ***Groundlayer*** *Dichondra repens, Pratia purpurascens, Rytidosperma tenuior, Cheilanthes sieberi, Fimbristylis dichotoma, Lomandra multiflora, Bothriochloa macra, Chloris ventricosa, Calotis lappulacea,* exotic species included, *Plantago lanceolata, Bidens pilosa** and *Sida rhombifolia*.*

Vegetation Community Condition

In accordance with the BioBanking Assessment Methodology (Office of Environment and Heritage 2014) this PCT occurred in one BioBanking condition, being moderate to good. It is noted that five of the patches have been differentiated in the mapping as moderate to good (poor) as these plots recorded a high percentage of exotic species and were below the majority of the benchmark values for the corresponding PCT 1601. The BioBanking plot 10 was located under the canopy of a native tree and whilst it contained a relative high diversity of natives they were commonly occurring natives which were not representative of the patch as a whole. Plot 9 recorded variables which were below benchmark, however this plot was located in an area of native regrowth which adjoined vegetation that was in good condition and therefore was considered to be in moderate to good condition. The remaining five plots were in a higher condition and are classified as typical moderate to good. A low number of hollow-bearing trees were recorded within all the BioBanking plots. The native mid storey was generally absent which was likely to be a result of grazing pressures. Plate 1 shows moderate to good condition and Plate 2 shows moderate to good (poor) condition.

Table 4-1: Comparison of Spotted Gum – Narrow-leaved Ironbark – red ironbark shrub – grass open forest of the central and lower hunter against the benchmark for [PCT 1601]

		Plot #								
Benchmark Attribute	**Benchmark Value**	**1**	**2**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Plant Species Diversity	38	***28***	***11***	***34***	***20***	***28***	***24***	***24***	***4***	***27***
Native Over Storey % Cover	15-40	29.5	***5***	15.5	***5.5***	28	27.5	20.5	33	***12***
Native Mid Story % Cover	4-40	***1.5***	***0***	***2.5***	***1.5***	***0***	***1.5***	8.5	***0***	15.5
Native Ground Grasses	30-60	56	***22***	46	***28***	***14***	50	***20***	***20***	66
Native Ground Shrubs	3-15	6	***0***	***2***	38	***0***	***2***	4	***0***	18
Native Ground Other	10-25	62	20	26	22	62	54	36	28	32
Exotic Species %	N/A	58	80	58	66	40	66	68	76	40
Number of Trees with Hollows	1.2	***0***	2	***0***	***0***	***0***	***0***	***0***	***0***	2
Over Storey Regeneration	N/A	0.5	1	0.6	1	1	1	1	1	1
Length of Fallen Timber	10	12	18	33	15	75	***3***	15	8	24
OEH Condition	N/A	M to G	M to G (poor)	M to G	M to G	M to G	M to G	M to G	M to G (poor)	M to G (poor)

Note:

1. Italics and bold are below the lower value of the benchmark
2. Italics, bold and underlined are 25% lower than the benchmark

Plate 1: Moderate to Good Condition Spotted Gum – Narrow-leaved Ironbark – Red Ironbark Shrub – Grass Open Forest

Plate 2: Moderate to Good (Poor) Condition Spotted Gum – Narrow-leaved Ironbark – Red Ironbark Shrub – Grass Open Forest

4.3.4 Swamp Oak Weeping Grass Grassy Riparian Forest of the Hunter Valley [PCT 1731]

This community is riparian vegetation that is associated with creeklines (Figure 4-3). The canopy of this community was native with the understory and ground layer dominated by exotics. The extent of the community is approximately 1.9 ha within the study area. This community is commensurate with endangered ecological community Swamp Oak Floodplain Forest as listed on the TSC Act. A description of the community is provided below.

- **Canopy height** ranged from 14 to 18 m with percent foliage cover of 30-70%;
- **Mid stratum** height ranged from 3 to 6 m with percent foliage cover of 0-30%; and
- **Groundcover** height ranged from 0 to m with percent foliage cover of 60-80%.

Dominant species were:

- ***Canopy*** *Casuarina glauca;*
- ***Mid stratum*** *Juvenile Casuarina glauca* and *Olea europaea* subsp. *cuspidata*; and*
- ***Groundlayer*** Dominated by exotic grasses *Panicum maximum* and Chloris gayana*,* with native species *Dichondra repens* and *Pratia purpurascens.*

Vegetation Community Condition

The comparison of the vegetation community against the corresponding BioBanking benchmark for this community (see Table 4-2) shows that the majority of the attributes are within the benchmarks. The vegetation community had a low native plant species diversity and this can be attributed to the high exotic species percentage cover. All of the patches of this community are classified as moderate to good condition in accordance with the BioBanking Assessment Methodology (Office of Environment and Heritage 2014). The extent of this community is mapped in Figure 4-3 and Plate 3 provides a photo of the community.

Table 4-2: Comparison of Swamp Oak Weeping Grass Grassy Riparian Forest of the hunter valley against the benchmark for PCT 1731

		Plot #	
Benchmark Attribute	**Benchmark Value**	**3**	**11**
Plant species diversity	24	***10***	***6***
Native overstorey % cover	15-70	33	49
Native Mid story % cover	10-60	***3.5***	***4***
Native Ground grasses	5-50	26	24
Native Ground shrubs	5-30	16	12
Native Ground other	5-40	34	20
Exotic Species %	N/A	96	96
Number of trees with hollows	0.2	***0***	***0***
Overstorey regeneration	N/A	1	1
Length of fallen timber	5	*3*	*2*
OEH Condition	N/A	M to G	M to G

Note:

1. Italics and bold are below the lower value of the benchmark
2. Italics, bold and underlined are 25% lower than the benchmark

Plate 3: Swamp Oak Weeping Grass Grassy Riparian Forest

4.3.5 Farm Dams and Cleared Riparian

Three farm dams were present within the study area. The majority of the dams were in poor condition. This community provides potential habitat for a number of commonly occurring and threatened fauna species (Plate 4). Farm dams and cleared riparian areas encompassed 1.5 ha of the study area, with this community mapped in Figure 4-3. Of this, 0.5 ha is comprised of dams and 1 ha is comprised of cleared riparian vegetation. A description of the dams is provided below.

Dominant species were:

- **Floating aquatics** *Azolla pinnata, Ludwigia peploides;*
- **Emergent aquatics** *Typha orientalis, Eleocharis sphacelata, Juncus usitatus, Bolboschoenus caldwellii, Eleocharis acuta; and*
- **Fringing terrestrial species** *Paspalum distichum, Juncus acutus*.*

The cleared riparian zones contained creek lines but have no overstorey or understorey vegetation with high erosion of banks being evident. These creek lines consisted of exotic aquatic species such as *Juncus acutus* and exotic pasture weeds. This vegetation type is discussed further in the riparian and aquatic habitat assessment.

Plate 4: Farm Dams

4.3.6 Cleared Land

This non-native vegetation community consisted of cleared paddocks, paddock trees and grazed vegetation (Plate 5). The occasional paddock trees were native species such as *Eucalyptus moluccana, Eucalyptus crebra, Angophora floribunda* and dead stags. Some of these trees were hollow-bearing and contained habitat for a number of arboreal mammals and birds. The dominant understorey species were exotic grasses, herbs and shrubs. These included *Olea europaea* subsp. *cuspidata**, *Pennisetum clandestinum**, *Panicum maximum*, Chloris gayana**, *Verbena rigida*, Conyza bonaerensis*, Plantago lanceolata*, Bidens pilosa* and Sida rhombifolia*.*

Plate 5: Cleared Land

4.4 Flora Species Recorded

184 flora species were recorded in the study area (Appendix 2) from 50 families. The most common family was Poaceae and Asteraceae. 71 species were exotic. No threatened flora species were recorded.

Three exotic species of flora are listed as noxious on the NW Act for the Upper Hunter Control Area. These include, *Opuntia aurantiaca* (Tiger Pear), *Opuntia stricta* (Prickly Pear) and *Senecio madagascariensis* (Fireweed). All of these weeds are Class 4, a locally controlled weed under NW Act which states that "*The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread"*. All of these weeds are also listed as a Weed of National Significance (WONS). Two further weeds

recorded within the study area are also listed as a WONS, being *Anredera cordifolia* (Madeira Vine) and *Lantana camara* (Lantana).

The African Olive is an invasive weed which was recorded in high density in the understorey of the vegetation within the study area. This weeds degrades the habitat for native biodiversity recorded within the study area.

4.5 Fauna Species Recorded

Seventy-seven (77) species of fauna were recorded within the study area (Appendix 3). Refer to Appendix 8 for bat call analysis results. Fauna recorded included Birds (53), Mammals (18), Frogs (4) and Reptiles (2). Three invasive species were recorded being Black Rat, Fox and Indian Myna.

Six species of threatened fauna were recorded during the field surveys. These included:

- Speckled Warbler;
- Grey-crowned Babbler;
- Squirrel Glider;
- Eastern Bent-wing Bat;
- Eastern Freetail-bat; and
- Grey-headed Flying Fox.

The observations in relation to these recorded species are summarised hereunder. Refer to Figure 4-4 for locations of threatened recorded fauna.

4.5.1 Speckled Warbler

The Speckled Warbler was recorded in seven locations, five records on the southern side of the New England Highway and two records on the northern side. The birds were recorded during bird surveys during the field surveys or while conducting winter bird surveys for Swift Parrot and Regent Honeyeater as follows:

- One pair was recorded foraging in dense understorey in woodland habitat on the 10 February on the southern side of the highway;
- One pair was recorded foraging in dense understorey in woodland habitat on the southern side of the New England Highway;
- One pair was recorded foraging in the riparian habitat on the northern side of the New England Highway on 8 February 2016;
- One individual was heard in dense understorey in woodland habitat on the southern side of the New England Highway on 2 August 2016;

- One individual was observed in dense understorey in woodland habitat on the southern side of the New England Highway on 5 August 2016;
- One individual was observed in dense understorey in woodland habitat on the northern side of the New England Highway on 12 August 2016; and
- One individual was heard in dense understorey in woodland habitat on the southern side of the New England Highway on 12 August 2016.

4.5.2 Grey-crowned Babbler

The Grey-crowned Babbler was recorded at five locations within the study area during bird transects during the field surveys or while conducting winter bird surveys for Swift Parrot and Regent Honeyeater. Details as follows:

- Six individuals were recorded foraging in the road reserve on the southern side of the New England Highway on 27 January 2016;
- Three individuals were recorded foraging in woodland habitat in the road reserve on the northern side of the New England Highway on 2 February 2016;
- Four individuals were recorded foraging in woodland habitat on the 12 February 2016;
- One nest was recorded in woodland habitat on the northern side of the New England Highway on 11 February 2016; and
- One individual was recorded foraging in woodland habitat in the road reserve on the southern side of the New England Highway on 2 August 2016.

4.5.3 Squirrel Glider

Two individuals of this species were confidently recorded at two locations on 27 January 2016 during spotlighting surveys. These individuals were recorded foraging in flowering eucalypts in woodland habitat.

4.5.4 Eastern Bent-wing Bat

The Eastern Bent-wing Bat was detected as by echolocation calls via an Anabat as a definite identification at four locations as follows

- South east side of the New England Highway in woodland habitat adjoining the rest area on the Golden Highway on 10 February 2016;
- Southern side of the New England Highway in cleared riparian habitat on 2 February 2016;
- Northern side of the highway adjoining paddock trees on the 25 February 2016; and
- Northern side of the highway in woodland habitat on 3 February 2016.

4.5.5 Eastern Freetail-bat

The Eastern Freetail-bat was detected as by echolocation calls via an Anabat as a probable identification at two locations as follows:

- Northern side of the highway adjoining paddock trees on 25 February 2016; and
- Northern side of the highway in woodland habitat on 3 February 2016.

4.5.6 Grey-headed Flying Fox

One Grey-headed Flying Fox was recorded to the south of the New England Highway during spotlighting surveys foraging on flowering eucalypts on planted eucalypts on 26 January 2016.

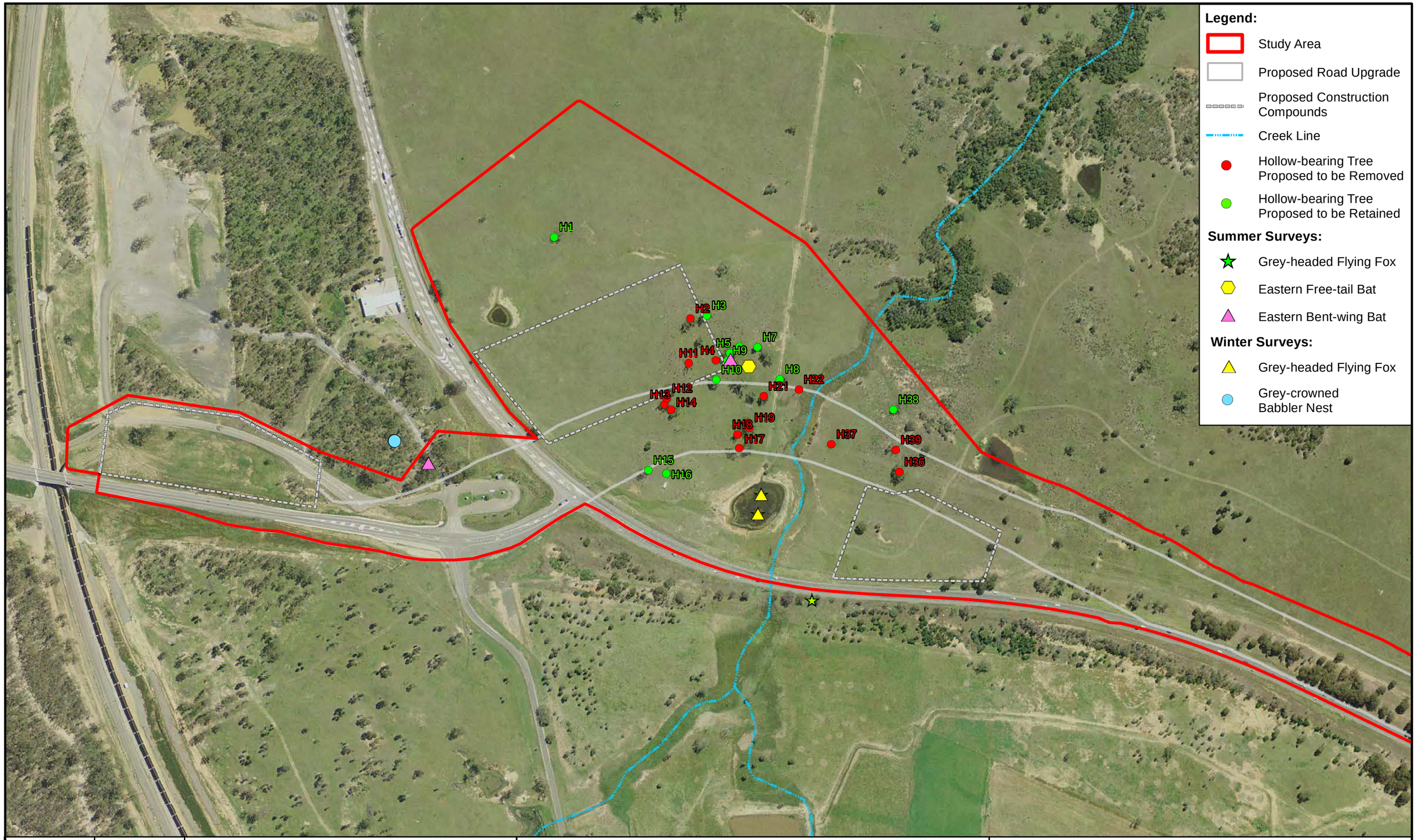
On 24 June 2016, during dawn winter bird surveys, two deceased (2) Grey-headed Flying Fox were observed tangled around a length of barbed-wire strung between fence-posts over a farm dam. The farm dam is located at the junction of Lot 21 DP 1014307 and Lot 4 DP 621020 (see Figure 4-4 for location). It is likely that they became entangled when flying close to the water's surface at night.

4.6 Hollow-bearing Trees

A total of 40 hollow bearing trees with a total of 151 hollows were recorded in the study area. 11 of the threatened fauna that have a moderate or higher likelihood of occurrence utilise tree hollows for roosting and breeding habitat.

These hollows would be used by a variety of fauna including mammals (e.g. Squirrel Glider), birds and microchiropteran bats. 90 small hollows, 55 medium hollows and five large hollows were recorded within the study area. The high percentage of small hollows indicates that the hollow resources within the study area would be an important resource for small mammals, birds and bats.

Refer to Figure 4-4 for the locations of the hollow-bearing trees within the study area, including likely removal and retention.



Author:	K. Lee
Reviewer:	T. Lambert
A3 Scale:	1:4,000
Job Ref:	11232

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Map Projection: GDA 1994 MGA Zone 56

Figure 4-4A

THREATENED FAUNA SPECIES & HOLLOW BEARING TREES

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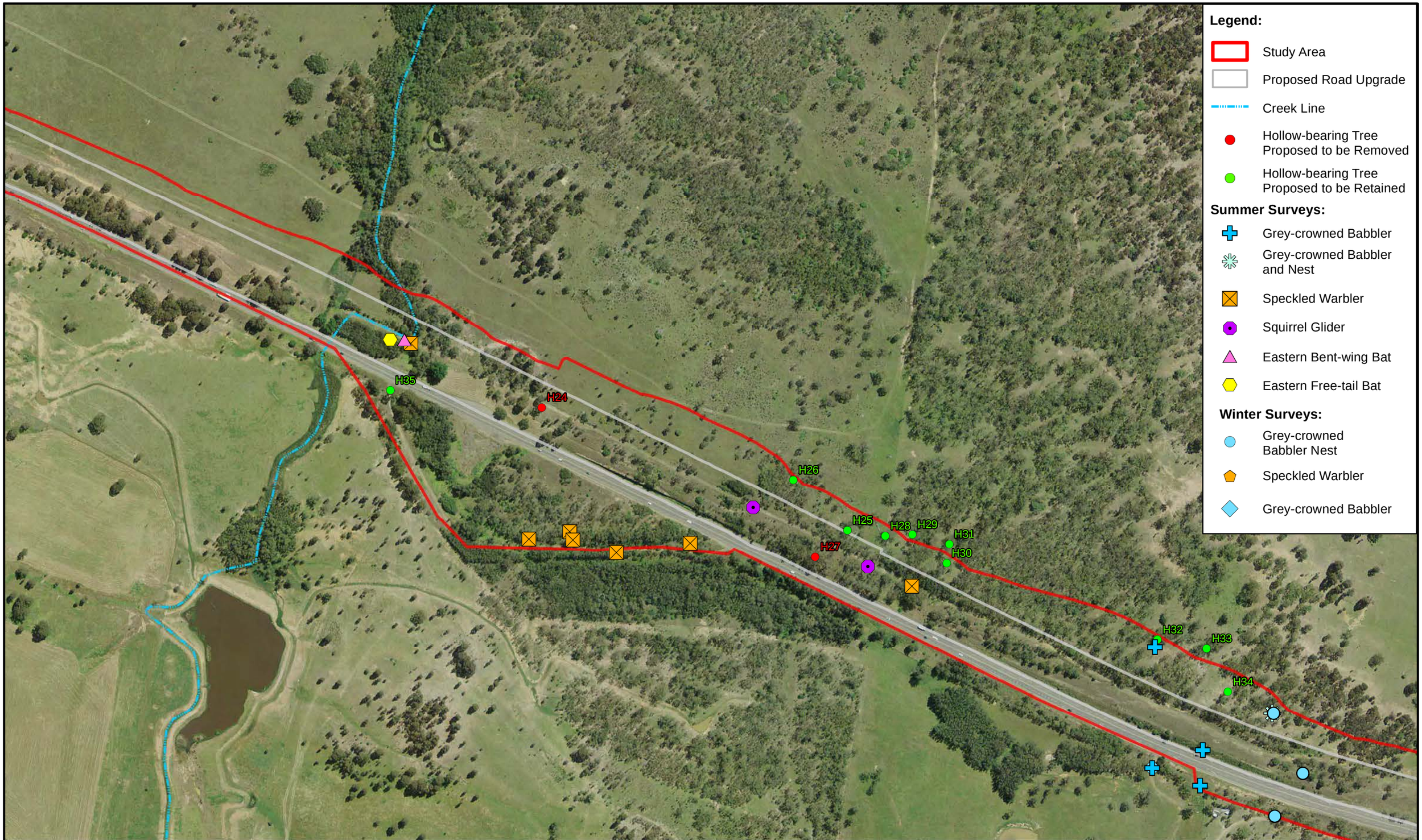

Legend:

- Study Area
- Proposed Road Upgrade
- Creek Line
- Hollow-bearing Tree Proposed to be Removed
- Hollow-bearing Tree Proposed to be Retained

Summer Surveys:

- Grey-crowned Babbler
- Grey-crowned Babbler and Nest
- Speckled Warbler
- Squirrel Glider
- Eastern Bent-wing Bat
- Eastern Free-tail Bat

Winter Surveys:

- Grey-crowned Babbler Nest
- Speckled Warbler
- Grey-crowned Babbler

Author:	K. Lee
Reviewer:	T. Lambert
A3 Scale:	1:4,000
Job Ref:	11232

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Map Projection: GDA 1994 MGA Zone 56

Figure 4-4B

THREATENED FAUNA SPECIES & HOLLOW BEARING TREES

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Reviewer:	T. Lambert
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Figure 4-4C

THREATENED FAUNA SPECIES & HOLLOW BEARING TREES

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4.7 Fauna Habitat

Three main fauna habitats were identified as occurring the study area. These three habitats provide a range of roosting, breeding and foraging habitat for commonly occurring and threatened species of fauna. The three fauna habitats are as follows:

- Open Forest/Woodland habitat;
- Cleared land; and
- Aquatic habitat.

4.7.1 Open Forest/Woodland

The open forest/woodland habitat within the study area includes the Spotted Gum – Narrow-leaved Ironbark – Red Ironbark shrub – grass open forest of the central hunter and lower hunter and the Swamp Oak Weeping Grass Grassy riparian forest of the hunter valley vegetation communities. This habitat type contains a number of fauna habitat features that provides habitat for a number of fauna species due to the high number of hollow-bearing trees and the presence of a wide range of microhabitat features. The condition of the habitat is moderate to good and the vegetation within the site has fragmented connectivity to greater regional vegetation patches to the south and north of the study area.

Canopy species present within this habitat comprised of *Corymbia maculata, Eucalyptus crebra, Eucalyptus moluccana, Eucalyptus fibrosa, Angophora floribunda, Eucalyptus tereticornis and Casuarina glauca.* These canopy species provide a range habitat resources including hollow-bearing trees which provide nesting opportunities for birds, nesting dens for arboreal mammals and roosting habitat for microchiropteran bats (refer to Figure 4-4). The eucalypt species provide nectar resources for a range of nectivorous birds and mammals year-round. Threatened species that were observed foraging in eucalypts include the Squirrel Glider and Grey-headed Flying Fox.

The understorey contained a mixture of low to high density shrub layer of Fabaceae species and a ground cover of grasses. The dense shrubs provided habitat for the threatened Speckled Warbler which was recorded within the woodland habitat. The edge of the woodland and cleared land provides habitat for the insectivorous species such as microchiropteran and threatened birds such as the Grey-crowned Babbler. A leaf litter of up to 10 cm was recorded in parts of this habitat, although it was generally observed between 0 – 5 cm deep. Decorticating bark and fallen timber was observed sparsely throughout this habitat, however, low-moderate fallen timber was recorded at four habitat assessment sites. Mistletoe was observed to occur at a low density within the study area, generally not being recorded over the majority of the study area.

Species recorded in Open Forest/Woodland within the study area included Eastern Brown Snake, Brown Thornbill, Eastern Yellow Robin, Yellow-faced Honeyeater, Squirrel Glider, Grey-crowned Babbler, Common Brush-tailed Possum, Speckled Warbler, Rainbow Lorikeet and Grey Butcherbird.

4.7.2 Aquatic Habitat

The study area aquatic habitat includes three farm dams, ditches on road verges and freshwater creeks and drainage lines. The farm dams provide potential habitat for a range of amphibians and waterbirds. The creeks and drainage lines were both ephemeral and permanent pools. The drainage lines were in poor to moderate condition with the creekline to the north of the study area containing native vegetation along the banks. The creekline in the south of the study area was in a highly degraded condition as all native vegetation has been removed. Fauna species recorded in this habitat included Dusky Moorhen, Common Eastern Froglet, Striped Marsh Frog and Eastern Water Skink.

4.7.3 Grassland

The grassland habitat is defined as the cleared land vegetation community. The habitat included exotic grassland and scattered paddock trees with a managed understorey. A number of hollow-bearing trees were recorded in the north of the study area in this habitat providing potential breeding and roosting habitat for a variety of mammals and birds. The grassland habitat provides foraging habitat particularly for insectivorous micro bats, small mammals and birds of prey, such as the Nankeen Kestrel and the Wedge-tailed Eagle. The understorey was absent with an exotic groundcover. The cleared land was generally devoid of essential micro habitat features such as leaf litter, fallen timber and understorey shrubs. Commonly occurring species recorded in this habitat included Eastern Grey Kangaroo, Australian Raven, Welcome Swallow, Australian Magpie-lark, Willie Wagtail, Crested Pigeon and Masked Lapwing. Pest species recorded in this habitat included the Black Rat and European Fox.

4.8 Riparian and Aquatic Habitat Assessment

The riparian habitat within the study area consisted of two creeks and three dams (Figure 3.3a to 3.3d). The two creeklines are tributaries of the Hunter River. The creekline in the north west of the study area (aquatic survey site 1) was cleared of the native riparian vegetation which is dominated by exotic grasses and cleared land. The creekline in the centre of the study area contained a combination of native canopy native and cleared riparian vegetation. The understorey of the native riparian contained was dominated by exotic vines and grasses (Plate 9). The remaining areas of the creeklines contained cleared exotic native vegetation. The dams in the study area contained a mixture of exotic and emergent aquatic vegetation (Plate 4). Slow water flow was recorded in both of the creeklines at aquatic survey sites 1 and 3. The creekline in the north west of the study area at aquatic survey site 1 of the contained permanent water (Plate 6 and Figure 3.3a). The remaining drainage lines contained ephemeral pools (Plate 7 and Plate 8). Barriers to fish passage included culverts and vehicle tracks. Water quality was likely to be poor as the water colour was brown indicating high dissolved sediment and algae was observed. Evidence of fox burrows and tracks were observed in the banks of the creekline located in the centre of the study area (aquatic survey site 2). A detailed description of the habitat features is provided in Table 4-3 and locations are shown on Figures 3-3a to 3.3d.

Plate 6: Permanent Pools

Plate 7: Disturbed Drainage Line

Plate 8: Ephemeral Drainage Lines

Plate 9: Riparian Vegetation

Table 4-3: Riparian and Aquatic Habitat

Habitat Attribute Description	Aquatic Survey Site									
	1	2	3	4	5	6 7 8	9	10	11	12
GPS Location (WSG94)	334586, 6386990	335579 6386491	335457 6386560	335457 6386621	335465 6386646	337160 6386006 337143 6386002 337226 6386000	337184 6385986	335614 6386403	336145 6386302	337085 6386040
DPI Fish Policy (2013) classification	Type 3 Class 4 unlikely fish habitat	Type 2 Class 3 minimal key fish habitat	Type 3 Class 4 unlikely fish habitat	Type 3 Class 4 unlikely fish habitat	Type 3 Class 4 unlikely fish habitat	Type 3 Class 4 unlikely fish habitat	Type 3 Class 4 unlikely fish habitat	Type 3 Class 4 unlikely fish habitat	Type 3 Class 4 unlikely fish habitat	Type 2 Class 3 minimal key fish habitat
Depth (m)	0.4m in pools.	Approx. 0.2 – 0.4m during rain event. No water during survey.	Approx. 1m.	0.5m	0.5m	0.4m. No water during survey.	Approx. 0.5m in pools during rain No water present during survey.	Wet area, no channel.	Approx. 0.3m after rain event. No water present during survey.	Approx. 1m after rain event. No water present during survey.
Flow / drainage filtration	Very slow through vegetation.	No water.	Slow	No flow.	No water.	No water.	No water.	No flow.	No water.	Evidence of fast flow during rain event.

Habitat Attribute Description	Aquatic Survey Site									
	1	2	3	4	5	6 7 8	9	10	11	12
Bed substrate	Clay & loam.	Clay & loose gravel or stones.	Clay & loam.	Clay & loam.	Clay & loam.	Clay.	Clay.	Clay & loam.	Clay & loam.	Clay.
Habitat Features	Pools, soaks, dense vegetation no canopy layer with dense exotic grassland	Ephemeral pools, Riparian vegetation with native canopy and a mixture of exotic and native moist soil.	Dam containing *Typha orientalis*. High exotic grass invasion	Dense exotic vegetation, permanent water in channel.	Dam type habitat. Permanent water with emergent native vegetation with high weed invasions	Pools during rain event. Dense exotic grasses Fauna burrows present.	Pools during rain event. Native riparian vegetation with minor weed invasions Fauna burrows present.	Dense exotic ground cover with native canopy cover	Ephemeral pools. Dense exotic ground cover with native canopy cover	Ephemeral pools, Riparian vegetation with native canopy and a mixture of exotic and native moist soil.
Infrastructure / Barriers to fish movement	Dam upstream.	Culverts beneath highway.	Culverts upstream to the south beneath highway.	Culverts upstream to the south beneath highway.	Culverts upstream to the south beneath highway.	Culvert plus vehicle track.	Culvert plus vehicle track.	None within immediate location of survey.	Culvert downstream to the south.	None within immediate location of survey.
Width (m)	1 – 3m	0.5 – 2m	Up to 10m	2m	4 – 5m	4m	1 – 2m	10m floodplain	2m	2 – 10m
Water Quality	Dark colour.	-	Dark. Algae present.	Dark brown.	Clear.	-	Light brown.	-	-	-

4.9 Culvert Inspections

Table 4-4 describes the results of nine culvert inspections and the locations of these are shown previously in Figure 3-3. Two of the culverts contained Swallow nests (Plate 10) and provide potential roosting habitat for micro bats (though none were observed). The culverts were a combination of pipe and box culverts with one culvert containing water (Plate 11 and Plate 12).

Table 4-4: Culvert Inspections

GPS Location	General Location	Culvert Size	Results
335577 6386549	Swamp Oak at western end of Patch 6 – North-side of highway.	three box culverts (approx. 1m x 1m)	No roosting bats or evidence of roosting bats observed.
335557 6386513	Swamp Oak to the west of Patch 5 – South-side of highway.	three box culverts (approx. 1m x 1m)	No roosting bats or evidence of roosting bats observed.
335458 6386560	South-west.	two box culverts (2.5m x 2m) South side	No roosting bats observed. Swallow nests may provide potential roosting habitat.
335454 6386606	North-west.	two box culverts (2.5 x 2m) North side	No roosting bats observed. Swallow nests may provide potential roosting habitat.
335976 6386351	Middle - Near Swamp Oak community. North side.	two pipe culverts (0.5m diameter)	No roosting bats or evidence of roosting bats observed.
335966 6386324	Middle - Near Swamp Oak community. South side.	Two pipe culverts (0.5m diameter)	No roosting bats or evidence of roosting bats observed.
336122 6386287	Middle – North side.	One pipe culvert (0.8m diameter)	No roosting bats or evidence of roosting bats observed.
336091 6386269	Middle – North side.	One pipe culvert (0.8m diameter)	No roosting bats or evidence of roosting bats observed.
337187 6385977	East – North side.	Two pipe culverts (0.5m diameter)	No roosting bats or evidence of roosting bats observed.

Plate 10: Box Culvert with Swallow's Nest

Plate 11: Pipe Culvert

Plate 12: Box Culverts

5 IMPORTANT BIODIVERSITY CONSIDERATIONS

5.1 Threatened Flora

5.1.1 EPBC Act Listed Flora Species

No threatened species of flora were recorded within the study area.

The EPBC Act protected matters search recorded 18 threatened flora species with potential habitat within a 20km radius of the study area.

Table 2 in Appendix 4 provides a description of the habitat for each of the threatened flora species listed on the EPBC Act and an assessment of the potential to occur within the study area. Four of the threatened flora species have been identified as having potential habitat within the study area. However, the habitat was degraded and/or the species was not recorded and therefore no impact assessment is required for any threatened flora species.

5.1.2 TSC Act Listed Flora Species

No threatened species of flora were recorded within the study area.

The OEH database search recorded 12 threatened flora species within a 20km radius of the study area (Figure 3-1) listed on the TSC Act. The PlantNet search recorded 15 threatened flora species listed on the TSC Act within a 25km radius around Branxton.

Table 2 in Appendix 4 provides a description of the habitat threatened flora species listed on the TSC Act and an assessment of the potential to occur within the study area. Four of the threatened flora species have been identified as having potential habitat within the study area. These include, *Rutidosis heterogama, Grevillea parviflora subsp. parviflora*, *Thesium australe, and Eucalyptus glaucina.*

A large number of records occur within the vicinity of the study area for *Eucalyptus glaucina.* This species is similar to *Eucalyptus tereticornis*, in that the juvenile leaves are ovate and glaucous. In addition, the leaves on the adult plants are grey green and the buds retain the glaucous colour. *Eucalyptus tereticornis* was recorded in five BioBanking plots and during random meander surveys throughout the study area in small numbers. These individuals were checked for characteristics of *Eucalyptus glaucina* and no individuals contained any of these characteristics. Whist the study area contained habitat this species was not observed; therefore, no impact assessment was completed. For the remaining three species, the habitat was degraded and/or the species was not recorded and therefore no impact assessment is required for any threatened flora species.

5.2 Threatened Fauna

5.2.1 EPBC Act Listed Fauna species

One species of threatened fauna species listed on the EPBC Act, the Grey-headed Flying Fox was recorded in the study area.

The EPBC Act protected matters search recorded 18 threatened fauna species with potential habitat within a 20km radius of the study area. Consisting of six bird, two frogs, nine mammals and one reptile.

Excluding the Grey-headed Flying Fox, seven threatened fauna species listed on the EPBC Act were assessed as having potential habitat within the study (Table 1, Appendix 4) these include one frog, two mammals and four birds as listed below.

- Green and Golden Bell Frog;
- Spotted-tailed Quoll;
- Koala;
- Regent Honeyeater;
- Swift Parrot;
- Australian Painted Snipe; and
- Painted Honeyeater.

In terms of habitat for the Swift Parrot and Regent Honeyeater, which were targeted during the winter surveys, the National Recovery Plan for the Swift Parrot (*Lathamus discolor*) (Saunders and Tzaros 2011) identifies Eucalypt woodlands and forests in Victoria and New South Wales as key foraging habitat during this species winter migration period. This species prefers larger trees that provide a more reliable foraging resource, typically in habitats of a less disturbed state. The National Recovery Plan identifies ten (10) tree species on mainland Australia suitable as a foraging resource for the Swift Parrot, including:

- *Eucalyptus leucoxylon* Yellow Gum;
- *E. tricarpa* Red Ironbark;
- *E. sideroxylon* Mugga Ironbark;
- *E. microcarpa* Grey Box;
- *E. albens* White Box;
- *E. melliodora* Yellow Box;
- *E. robusta* Swamp Mahogany;
- *E. tereticornis* Forest Red Gum;
- *E. pilularis* Blackbutt; and
- *Corymbia maculata* Spotted Gum.

The report *Swift Parrots and Regent Honeyeaters in the Lower Hunter Region of New South Wales* (Roderick *et al.* 2013) highlighted that four (4) of these tree species occur within the Hunter-Central Rivers Catchment Management Area, including:

- *Eucalyptus robusta* Swamp Mahogany;
- *E. tereticornis* Forest Red Gum;
- *E. pilularis* Blackbutt; and
- *Corymbia maculata* Spotted Gum.

Of these, mature *E. tereticornis* and *C. maculata* occur on the subject site, with the potential to act as a foraging resource for the Swift Parrot.

The National Recovery Plan for the Regent Honeyeater (2016) highlights that the majority of records of Regent Honeyeaters is in association with box-ironbark. The National Recovery Plan identifies the following flora species as key foraging resources for the Regent Honeyeater, including:

- *Eucalyptus sideroxylon* (Mugga or Red Ironbark);
- *E. melliodora* (Yellow Box);
- *E. albens* (White Box);
- *E. leucoxylon* (Yellow Gum);
- *Corymbia maculata* (Spotted Gum);
- *E. robusta* (Swamp Mahogany);
- *Amyema cambagei* (Needle-leaf Mistletoe), on *Casuarina cunninghamiana* (River Sheoak);
- *A. miquelii* (Box Mistletoe); and
- *Dendropthoe vitellina* (Long-flower Mistletoe).

The report *Swift Parrots and Regent Honeyeaters in the Lower Hunter Region of New South Wales* (Roderick *et al.* 2013) highlights eight (8) key-foraging flora species that occur within the Lower Hunter study area, including:

- *E. robusta* (Swamp Mahogany);
- *E. punctata* (Grey Gum);
- *E. eugenioides* (Thin-leaved Stringybark);
- *E.* sp. aff. *agglomerata* (Stringybark sp.) (undescribed);
- *E. fibrosa* (Broad-leaved Ironbark);
- *Corymbia maculata* (Spotted Gum);
- *Amyema miquelii* (Box Mistletoe); and
- *Dendropthoe vitellina* (Long-flower Mistletoe).

Of these, *E. fibrosa*, *C. maculata* and *A. miquelii* were recorded on the subject site, with the potential to act as a foraging resource for the Regent Honeyeater.

5.2.2 TSC Act listed Fauna Species

Six species of threatened fauna listed on the TSC Act (Figure 4-4) were recorded within the study area as follows:

- Speckled Warbler.
- Grey-crowned Babbler;
- Squirrel Glider;
- Grey-headed Flying Fox;
- Eastern Bent-wing Bat; and
- Eastern Freetail-bat.

The OEH database search recorded 40 threatened fauna species within a 20km radius of the study area. These threatened fauna species included one frog, 23 birds and 15 mammals. In addition to the recorded species, thirty threatened fauna species have been assessed (Table 1, Appendix 4) as having potential habitat within the study area and these include:

- Green and Golden Bell Frog;
- Australian Painted Snipe;
- Black-necked Stork;
- Little Lorikeet;
- Painted Honeyeater;
- Regent Honeyeater;
- Swift Parrot;
- Black-chinned Honeyeater;
- Brown Treecreeper;
- Diamond Firetail;
- Hooded Robin;
- Scarlet Robin;
- Turquoise Parrot;
- Varied Sittella;
- Black Falcon;
- Little Eagle;
- Square-tailed Kite;
- Powerful Owl;
- Masked Owl;
- Barking Owl;
- Brush-tailed Phascogale;
- Koala;
- Spotted-tailed Quoll;

- Eastern False Pipistrelle;
- Yellow-bellied Sheathtail Bat;
- Greater Broad-nosed Bat;
- Large-eared Pied Bat;
- Little Bent-wing Bat;
- Eastern Cave Bat; and
- Southern Myotis.

5.3 Endangered Populations

The habitat within the study area has the potential for three endangered populations listed on the TSC Act to occur within the vicinity of the study area (Appendix 4). The OEH database search records for these three endangered populations included *Acacia pendula* (two records), *Eucalyptus camaldulensis* (62 records) and *Cymbidium canaliculatum* (two records). *Cymbidium canaliculatum and Acacia pendula* have potential within the study area. These species are easily detected outside of their flowering period and no individuals were recorded during the field surveys. No habitat for *Eucalyptus camaldulensis* occurs within the study area.

5.4 Threatened Aquatic Species and Communities

No threatened endangered habitat, aquatic species, endangered populations or communities listed under the FM Act was recorded within the study area.

One threatened species of fish, Macquarie Perch, listed on the FM Act was recorded by the DPI records viewer for the Singleton LGA. No habitat for this species was recorded within the study area (Table 1, Appendix 4). No other threatened aquatic species, populations and or communities were identified as having habitat within the study area listed under the FM Act.

5.5 Threatened Ecological Communities

There is the potential for 22 threatened communities listed on the TSC Act and/or the EPBC Act to occur within the study area (Appendix 1). Two threatened ecological communities were recorded in the study area. One community is listed on both the TSC Act and the EPBC Act and the other is listed on the TSC Act. These communities are described in the sections below.

5.5.1 TSC Act Central Hunter Ironbark Spotted Gum Grey Box Forest

Spotted Gum – Narrow-leaved Ironbark – Red Ironbark shrub – grass open forest of the Central Hunter and Lower Hunter recorded (Figure 5-1) within the study area is consistent with Central Hunter Ironbark Spotted Gum Grey Box Open Forest listed as Endangered under the TSC Act. The community recorded within the study area meets the criteria for this community as it occurs in the Sydney Basin Bioregion on Permian Sediments. The canopy is dominated by *Corymbia maculata, Eucalyptus crebra* and *Eucalyptus moluccana* and contains the characteristic species listed in the Scientific Determination. Figure 5-1 shows the location of this community within the study area.

5.5.2 TSC Act Swamp Oak Floodplain Forest

Swamp Oak Weeping grass grassy riparian forest of the hunter valley within the study area is consistent with Swamp Oak Floodplain Forest listed as Endangered under the TSC Act. The community recorded (Figure 5-1) within the study area meets the criteria for listing as the community occurs in the Sydney Basin Bioregion on a coastal floodplain, being the Hunter River Floodplain. The vegetation occurs on poorly drained sandy loam soils of the Hunter River. The community is at an elevation of below 10 m and below the 1 in 100-year flood level. *Casuarina glauca* is the dominant canopy species and it contains the characteristic understorey and ground layer species listed in the scientific determination. Figure 5-1 shows the location of this vegetation community.

5.5.3 EPBC Act Central Hunter Valley Eucalypt Forest and Woodland Complex

Central Hunter Valley Eucalypt Forest and Woodland Complex was listed in late 2015 as critically endangered under the EPBC Act. The vegetation community of Spotted Gum – Narrow-leaved Ironbark – Red Ironbark shrub – grass open forest of the Central Hunter and Lower Hunter has the potential to meet the criteria for the federal listing of Central Hunter Valley Eucalypt Forest and Woodland Complex. Table 5-1 below outlines the key diagnostic criteria against the community recorded within the study area. Portions of the Spotted Gum – Narrow-leaved Ironbark – Red Ironbark shrub – grass open forest of the Central Hunter and Lower Hunter within the study area meet the key diagnostic criteria for listing as described in the following section.

Table 5-1: Central Hunter Valley Eucalypt Forest/Woodland Key Diagnostic Characteristics

Key Diagnostic Characteristic	Response
It occurs in the Hunter River catchment (typically called the Hunter Valley region) **AND**	Occurs within the Hunter River Catchment
It typically occurs on lower hillslopes and low ridges, or valley floors in undulating country; on soils derived from Permian sedimentary rocks; **AND**	Occurs the lower slopes and undulating hills on soils derived from Permian sediments and not on alluvial soils
It does not occur on alluvial flats, river terraces, Aeolian sands, Triassic sediments, or escarpments; **AND**	The community is on the Yellow and Red Podzolic soils of the Branxton and Rothbury soil types which are derived from Permian sediments as mapped by the Soil Landscapes of the Singleton 1:250,000 map sheet.
It is woodland or forest, with a projected canopy cover of trees of 10% or more; or with a native tree density of at least 10 native tree stems per 0.5 ha (at least 20 native tree stems/ha) that are at least one metre in height **AND**	The projected canopy cover is 15 to 25%
The canopy of the ecological community is dominated by one or more of the following four eucalypt species: *Eucalyptus crebra* (narrow-leaved ironbark), *Corymbia maculata* (syn. *E. maculata*) (spotted gum), *E. dawsonii* (slaty gum) and *E. moluccana* (grey box); **OR** a fifth species, *Allocasuarina luehmannii* (bulloak, buloke) dominates in combination with one or more of the above four eucalypt species, in sites previously dominated by one or more of the above four eucalypt species **AND**	The community is dominated by *Corymbia maculata* and *Eucalyptus crebra*
Allocasuarina torulosa (forest oak/ she-oak, rose she-oak/oak), *Eucalyptus acmenoides* (white mahogany) and *E. fibrosa* (red/broad-leaved ironbark) are largely absent 15 from the canopy of a patch and **AND**	*Eucalyptus fibrosa* occurs occasionally throughout the community however it is lower than 5% of the canopy cover. *Eucalyptus acmenoides* and *Allocasuarina torulosa* are absent.

Key Diagnostic Characteristic	Response
A ground layer is present (although it may vary in development and composition), as a sparse to thick layer of native grasses and other native herbs and/or native shrubs.	The groundlayer consists of native grasses such as *Rytidosperma tenuior, Chloris ventricosa and Bothriochloa macra, with native herbs us as Calotis sp. Dichondra repens and Cheilanthes sieberi.* A moderate invasion of exotic herbs and grasses occur within the groundlayer.
Does the community meet the key characteristics:	Yes

Condition Classification of the Central Hunter Valley Eucalypt Forest/Woodland

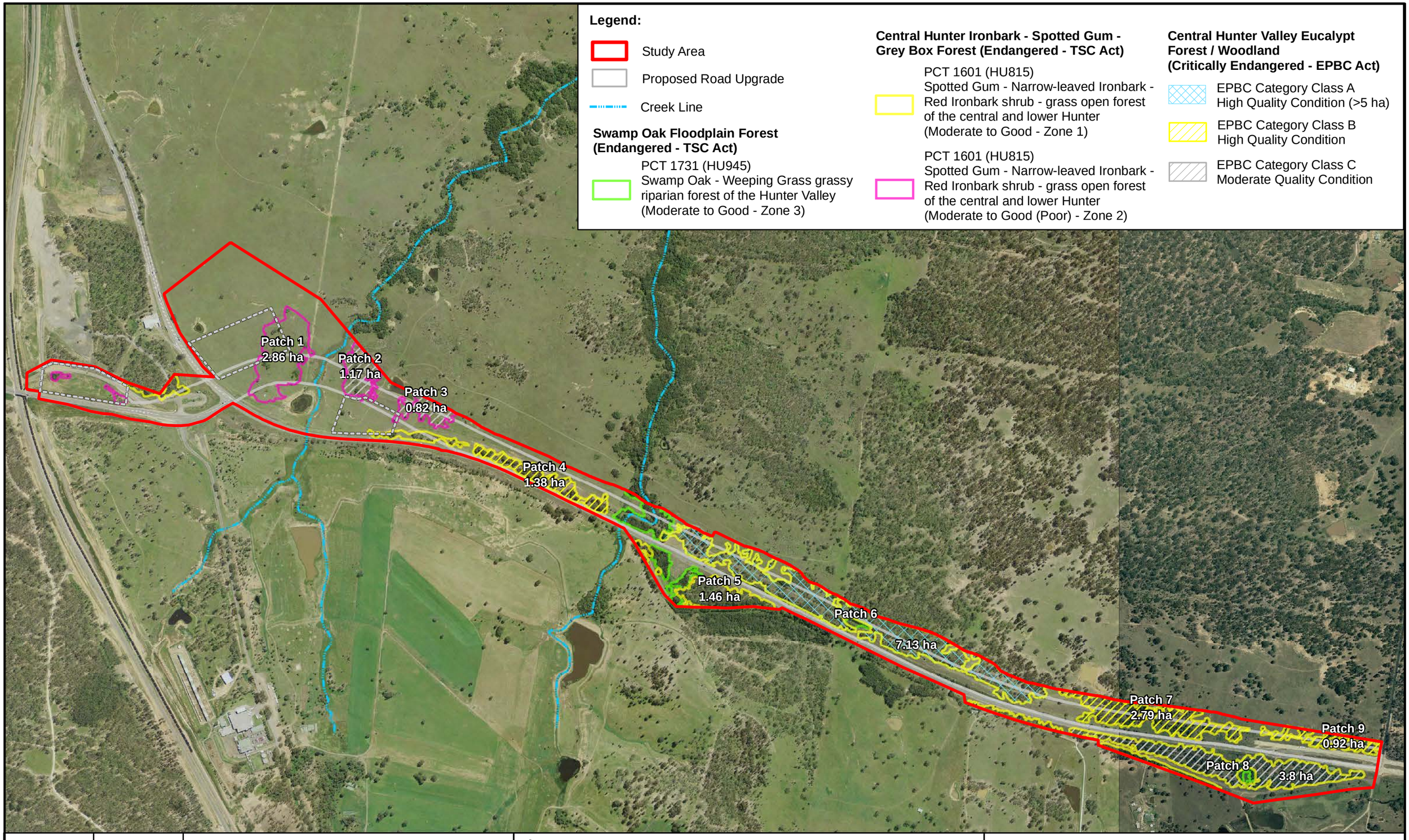
The conservation advice (Threatened Species Scientific Committee, 2015) for this community outlines the criteria to determine if a field verified community meets the EPBC Act listing. The conservation advice has classified the community in four classes. If the vegetation does not meet any of the criteria listed below then the vegetation does not meet the criteria for listed as the EPBC Act community. These classes are as follows:

- Class A high quality is Patch size ≥ 5 ha **and** ≥50% of perennial understorey cover is native and contains at least 12 native understorey species;
- Class B high quality Is Patch size ≥ 0.5 ha **and** ≥70% of perennial cover in all floristics layers is native **and** contains at least 12 native understorey species;
- Class C moderate quality Is Patch size ≥ 0.5 ha **and** ≥50% of perennial understorey cover is native **and** contains at least 12 native understorey species; and
- Class D moderate quality Patch size ≥ 2 ha and ≥50% of perennial understorey is native **AND one** of the following:
    - The patch is contiguous with another patch of native vegetation ≥1 ha; **or**
    - The patch size has a least one large locally native tree (≥60 cm dbh) or at least one tree with hollows.

In the study area the Spotted Gum – Narrow-leaved Ironbark – Red Ironbark shrub – grass open forest of the Central Hunter and Lower Hunter vegetation community has the potential to meet the criteria for the listing of Central Hunter Valley Eucalypt Forest and Woodland. This community occurred in nine patches within the study area (Figure 5-1). These patches were assessed against the criteria for this threatened community. Of these, seven patches meet the criteria for listing under the EPBC Act. This assessment included a condition assessment in accordance with the conservation advice (Threatened Species Scientific Committee, 2015). Outlined below is a summary of the condition class assessment for the Spotted Gum – Narrow-leaved Ironbark – Red Ironbark shrub – grass open forest of the Central Hunter and Lower Hunter recorded in the site against the criteria for this critically endangered community. Refer to Figure 5-1 for patch locations.

- Class A high quality condition:
    - Patch six is 7.13 ha midstorey is 70% and 25 native understorey species are present
- Class B high quality condition:
    - Patches four, seven and nine are all lower than 5 ha but have >70% cover in all floristic layers and have more than 12 native understorey species.
- Class C moderate quality:
    - Patches two, three and eight are < 5 ha, perennial understorey cover is < 70% and have >12 native species in the understorey.
- Patches one and five do not meet the criteria for listing on the EPBC Act.

The conservation advice for this community (Threatened Species Scientific Committee, 2015) states that all patches that meet the above criteria for listing are considered as habitat critical to the survival of this community. Therefore, patches two, three, four, six, seven, eight and nine are critical to the survival of this community.



Author:	K. Lee
Reviewer:	T. Lambert
A3 Scale:	1:10,000
Job Ref:	11232

N

0 120 240 480
Metres

Map Projection: GDA 1994 MGA Zone 56

Figure 5-1

THREATENED ECOLOGICAL COMMUNITIES & PATCH SIZE

ARUP B2GH | Belford, NSW, Australia

04 November 2016

EPS

ENVIRONMENTAL PROPERTY SERVICES

5.6 Migratory Species

The EPBC Act protected matters database search identified one migratory marine species, nine terrestrial migratory species and five migratory wetland species with the potential to occur within the study area (Table 1 in Appendix 4). These migratory species include the following:

- Fork-tailed Swift;
- Oriental Cuckoo;
- White-throated Needletail;
- Rainbow Bee-eater;
- Black-faced Monarch;
- Spectacled Monarch;
- Yellow Wagtail;
- Satin Flycatcher;
- Rufous Fantail;
- Eastern Great Egret;
- Cattle Egret;
- Latham's Snipe;
- Osprey; and
- Common Greenshank.

Three threatened species being the Swift Parrot, Australian Painted Snipe and the Regent Honeyeater are listed as migratory. These species have potential foraging habitat within the study area. Significant impact assessments for these species have been conducted in Appendix 7.

5.6.1 Relevant Migratory Species

The White-throated Needletail was recorded in the study area. The following non-threatened migratory species also have potential habitat within the study area;

- Rainbow Bee-eater;
- Fork-tailed Swift; and
- Cattle Egret.

Under the EPBC Act listed migratory species have areas of important habitat. The EPBC Act Significant impact guidelines for Matters of National Significance (2013) defines important habitat for migratory species as:

- Habitat utilised by migratory species occasionally or periodically within a region that supports ecological significant proportion of the species; and /or

- Habitat that is of critical importance to the species at particular life-cycle stages; and/or
- Habitat utilised by a migratory species which is at the limit of the species range; and/or
- Habitat in an area where the species is declining.

The study area would provide habitat for the White-throated Needletail and potential habitat for the Rainbow Bee-eater, Fork-tailed Swift and the Cattle Egret. The habitat within the study area is degraded and whilst it contains foraging habitat it would not be classified as important habitat under the EPBC Act significant assessment guidelines (2013) for these species.

5.7 Wildlife Connectivity Corridors

Wildlife corridors provide linkages as stepping stones within a fragmented landscape between native vegetation (Wilson & Lindenmayer, 1995). This connectivity provides fauna with linkages to foraging, breeding and roosting habitat. Connectivity corridors may also provide refuge from fire, avoidance of predators and retention of population levels through genetic linkages.

The riparian vegetation and road side vegetation to the north of the New England Highway provides connectivity in the local landscape to Belford National Park to the east and fragmented connectivity to the north to the Hunter River.

The vegetation to the south west of the New England Highway is linked to fragmented vegetation which extends to the Pokolbin State Forest and the Howes Valley. Connectivity to this large area of native vegetation would provide a range of arboreal and more mobile fauna access to these areas from the study area.

5.8 Groundwater Dependent Ecosystems

Groundwater Dependent Ecosystems (GDEs) are ecosystem that are wholly dependent or partially dependent on groundwater for their water requirements (Hatton & Evans, 1998). The NSW State Groundwater Dependent Ecosystem Policy has outlined five principles to manage impacts to groundwater dependent ecosystems (GDEs) (Department of Land and Water Conservation 2002). These principles have been developed to protect and manage GDEs. These policies include avoidance of threats, management of groundwater extraction to ensure the health of the GDE is maintained, maintenance of water quality, adoption of the precautionary principle to protect GDEs and management of developments, land use activities should aim to maintain natural patterns of GDE water flow, not polluting or causing changes in water quality and rehabilitating of degraded GDEs systems where practical.

The study area is located on Podzolic soils derived from Permian sediments. The creekline that supports the Swamp Oak Weeping Grass Grassy riparian forest is unlikely to be groundwater dependent.

No groundwater drawdown is proposed as part of the project. The upgrade of the New England Highway is unlikely to decrease any surface water flow rates which would be recharging the alluvial aquifers. The project is unlikely to impact upon groundwater levels and/or ecosystems with depend upon groundwater resources.

5.9 State Environmental Planning Policies

5.9.1 State Environmental Planning Policy No 44 Koala Habitat Management

SEPP 44 applies to each local government area (LGA) listed in Schedule 1 of the SEPP. The project occurs within the Singleton LGA and is listed on Schedule 1 of the SEPP. Part 2 of SEPP 44 outlines development control of koala habitats only applies to the following land:

> *(a) that is land to which this Policy applies, and*
> *(b) that is land in relation to which a development application has been made, and*
> *(c) that:*
>
> > *(i) has an area of more than 1 hectare, or*
> > *(ii) has, together with any adjoining land in the same ownership, an area of more than 1 hectare, whether or not the development application applies to the whole, or only part, of the land.*

The field surveys determined that there is one 'supplementary' Koala feed tree species present as listed under Schedule 2 of SEPP 44 for the Singleton Shire Council and the North Coast Koala Management area in the approved Koala Recovery Plan (Department of Environment and Climate Change 2008b). This species is Forest Red Gum *E. tereticornis* which generally comprises less than 15% of the total trees. Therefore, the study area does not comprise core or potential koala habitat. No evidence of the presence of Koala (such as scats, scratches etc.) were recorded. The construction of the proposed upgrade of the New England Highway and associated infrastructure involves the removal of a comparatively limited amount of vegetation and the impact to this species is expected to be minimal. Impact assessments under the TSC Act and the EPBC Act have been undertaken in Appendix 7.

5.10 Other Ecological Values and Matters of National Significance

5.10.1 World Heritage

No world heritage properties of places were identified by the EPBC Act protected matters search.

5.10.2 Ramsar Wetland

One RAMSAR wetland of international importance was identified by the protected matters database search being Hunter estuary wetlands. This wetland occurs at the estuarine areas of the Hunter River. The study area occurs 60 km upstream of this wetland and is unlikely to have an impact upon this wetland.

No other MNES are relevant to this project.

6 IMPACT ASSESSMENT

6.1 Types of Impact

The project has the potential to impact biodiversity during both the construction and operational phases.

Potential impacts from the project during the construction phase include:

- Vegetation and habitat loss;
- Loss of hollow-bearing trees;
- Habitat fragmentation, edge and barrier effects;
- Aquatic habitat degradation;
- Fauna injury and mortality;
- Increase in spread of weeds;
- Pests and pathogens;
- Changed hydrology;
- Noise, vibration and light;
- Impact on key threatening processes; and
- Cumulative impacts.

Potential impacts from the project during the operation phase include:

- Fauna injury and mortality;
- Increase in the spread of weeds;
- Changed hydrology;
- Aquatic impacts; and
- Cumulative impacts.

6.2 Vegetation Impacts

6.2.1 Summary

Vegetation loss resulting from the project is predicted to amount to 27.73 ha (including 16.20 ha disturbed/cleared areas).

The loss of vegetation will include two threatened communities (refer Table 6-1 below). This will include the loss of 11.23 ha of endangered ecological communities, being Central Hunter Spotted Gum Grey Box Forest and Swamp Oak Floodplain Forest as listed on the TSC Act. A total of 8.20 ha of impacted vegetation

also meets the criteria for the federal listing for the critically endangered ecological community of Central Hunter Valley Eucalypt Forest and Woodland as listed on the EPBC Act.

Table 6-1: Vegetation Loss

Field verified Vegetation Community[1]	TSC Act status/name	EPBC Act status/name	Proposed area of removal (ha)
Spotted Gum – Narrow-leaved Ironbark – Red Ironbark shrub – grass open forest of the central hunter and lower hunter	Endangered Central Hunter Ironbark – Spotted Gum Grey Box Forest	-	10.40
Spotted Gum – Narrow-leaved Ironbark – Red Ironbark shrub – grass open forest of the central hunter and lower hunter. (In part)	-	Critically Endangered Central Hunter Valley eucalypt Forest and Woodland	Class A - 3.94 Class B – 3.27 Class C – 0.99 Total EPBC Act 8.20
Swamp Oak Weeping grass grassy riparian forest of the hunter valley	Endangered Swamp Oak Floodplain Forest	Not Listed	0.83
Farm Dams and cleared riparian	-	-	0.30
Cleared Land	-	-	16.20
Total all vegetation			**27.73**
Total TSC Act threatened community			**11.23**
Total EPBC Act threatened community			**8.20**

Notes:

1. Not all the of the patches mapped as Spotted Gum – Narrow-leaved Ironbark – Red Ironbark shrub – grass open forest of the central hunter and lower hunter meet the criteria for listing under the EPBC Act.

2. No removal of farm dams is proposed, only removal of cleared riparian vegetation

6.2.2 Impacts to Critically Endangered Central Hunter Valley Eucalypt Forest/Woodland

Central Hunter Valley Eucalypt Forest and Woodland is listed as critically endangered under the EPBC Act because of a decline in extent, a restricted distribution, being highly fragmented, and a reduction in community integrity (Threatened Species Scientific Committee, 2015).

The extent of distribution of this community has declined in recent years with an estimated extent of 37,000 ha (Peake 2006). This decline has been estimated to be 65% of the pre-European extent. The current patch sizes of the remaining extent of the community is estimated to be an average of 1.7 ha in size, with 86% of the patch sizes less than 10 ha (Threatened Species Scientific Committee, 2015).

The proposal will reduce the extent of this community within the construction footprint by 8.20 ha. One of the patches recorded within the study area is 7.1 ha in size, which is in the high range for remaining patch size for this community. This patch size is classified as high quality class A in accordance with the criteria set out by the Commonwealth Threatened Species Scientific Committee. The proposal will result in decreasing the size of this patch to 3.9 ha which equates to 54% of the current patch size. Furthermore, any area of the EPBC Act listed community that meets the criteria for moderate or higher quality is defined as habitat that is critical to the survival of the community.

The impact assessment undertaken in Appendix 7 for this community determined a significant impact upon this community.

The conservation advice for this community states that the minimum threshold for a patch to be the subject of a referral under the EPBC Act is moderate or higher condition. Two of the patches within the study area (one and five) do not meet the criteria for the federal listing. The remaining seven patches within the study area are all in moderate and high condition class. Roads and Maritime currently is not required to submit a referral to the Commonwealth, however a strategic assessment is required.

6.2.3 Impacts to Central Hunter Spotted Gum Ironbark Forest

Central Hunter Spotted Gum Ironbark Forest is listed as endangered on the TSC Act. The community within the study area has been modified due to previous land uses and already fragmented. The project will remove a linear strip of this community within the locality. Peake (2006) has mapped 15,605 ha of this community within the Singleton LGA and 18,305 ha within the Central Hunter. As shown in Figure 4-2, the clear majority of the extensive remnant vegetation in the immediate locality is comprised of this community. The removal of 10.40 ha of this community equates to 0.06 % removal in the locality and 0.07 % of the extent of this community in the Central Hunter. Extensive areas of this community in the immediate locality adjoining the study area. Therefore, it is considered that the removal of a comparatively minor area of this community is not likely to place the local occurrence of this community at risk of extinction.

The impact assessment in Appendix 7 concluded that the project is unlikely to have a significant impact upon this community under the TSC Act.

6.2.4 Impacts to Swamp Oak Floodplain Forest

Swamp Oak Floodplain Forest is listed as endangered on the TSC Act. The project proposes to remove a small area (0.8 ha) of degraded extent of this community. The understorey is dominated by weeds with the shrub layer absent. The removal will result a reduction of 0.07% of the extent of this community within the locality and 0.06% of the extent of this community in the Central Hunter. The significant impact

assessment in Appendix 7 concluded that the project is unlikely to have a significant impact upon this community.

6.3 Fauna Habitat Loss

Direct fauna loss includes all habitats of open forest/woodland, aquatic habitat and cleared land (refer Table 6-2).

Table 6-2: Fauna Habitat Loss

Fauna habitat	Corresponding vegetation community	Proposed removal (ha)
Open Forest/Woodland	Spotted Gum – Narrow-leaved Ironbark – Red Ironbark shrub – grass open forest of the central hunter and lower hunter. Swamp Oak Weeping grass grassy riparian forest of the hunter valley	11.23
Aquatic	Farm dams and cleared riparian	0.30[1]
Grassland	Cleared Land	16.20
Total		**27.73**

1. Aquatic habitat removal is of Cleared riparian areas only, not the farm dams.

6.3.1 Hollow-bearing Trees

Forty hollow-bearing trees with 151 hollows were recorded within the study area. Eighteen hollow-bearing trees are proposed to be removed as part of the upgrade of the New England Highway and 22 hollow-bearing trees are likely to be retained within the study area. Hollow-bearing trees provide important roosting and breeding habitat for a range of birds and mammals. The highest size class of hollows recorded within the study area was <10cm and these hollows provide habitat for small hollow dwelling fauna such as birds, arboreal mammals and microbats. The Squirrel Glider was recorded along the north of the New England Highway and this species utilises small hollows for roosting and breeding. Removal of hollow-bearing trees would be reducing nesting habitat for this species. Proposed mitigation measures are outlined in Section 7.

6.4 Threatened Species

Appendix 7 contains impact assessments for all threatened species recorded or considered to have potential habitat within the study area. No threatened flora species were recorded. Those threatened fauna species recorded have been discussed below. As outlined in further detail in Appendix 7, no threatened species were considered to be significantly impacted by the project.

6.4.1 Speckled Warbler

The Speckled Warbler is frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast. Wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy.

This species was recorded at seven locations on both sides of the New England Highway. Refer to Figure 4-4 for recorded locations. The Speckled Warbler was observed foraging in dense understorey in open forest and woodland habitat within the study area. The study area provides known foraging, roosting and breeding habitat for this species.

The Speckled Warbler is a sedentary woodland species and the proposal will remove a small linear portion of habitat for this species. A large expanse of higher quality habitat occurs to the north of the New England Highway, which provides foraging, breeding and roosting habitat for this species. The proposal will remove or modify a maximum of 11.23 ha of habitat within the study area. Whilst the proposal will remove known habitat for this species, it is considered unlikely to have an adverse effect on the life cycle of the Speckled Warbler such that a viable local population will be placed at risk of extinction. The local population is highly likely to extend in all directions immediately outside of the study area.

6.4.2 Grey-crowned Babbler

The Grey-crowned Babbler inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Grey-crowned Babblers occupy open woodlands dominated by mature eucalypts, with regenerating trees, tall shrubs, and an intact ground cover of grass and forbs. The species builds conspicuous dome-shaped nests and breeds co-operatively in sedentary family groups of 2-13 birds (Davidson and Robinson 1992). Grey-crowned Babblers are insectivorous and forage in leaf litter, on bark of trees, trunks and branches of eucalypts and other woodland trees, or on the ground, digging and probing amongst litter and tussock grasses.

This species was recorded at five locations on both sides of the New England Highway. Refer to Figure 4-4 for locations. The Grey-crowned Babbler was observed foraging within the forested habitat within the study area. Six Grey-crowned Babbler nests were recorded in the study area. The study area provides foraging, roosting and breeding habitat for this species.

A large expanse of high quality habitat occurs to the north of the New England Highway, which provides contiguous foraging, breeding and roosting habitat for this species. Whilst the proposal will remove habitat for this species, it is considered unlikely to have an adverse effect on the life cycle of the Grey-crowned Babbler such that a viable local population will be placed at risk of extinction. Extensive habitat will remain in the immediate locality.

6.4.3 Squirrel Glider

Inhabits mature or old growth box, box-ironbark woodlands and river red gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia mid-storey. Uses tree hollows as den sites. Diet varies seasonally and consists of Acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein.

This species was recorded at two locations on the northern side of the New England Highway. Refer to Figure 4-4 for recorded locations. The Squirrel Glider was observed foraging in flowering Eucalypts in the forested habitat within the study area. A large number of hollow-bearing trees with suitable hollows for this species were recorded in the study area. From a total of 40 hollow-bearing trees, 18 (45%) are required to be removed for the project. The study area provides foraging, roosting and breeding habitat for this species.

A large expanse of high quality habitat occurs to the north of the New England Highway, which provides foraging, breeding and roosting habitat for this species. The proposal will remove hollow-bearing trees which would reduce breeding habitat for this species. The widening of the New England Highway as a result of the proposal would widen the barrier for this species to access foraging and breeding habitat on the south side of New England Highway. The proposal is considered unlikely to result in an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction. This is primarily due to the extensive habitat that extends to the north and south of the study area. However, it is considered that existing connectivity for the Squirrel Glider across the existing New England Highway, which is as close as 15m currently (a distance over which the species could glide) would be widened to over 50m. If connection structures such as glider poles or arboreal rope crossings are installed, this would mitigate any impacts to the life cycle of the Squirrel Glider such that a viable local population will be placed at risk of extinction.

6.4.4 Grey-headed Flying Fox

This species is generally found within 200 km of Australia's eastern coast. Generally, occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are commonly found in gullies, close to water, in vegetation with a dense canopy.

This species was recorded at one location on the southern side of the New England Highway. The Grey-headed Flying Fox was observed foraging on flowering eucalypts within the study area. Two deceased Grey-headed Flying Fox were also observed at the junction of Lot 21 DP 1014307 and Lot 4 DP 621020 entangled on barbed wire strung across a farm dam. The study area provides foraging, habitat for this species however, no camps are in the study area.

A large expanse of high quality habitat occurs to the north of the New England Highway, which provides foraging habitat for this species. No breeding or roosting habitat such as camps were recorded in the study area. Whilst the proposal will remove habitat for this species, it is considered unlikely to have an adverse effect on the life cycle of the Grey-headed Flying Fox such that a viable local population will be placed at risk of extinction.

6.4.5 Eastern Bent-wing Bat

This species forages in a range of habitat types. Roosts in caves, derelict mines, culverts and other man-made structures. Form maternity colonies that are faithful to particular caves.

Eastern Bent-wing Bat was recorded by Anabat within the study area (refer to Figure 4-4). The study area provides foraging habitat for this species. No roosting or breeding habitat in the form of caves and other structures such as mine shafts were recorded within the study area. This species is insectivorous and the reduction in a small amount of foraging habitat is unlikely to impact on the availability of foraging resources significantly.

A large expanse of high quality habitat occurs to the north of the New England Highway, which provides foraging habitat for this species. The proposal is unlikely to impact on the lifecycle of this species such that a viable local population will be placed at risk of extinction.

6.4.6 Eastern Freetail-bat

The Eastern Freetail-Bat is found along the east coast from Southern QLD to Southern NSW. Occurs in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark.

Eastern Freetail-bat was recorded by Anabat within the study area. The study area provides foraging, roosting and breeding habitat this species. A large number of hollow-bearing trees were recorded within the study area (40) which contain suitable hollows for breeding and roosting for this bat. The proposal will remove 18 hollow-bearing trees which would reduce roosting sites for this species. The species is insectivorous and the reduction in a small amount of foraging habitat is unlikely to impact on the availability of foraging resources.

A large expanse of high quality habitat occurs to the north of the New England Highway, which provides foraging, breeding and roosting habitat for this species. The proposal is unlikely to impact on the lifecycle of these species such that a viable local population, will be placed at risk of extinction.

6.5 Aquatic habitat

The aquatic assessment conducted as part of the project assessed the aquatic habitat within the study area (Table 3-4). Potential impacts that may occur as a result of the project include the following:

- Loss of riparian and aquatic habitat;
- Changes to hydrology, turbidity and sedimentation;
- Obstructions to fish passage; and
- Increase in Key Threatening Processes under the FM Act.

The riparian vegetation within the study area is currently disturbed with several drainage lines containing exotic vegetation with little native vegetation being present. The water quality was poor with the majority of the creeks having no flow or slow flow and were shallow. Barriers to fish passage include culverts and vehicle tracks and dams upstream. Water quality was likely to be poor as the water colour was quite brown indicating high dissolved sediment and algae also being observed. Evidence of fox burrows and tracks were observed in the banks of the creekline within fringing Swamp Oak Forest.

The project will remove a small area of riparian vegetation and during the construction phase soil is exposed and this may result in additional sedimentation and erosion of the aquatic habitat. This impact is likely to be mitigated if the measures outlined in Section 8 are adhered to.

Existing obstructions to fish passage in the study area are upstream dams, culverts and vehicle tracks. The project will widen the existing culverts although this is considered unlikely to substantially impact upon the aquatic habitat within the study area.

Eight Key Threatened Processes (KTPs) are listed on the FM Act (Appendix 6). Three marine KTPs have been excluded from this assessment. Of the five remaining KTPs, two being anthropogenic climate change and degradation of native riparian vegetation have the potential to be increased by the project. The project is unlikely to substantially exacerbate the KTPs (Appendix 6).

6.6 Habitat Fragmentation, Edge and Barrier Effects

Habitat fragmentation can result in a barrier for fauna and flora to the function of ecosystems and species life cycles. Types of fauna impacted include mammals, both ground dwelling and arboreal and sedentary fauna. Reduction in connectivity can impact upon access to resources, predator avoidance and breeding capacity (Roads and Maritime Services, 2011a).

Barriers to plant lifecycles include barrier to pollinator vectors such as arboreal mammals, insects and sedentary birds. These barriers can genetically isolate populations of both common and threatened plant species.

6.6.1 Habitat Fragmentation

The project will involve the widening of the New England Highway. Vegetation along the road verges will be impacted during the upgrade. The vegetation to the north of the New England Highway contains much larger areas of vegetation and while these patches are fragmented to a certain degree, overall they are well connected over an expansive area. The project will widen the areas of disturbance but is unlikely to further fragment the vegetation within the study area to a substantial degree.

6.6.2 Edge and Barrier Effects

The project will involve the widening of the existing New England Highway. The project will remove 27.73 ha of vegetation (16.20 ha already cleared) and it is expected that this widening could affect connectivity for the threatened Squirrel Glider. This species was recorded in the vegetation on the north of the New England Highway. The widening of this connectivity is likely to increase the existing narrow gap between Squirrel Glider habitat. Squirrel Gliders have a maximum gliding distance of approximately 70 m (NSW Scientific Committee, 2008). The current distance between the remnant vegetation areas either side of the existing highway is approximately 15-30 m. The project would increase this distance from one side of the highway to the other to a conservative maximum of approximately 75 to 80 m. This could result in a barrier to the movement of the Squirrel Glider population post-construction. Mitigation measures outlined in Section 7 would reduce the impact from the project on the movement of arboreal mammals such as Squirrel Glider.

The edge effects are already relatively high and the widening of the existing road is not expected to exacerbate this effect to a substantial degree except for the Squirrel Glider.

Pollinator and seed dispersal vectors for flora species are likely to include birds, mammals, insects and micro bats. The widening of the New England Highway is unlikely to create result in a barrier for flora species pollinators than already is occurring.

The Squirrel Glider forages on flowering species such as eucalypts and understorey shrubs. The barrier to pollination as a result of the movement of this species would have minimal impact on flora as other fauna species would also currently pollinate the flora in the study area.

6.7 Injury and Mortality

Fauna injury and mortality is currently occurring as a result of the existing New England Highway. However, an increase in mortality may occur during construction of the project, through collision with

construction machinery and light vehicles. Mobile species such as birds can mostly avoid collision through moving out of the path of any vehicles during construction. However, species that roost in hollows and are nocturnal are likely to have difficulty in avoiding direct impact and moving out of the construction footprint. These species are most likely to sustain injury or mortality as a result of construction works.

Grey-headed Flying Fox mortality, and potentially unrecorded injury, is occurring at the farm dam located at the junction of Lot 21 DP 1014307 and Lot 4 DP 621020; Figure 4-4. This mortality is caused by a length of barbed-wire connected between fence-posts over a farm dam which entangles these species as they fly.

The vegetation removal as part of the project and therefore the potential for injury or mortality to fauna is likely to be comparatively minor. However, hollow-bearing tree removal has the potential to injure and result in the mortality of hollow dependent species such as the Squirrel Glider, Common Brushtail Possum and microchiropteran bats. Mitigation measures outlined in Section 7 will limit the effect of the project on such fauna species. Impact assessments for related threatened species have been undertaken in Appendix 7 to assess the impacts to threatened species.

6.8 Weeds

Seventy-one species of weed were recorded within the study area. Of these five are listed as Noxious Weeds under the NW Act and/or are weeds of national significance. Other invasive weeds that were recorded include *Olea europaea* subsp. *europaea* (African Boxthorn), *Juncus acutus* (Spiny Rush), *Chloris gayana* (Rhodes Grass), *Hyparrhenia hirta** (Coolatai Grass), *Ipomoea indica** (Morning Glory) and *Anredera cordifolia** (Madeira Vine). During construction, the project has the potential to spread weeds through the movements of heavy machinery and light vehicles.

The African Olive is an invasive weed that was recorded in high densities within the study area. This species restricts the habitat for native fauna and degrades the threatened communities recorded within the study area. Invasion of native plant communities by African Olive is listed as a key threatening process on the TSC Act.

The increase in weeds degrades the habitat for flora and fauna species and ecological communities. The two threatened woodland bird species, being the Speckled Warbler and Grey-crowned Babbler, were recorded in the study area in woodland habitat. The spread of weeds in this habitat may reduce the quality of the habitat for these species and other woodland bird species (Robinson *et al* 2001). Two threatened ecological communities recorded in the study area have a reduced function due to the invasive weeds particularly the dense understory of African Olive.

Invasion of native plant communities by exotic perennial grass is a key threatening process under the TSC Act. Exotic perennial grasses are listed as part of this KTP. The project has the potential to further spread weeds throughout the study area and exacerbate this KTP.

If the mitigation measures outlined in Section 7 are implemented, then the impact of the project is unlikely to increase the spread of weeds recorded in the study area.

6.9 Changed Hydrology

Nine concrete culverts currently occur to direct water flow under the existing New England Highway. These culverts were inspected during the field surveys with no roosting habitat or bats being observed. One culvert contained a swallow's nest that may provide roosting habitat, however no bats were observed roosting in the nest. No aquatic vegetation was identified within the culverts.

The project will extend the existing culverts and as such minor changes to hydrology are likely to occur during construction. No changes to hydrology is likely to occur in the post-construction environment provided the proposed management measures are implemented.

6.10 Noise Impacts

Sound is important for fauna for communication, navigation, foraging and detecting prey species or danger. Changes in noise through a number of human induced noise sources, such as vehicle traffic, can affect fauna species ability to function (Forman et al, 2000). Adaption by animals to noise in their natural environment such as wind or other animals can cause them to change their behavior to function within their environment (Eve, 1991).

Heavy machine, vehicle movements and vegetation clearing will cause an increase in noise levels in the construction phase of the project. This increase in noise level may be detrimental to fauna and their ability to function in their environment. Noise might startle animals such as birds and mammals and frogs may stop calling.

The increase in noise levels during construction will temporarily impact on fauna species. The New England Highway currently has high traffic volumes and fauna in the locality are currently not known to be substantially affected by traffic noise. The widening of the New England Highway is unlikely to have a long-term impacts on fauna within the study area because of increased noise.

6.11 Impact on Key Threatening Processes

Forty KTPs are currently listed on the TSC Act and/or the EPBC Act. Of these the following (as outlined in Appendix 6) have been assessed as having the potential to being increased by the proposal. These include the following:

- **Anthropogenic Climate Change** – minor incremental contribution to greenhouse gas;
- **Clearing of Native Vegetation** – The project will contribute to an incremental loss in native vegetation. Impact assessments for removal of vegetation and assessment of the need for biodiversity offsets is required;
- **Infection of Frogs by amphibian chytrid causing the disease chytridiomycosis** – The project has the potential to spread this disease through the transportation of machinery;
- **Infection of native plants by *Phytophthora cinnamomi* -** No evidence of Phytophthora was recorded on any plant species, however the project may facilitate the transmission of this disease through machinery transportation;
- **Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on the family Myrtaceae –** No evidence of myrtle rust was recorded on any Myrtaceaous species, however the project may facilitate the transmission of this disease through machinery transportation;
- **Invasion and establishment of exotic vines and scramblers** – The project has the potential to further spread exotic vines and scramblers through vehicle traffic during construction works;
- **Invasion of native plant communities by African Olive** – The project has the potential to further spread African Olive through vehicle traffic during construction works;
- **Loss of hollow-bearing trees** – removal of 18 hollow bearing trees, requires mitigation measures and impact assessments on fauna that utilise hollows;
- **Removal of dead wood and trees –** fallen timber and dead trees were recorded throughout the study area. The project is likely to remove these during construction works; and
- **Removal of Bushrock –** Minor areas of bushrock were recorded within the study area. The proposal is likely to remove a small amount of bushrock.

Section 8 outlines proposed mitigation measures to address these KTP's where possible.

7 SIGNIFICANCE ASSESSMENTS SUMMARY

7.1 Commonwealth

A summary of the threatened biodiversity assessments undertaken in accordance with the requirements of the EPBC Act is presented in Table 7-1 below. The detailed impact assessments are provided in Appendix 7.

The proposal is considered likely to result in a significant impact upon the critically endangered community of Central Hunter Valley Eucalypt Forest and Woodland listed on the EPBC Act (Appendix 7). The following reasons for the likely significant impact are outlined below:

The project will result in the reduction in the extent of this community; and Critical habitat for this community is defined as when the condition of the vegetation is in moderate or higher condition (which it is within the study area). Therefore, the project will affect habitat critically to the survival of this community.

No other Commonwealth MNES are considered likely to be significantly impacted by the project.

Table 7-1: Summary of EPBC Act Assessments

Species/Ecological Community	EPBC Act[1]		Significance Impact Question[2]							Likely Significant Impact?	Important Population[3]	
		1	2	3	4	5	6	7	8	9		
Critically Endangered Community												
Central Hunter Valley Eucalypt Forest/Woodland4	CE	Y	N	Y	N	N	N	N/A	N/A	N/A	Significant	N/A
Critically Endangered Fauna												
Regent Honeyeater	CE, M	N	N	N	N	N	N	N	N	N	Not Significant	N/A
Swift Parrot	CE, M	N	N	N	N	N	N	N	N	N	Not Significant	N/A
Endangered Fauna												
Australian Painted Snipe	E, M	N	N	N	N	N	N	N	N	N	Not Significant	N/A
Spotted-tailed Quoll	E	N	N	N	N	N	N	N	N	N	Not Significant	N/A
Vulnerable Fauna												

Species/Ecological Community	EPBC Act[1]		Significance Impact Question[2]							Likely Significant Impact?	Important Population[3]	
		1	2	3	4	5	6	7	8	9		
Green and Golden Bell Frog	V	N	N	N	N	N	N	N	N	N	Not Significant	No
Grey-headed Flying Fox	V	N	N	N	N	N	N	N	N	N	Not Significant	No
Koala	V	N	N	N	N	N	N	N	N	N	Not Significant	No
Large-eared Pied Bat	V	N	N	N	N	N	N	N	N	N	Not Significant	No
Painted Honeyeater	V	N	N	N	N	N	N	N	N	N	Not Significant	No

Notes:

1 CE = Critically Endangered, E = Endangered and V = Vulnerable, M = Migratory under the EPBC Act

2 Assessment of significance questions under the EPBC Act:

- Lead to a long-term decrease in the size of a population;
- Reduce the area of occupancy of the species;
- Fragment an existing population into two or more populations;
- Adversely affect habitat critical to the survival of a species;
- Disrupt the breeding cycle of a population;
- Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;
- Introduce disease that may cause the species to decline; or
- Interfere with the recovery of the species.

3 Important Population as determined by the EPBC Act is a population of a vulnerable species that: is likely to be key source populations either for breeding or dispersal is likely to be necessary for maintaining genetic diversity is at or near the limit of the species range.

1 Assessment of Significance for Critically Endangered Ecological Communities:

- Reduce the extent of the ecological community;
- Fragment or increase the fragmentation of an ecological community;
- Adversely affect habitat critical to the survival of an ecological community;
- Modify or destroy abiotic (non-living) factors necessary for the community's survival, including, reduction in groundwater, or substantial alterations to surface water drainage patterns;
- Cause a substantial change in the species composition of an occurrence of an ecological community, including decline or loss of functionally important species:
    - assisting invasive species, that are harmful to the listed ecological community to become established

- causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community

- Interfere with the recovery of an ecological community.

7.2 State

A summary of the impact assessments conduction as for TSC Act listed biodiversity is presented in **Error! R eference source not found.**. The detailed impact assessments are provided in Appendix 7. No significant impacts were considered likely to occur upon any threatened biodiversity listed under the TSC Act or FM Act as a result of the project impacts.

Table 7-2: Summary of TSC Act Assessments

Species/Ecological Community	TSC Act[1]	Significant Impact Question[1]								Likely Significant Impact?
			a	b	c	d	e	f	g	
Central Hunter Ironbark – Spotted Gum – Grey Box Forest		E3	X	X	N	N	X	X	Y	Not Significant
Swamp Oak Floodplain Forest		E3	X	X	N	N	X	X	Y	Not Significant
Amphibians										
Green and Golden Bell Frog		E1	N	X	X	Y	N	X	Y	Not Significant
Birds										
Black-necked Stork		E1	N	X	X	Y	N	X	Y	Not Significant
Little Lorikeet		V	N	X	X	Y	N	X	Y	Not Significant
Painted Honeyeater		V	N	X	X	Y	N	X	Y	Not Significant
Regent Honeyeater		E4A	N	X	X	Y	N	X	Y	Not Significant
Swift Parrot		E1	N	X	X	Y	N	X	Y	Not Significant
Varied Sittella		V	N	X	X	Y	N	X	Y	Not Significant
Woodland Birds										
Australian Painted Snipe		E1	N	X	X	Y	N	X	Y	Not Significant
Black-chinned Honeyeater (Eastern subspecies)		V	N	X	X	Y	N	X	Y	Not Significant
Brown Treecreeper (eastern subspecies)		V	N	X	X	Y	N	X	Y	Not Significant
Diamond Firetail		V	N	X	X	Y	N	X	Y	Not Significant
Grey-crowned Babbler		V	N	X	X	Y	N	X	Y	Not Significant
Hooded Robin (South-eastern Form)		V	N	X	X	Y	N	X	Y	Not Significant

Species/Ecological Community	TSC Act[1]	Significant Impact Question[1]								Likely Significant Impact?
			a	b	c	d	e	f	g	
Speckled Warbler		V	N	X	X	Y	N	X	Y	Not Significant
Scarlet Robin		V	N	X	X	Y	N	X	Y	Not Significant
Turquoise Parrot		V	N	X	X	Y	N	X	Y	Not Significant
Birds of Prey										
Black Falcon		V	N	X	X	Y	N	X	Y	Not Significant
Little Eagle		V	N	X	X	Y	N	X	Y	Not Significant
Square-tailed Kite		V	N	X	X	Y	N	X	Y	Not Significant
Forest Owls										
Barking Owl		V	N	X	X	Y	N	X	Y	Not Significant
Masked Owl		V	N	X	X	Y	N	X	Y	Not Significant
Powerful Owl		V	N	X	X	Y	N	X	Y	Not Significant
Mammals										
Brush-tailed Phascogale		V	N	X	X	Y	N	X	Y	Not Significant
Grey-headed Flying Fox		V	N	X	X	Y	N	Y	Y	Not Significant
Koala		V	N	X	X	Y	N	Y	Y	Not Significant
Squirrel Glider		V	N	X	X	Y	N	X	Y	Not Significant
Spotted-tailed Quoll		V	N	X	X	Y	N	X	Y	Not Significant
Cave Bats										
Eastern Bent-wing Bat		V	N	X	X	Y	N	X	Y	Not Significant
Large-eared Pied Bat		V	N	X	X	Y	N	X	Y	Not Significant
Eastern Cave Bat		V	N	X	X	Y	N	X	Y	Not Significant
Southern Myotis		V	N	X	X	Y	N	X	Y	Not Significant
Hollow tree Dwelling Bats										
Eastern False Pipistrelle		V	N	X	X	Y	N	X	Y	Not Significant
Eastern Freetail Bat		V	N	X	X	Y	N	X	Y	Not Significant
Little Bent-wing Bat		V	N	X	X	Y	N	X	Y	Not Significant
Yellow-bellied Sheathtail bat		V	N	X	X	Y	N	X	Y	Not Significant
Greater Broad-nosed Bat		V	N	X	X	Y	N	X	Y	Not Significant

Notes:

1. Y = Negative impact, N = No positive impact, X = not applicable;
2. V = Vulnerable, E1 = Endangered, E4a = Critically Endangered, E3 = Endangered Ecological Community listed under the TSC Act;
3. Significance Assessment questions as set out in the TSC Act / EP&A Act:

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,

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,

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,

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, and

(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

(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,

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

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

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.

8 Mitigation Measures

Mitigation measures will be implemented to reduce the impact to biodiversity within and surrounding the construction footprint as a result of the project. Roads and Maritime has a number of policies that guide appropriate mitigation measures in relation to road construction.

Table 8.1 below outlines the mitigation measures for the project.

Table 8-1: Mitigation Measures

Impact	Mitigation Measure	Responsibility	Timing
Core safeguards	A Flora and Fauna Management Plan will be prepared in accordance with Roads and Maritime's Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects (RTA, 2011) and implemented as part of the CEMP. It will include, but not be limited to: • plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas • requirements set out in the Landscape Guideline (RTA, 2008) • pre-clearing survey requirements • procedures for unexpected threatened species finds and fauna handling • procedures addressing relevant matters specified in the Policy and guidelines for fish habitat conservation and management (DPI Fisheries, 2013) • Protocols to manage weeds and pathogens.	Roads and Maritime	Pre and post construction
Vegetation Clearing	Consistent with the Biodiversity Guidelines - Protecting and managing biodiversity on RTA projects, and any specific requirements of the approved Flora and Fauna Management Plan, protocols for clearing of vegetation will be developed and implemented in accordance with the Roads and Maritime Biodiversity Guidelines (Guide 4: Clearing of vegetation and removal of bushrock) (RTA 2011).	Roads and Maritime Ecologist Contractor	Pre-construction and construction
Unexpected Threatened species	Consistent with the Biodiversity Guidelines - Protecting and managing biodiversity on RTA projects, and any specific requirements of the approved Flora and Fauna Management Plan, an unexpected finds procedure will be implemented if a threatened species or ecological community that had not been identified and assessed by the REF is unexpectedly encountered during the construction process.	Roads and Maritime Contractor	Construction
Hollow-bearing tree removal	A nest box strategy will be developed in accordance with the Roads and Maritime Services Biodiversity Guidelines 2011 – Guide 8 (nest boxes).	Roads and Maritime	Pre- Ŏ2ƴãůŃdzŎůʌ2ƴ

Impact	Mitigation Measure	Responsibility	Timing
Wildlife Connectivity	Roads and Maritime will install one aerial crossing to retain fauna connectivity. This crossing will be provided in the vicinity of recorded Squirrel Gliders. The final location, design and type of aerial crossing will be determined during detailed design, however an indicative location is provided in Figure 8-1.	Roads and Maritime	Pre-construction and Construction
Spread of pathogens	Protocols for preventing the introduction and/or spread of disease causing agents such as bacteria and fungi will be developed and implemented in accordance with the Roads and Maritime Biodiversity Guidelines (Guide 7: Pathogen Management) (RTA 2011).	Roads and Maritime	Pre-construction and Construction
Spread of Noxious Weeds	Declared noxious weeds are to be managed according to requirements under the Noxious Weeds Act 1993 and Guide 6 (Weed Management) of the Roads and Maritime Services Biodiversity Guidelines 2011."	Roads and Maritime	Pre-construction and Construction
Biodiversity offsets	A Biodiversity Offset Strategy will be developed for the project in accordance with Roads and Maritimes Guidelines for Biodiversity Offsets.	Roads and Maritime	Pre-construction or Construction

Author:	K. Lee
Reviewer:	T. Lambert
A3 Scale:	1:10,000
Job Ref:	11232

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0 150 300 600 Metres

Map Projection: GDA 1994 MGA Zone 56

Figure 8-1

PROPOSED CANOPY BRIDGES

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04 November 2016

EPS

ENVIRONMENTAL PROPERTY SERVICES

9 BIODIVERSITY OFFSETS

Roads and Maritime biodiversity offset policies require consideration of the provision of offsets when remnant vegetation is to be impacted. Given the project is impacting upon areas of Commonwealth and State-listed threatened ecological communities it is considered that biodiversity offsets will be required to be provided via a Biodiversity Offset Strategy and related works.

In accordance with the RMS Guideline for Biodiversity Offsets (2011), offsets are only required for Central Hunter Ironbark - Spotted Gum – Grey Box Forest (10.40 ha) – as this community is listed as an endangered ecological community on the TSC Act and more than 1 ha is to be cleared. Offsetting this vegetation will also compensate for the impacts to threatened species habitat for the ecosystem credit species recorded or considered likely to occur.

Other native vegetation in the project area includes the Swamp Oak Floodplain Forest EEC, however as only 0.8 ha is being cleared, this does not meet the thresholds for requiring offsets. This 'other native vegetation' also contains habitat for threatened species, but does not exceed the 5ha threshold for requiring offsets.

As no species credit species were recorded in the project area, no species-specific offsets are required.

A preliminary calculation to determine required ecosystem credits to offset the likely impacts of the project has been completed, with the credit report being included in Appendix 9. The calculation was undertaken using the linear assessment option of the Major Project module (Framework for Biodiversity Assessment or FBA methodology) as although this project is not a Major Project, the linear assessment option was considered to best suit the project design. Data collected from the BioBanking plots was used in the calculation.

As outlined in the credit report, a preliminary credit requirement of 520 credits of Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter, (HU815) is required to be retired to offset the impacts of the project.

A strategic assessment in accordance with RMS's *Environment Protection and Biodiversity Conservation Act 1999* – Strategic Assessment policy states biodiversity offsets are required when a significant impact is determined to threatened biodiversity listed under the EPBC Act (Roads and Maritime Services, 2005). The project will result in a significant impact upon the critically endangered community listed under the EPBC Act of Central Hunter Valley Eucalypt Forest and Woodland Complex, therefore biodiversity offsets are required. The strategic assessment recommends that biodiversity offsets can be calculated using the FBA methodology. The preliminary biodiversity offsets have been calculated using the FBA methodology. The project will impact upon 8.2 ha of this federally listed community and proportionally this means 410 credits of the total 520 credits have been calculated to be required to offset this community. As outlined above the Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central

and lower Hunter, (HU815) is the like for like community that is required to offset residual impacts from the project.

The future Biodiversity Offset Strategy will outline the methodology for finalising a biodiversity offset for the project, including refining credit requirements if project design is further refined leading to alteration of project impacts. Such offsets will provide suitable compensation for the biodiversity impacts of the project.

10 CONCLUSION

The study area is comprised of cleared agricultural land, partially fragmented roadside native vegetation and modified aquatic habitats. The native vegetation is currently fragmented from previous land use; however, connectivity exists to extensive similar native remnant vegetation to the north side of the New England Highway which extends to Belford National Park to the east. To the south west of the New England Highway the vegetation has links to a large expanse of native vegetation associated with the Singleton Army Base and then onwards to Howes Valley.

The construction of the upgrade of the New England Highway will involve the removal of 27.73 ha of disturbed and remnant vegetation. This removal is comprised of:

- 10.40 ha of Spotted Gum – Narrow-leaved Ironbark – Red Ironbark Shrub – grass open forest of the central and lower hunter;
- 0.83 ha of Swamp Oak Weeping grass grassy riparian forest of the hunter valley;
- 16.20 ha of cleared land; and
- 0.30 ha of farm dams and cleared riparian areas to be removed as a result of the project. Note no actual dams will be directly impacted.

One critically endangered ecological community listed on the EPBC Act was recorded in the study area, being Central Hunter Valley Eucalypt Forest and Woodland. Seven of the patches of the Spotted Gum – Narrow-leaved Ironbark – Red Ironbark shrub – grass open forest of the central hunter and lower hunter meet the criteria for listing of this community. Central Hunter Valley Eucalypt Forest and Woodland has four typical condition classes as outlined by DoEE. The ecological community within the study area meets the criteria for three of these condition classes. These include Class A and B high quality condition class and moderate condition Class C. The project is likely to remove the following areas and condition classes of this community:

1. 3.94 ha of High Quality Class A;
2. 3.27 ha of High Quality Class B; and
3. 0.99 ha of Moderate Quality Class C.

The impact assessment under the EPBC Act for the Central Hunter Valley Eucalypt Forest and Woodland determined that a significant impact upon this community was likely for the following reasons:

1. A reduction in the extent of the community; and
2. Impacting upon habitat that is considered critical to the survival of this community.

Two communities listed as endangered on the TSC Act were recorded in the study area being:

1. Central Hunter Ironbark – Spotted Gum Grey Box Forest listed as endangered on the TSC Act; and
2. Swamp Oak Floodplain Forest listed as endangered on the TSC Act.

The project will remove 10.40 ha of Central Hunter Ironbark – Spotted Gum – Grey Box Forest and 0.83 ha of Swamp Oak Floodplain Forest. Impact assessments under the TSC Act for the Swamp Oak Floodplain Forest and Central Hunter Ironbark – Spotted Gum Grey Box Forest concluded that the project was unlikely to result in a significant impact on these ecological communities.

No threatened flora was recorded in the study area.

No endangered populations were recorded or have the potential to occur within the study area.

Six threatened fauna species were recorded within the study area as follows:

- Squirrel Glider (TSC Act-listed);
- Speckled Warbler (TSC Act-listed);
- Grey-crowned Babbler (TSC Act-listed);
- Grey-headed Flying Fox (TSC Act-listed and EPBC Act-listed);
- Eastern Bent-wing Bat (TSC Act-listed); and
- Eastern Free-tailed Bat (TSC Act-listed).

A further 31 threatened fauna species have potential habitat within the study area (Appendix 4) though were not recorded. Significance assessments for these recorded and potential threatened fauna species was undertaken and no significant impacts were considered likely.

One migratory species was recorded with habitat for additional three species to occur. An assessment of the impact of the project on these species was conducted and the study area is not classified as important habitat for any of the migratory species recorded or have to potential to occur within the study area.

No threatened ecological communities or aquatic species listed under the FM Act were present within the study area.

In conclusion, the impact assessment for the critically endangered Central Hunter Valley Eucalypt Forest and Woodland indicated that a significant impact as a result of the project is likely to occur. Therefore, this assessment has been prepared in accordance with Roads and Maritime's Environmental Impact Assessment Practice Note: *Environment Protection and Biodiversity Conservation Act 1999* - Strategic Assessment and appropriate offsets will be provided.

As outlined in the credit report, a preliminary credit requirement of 520 credits of Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter, (HU815) is

required to be retired to offset the impacts of the project. The strategic assessment recommends that biodiversity offsets can be calculated using the FBA methodology. The preliminary biodiversity offsets have been calculated using the FBA methodology. The project will impact upon 8.2 ha of the federally listed community and proportionally this means 410 credits of the total 520 credits have been calculated to be required to offset this community. As outlined above the Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter, (HU815) is the like for like community that is required to offset residual impacts from the project.

The future Biodiversity Offset Strategy will outline the methodology for finalising a biodiversity offset for the project, including refining credit requirements if project design is further refined leading to alteration of project impacts. Such offsets will provide suitable compensation for the biodiversity impacts of the project.

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Appendix 1

Raw Data from Database Reports

Australian Government

Department of the Environment

EPBC Act Protected Matters Report

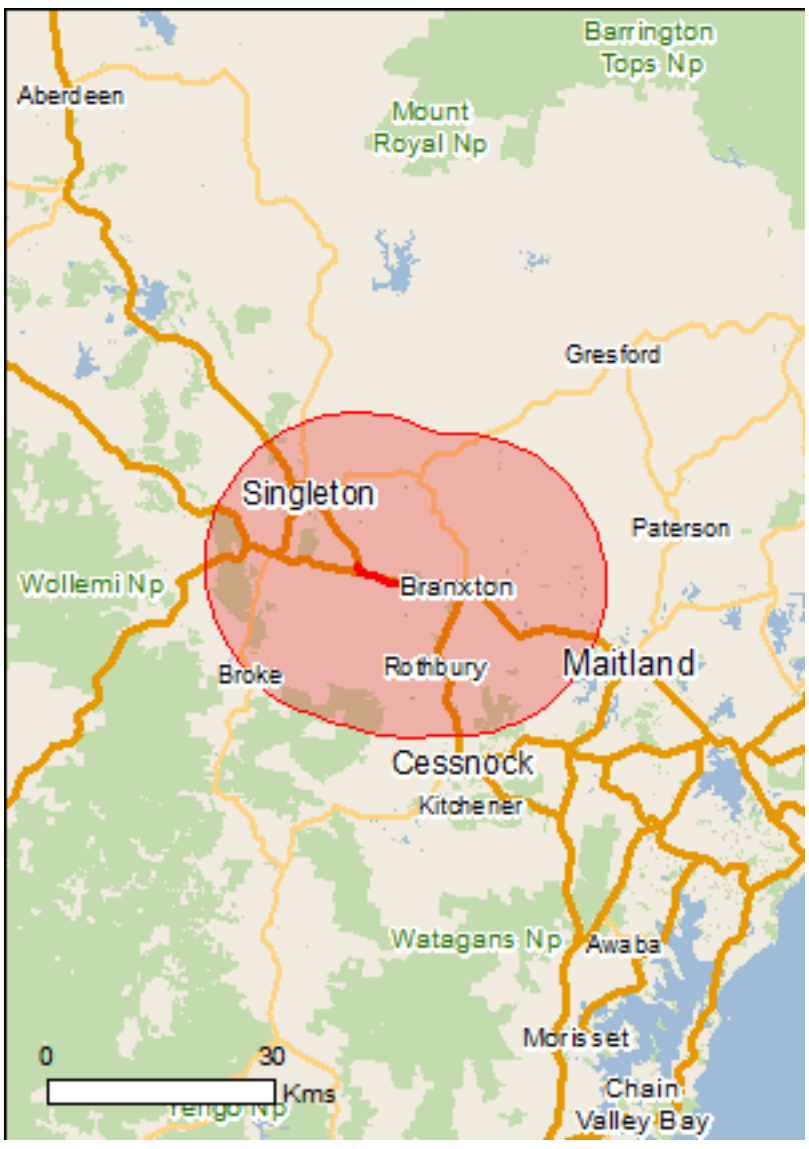
This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 11/04/16 13:12:24

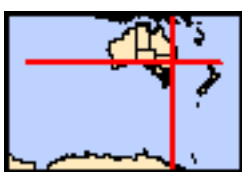
Summary
Details
Matters of NES
Other Matters Protected by the EPBC Act
Extra Information
Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates

Buffer: 20.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	38
Listed Migratory Species:	14

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	7
Commonwealth Heritage Places:	1
Listed Marine Species:	17
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	7
Regional Forest Agreements:	1
Invasive Species:	49
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Hunter estuary wetlands	20 - 30km upstream

Listed Threatened Ecological Communities		[Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Central Hunter Valley eucalypt forest and woodland	Critically Endangered	Community likely to occur within area
Hunter Valley Weeping Myall (Acacia pendula) Woodland	Critically Endangered	Community may occur within area
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community likely to occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Frogs		
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat likely to occur within area
Litoria booroolongensis Booroolong Frog [1844]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Litoria littlejohni		
Littlejohn's Tree Frog, Heath Frog [64733]	Vulnerable	Species or species habitat may occur within area
Mixophyes balbus		
Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Chalinolobus dwyeri		
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Nyctophilus corbeni		
Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area
Petrogale penicillata		
Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat known to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus		
Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat may occur within area
Pseudomys novaehollandiae		
New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat known to occur within area
Pseudomys oralis		
Hastings River Mouse, Koontoo [98]	Endangered	Species or species habitat likely to occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
Plants		
Acacia bynoeana		
Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat likely to occur within area
Allocasuarina glareicola		
[21932]	Endangered	Species or species habitat may occur within area
Angophora inopina		
Charmhaven Apple [64832]	Vulnerable	Species or species habitat likely to occur within area
Asterolasia elegans		
[56780]	Endangered	Species or species habitat may occur within area
Cryptostylis hunteriana		
Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat may occur within area
Cynanchum elegans		
White-flowered Wax Plant [12533]	Endangered	Species or species habitat likely to occur within area
Eucalyptus glaucina		
Slaty Red Gum [5670]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Eucalyptus parramattensis subsp. decadens Earp's Gum, Earp's Dirty Gum [56148]	Vulnerable	Species or species habitat known to occur within area
Eucalyptus pumila Pokolbin Mallee [16510]	Vulnerable	Species or species habitat likely to occur within area
Euphrasia arguta [4325]	Critically Endangered	Species or species habitat may occur within area
Grevillea parviflora subsp. parviflora Small-flower Grevillea [64910]	Vulnerable	Species or species habitat known to occur within area
Pelargonium sp. Striatellum (G.W.Carr 10345) Omeo Stork's-bill [84065]	Endangered	Species or species habitat likely to occur within area
Persoonia pauciflora North Rothbury Persoonia [67214]	Critically Endangered	Species or species habitat known to occur within area
Prostanthera cineolifera [11233]	Vulnerable	Species or species habitat likely to occur within area
Pterostylis gibbosa Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood [4562]	Endangered	Species or species habitat may occur within area
Rutidosis heterogama Heath Wrinklewort [13132]	Vulnerable	Species or species habitat likely to occur within area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Pocket-less Brush Cherry, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat likely to occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Hoplocephalus bungaroides Broad-headed Snake [1182]	Vulnerable	Species or species habitat likely to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Monarcha melanopsis		
Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus		
Spectacled Monarch [610]		Species or species habitat may occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat likely to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Australian Telecommunications Corporation
Commonwealth Land - Commonwealth Trading Bank of Australia
Commonwealth Land - Defence Housing Authority
Commonwealth Land - Telstra Corporation Limited
Defence - SINGLETON MILITARY AREA ; Lone Pine Barracks

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Historic		
Murinbin House Group	NSW	Listed place

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Cuculus saturatus Oriental Cuckoo, Himalayan Cuckoo [710]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Belford	NSW
FMAs in MORISSET	NSW
LNE Special Management Zone No1	NSW
Pokolbin	NSW
UNE_LNE_OldGrowth	NSW
Werakata	NSW
Werakata	NSW

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Protasparagus densiflorus Asparagus Fern, Plume Asparagus [5015]		Species or species habitat likely to occur within area
Protasparagus plumosus Climbing Asparagus-fern, Ferny Asparagus [11747]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-32.636103 151.23049,-32.642464 151.233752,-32.647234 151.250403,-32.65316 151.269801,-32.656628 151.294005,-32.655183 151.318037,-32.65605 151.345332,-32.65605 151.345332

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Parks and Wildlife Commission NT, Northern Territory Government
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Data from the BioNet Atlas of NSW Wildlife website, which holds records from a number of custodians. The data are only indicative and cannot be considered a comprehensive inventory, and may contain errors and omissions. Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1Â°; ^^ rounded to 0.01Â°). Copyright the State of NSW through the Office of Environment and Heritage. Search criteria : Public Report of all Valid Records of Threatened (listed on TSC Act 1995) or Commonwealth listed Animals in selected area [North: -32.49 West: 151.09 East: 151.44 South: -32.76] returned a total of 767 records of 40 species.
Report generated on 11/04/2016 9:44 AM

Kingdom	Class	Family	Species Code	Scientific Name	Exotic	Common Name	NSW status	Comm. status	Records	Info
Animalia	Amphibia	Myobatrachidae	3042	*Heleioporus australiacus*		Giant Burrowing Frog	V,P	V	1	
Animalia	Aves	Ciconiidae	0183	*Ephippiorhynchus asiaticus*		Black-necked Stork	E1,P		10	
Animalia	Aves	Accipitridae	0225	*Hieraaetus morphnoides*		Little Eagle	V,P		2	
Animalia	Aves	Accipitridae	0230	*^^Lophoictinia isura*		Square-tailed Kite	V,P,3		1	
Animalia	Aves	Falconidae	0238	*Falco subniger*		Black Falcon	V,P		2	
Animalia	Aves	Cacatuidae	0268	*^^Callocephalon fimbriatum*		Gang-gang Cockatoo	V,P,3		4	
Animalia	Aves	Cacatuidae	0265	*^Calyptorhynchus lathami*		Glossy Black-Cockatoo	V,P,2		3	
Animalia	Aves	Psittacidae	0260	*Glossopsitta pusilla*		Little Lorikeet	V,P		31	
Animalia	Aves	Psittacidae	0309	*^^Lathamus discolor*		Swift Parrot	E1,P,3	E	58	
Animalia	Aves	Psittacidae	0302	*^^Neophema pulchella*		Turquoise Parrot	V,P,3		1	
Animalia	Aves	Strigidae	0246	*^^Ninox connivens*		Barking Owl	V,P,3		1	
Animalia	Aves	Strigidae	0248	*^^Ninox strenua*		Powerful Owl	V,P,3		3	
Animalia	Aves	Tytonidae	0250	*^^Tyto novaehollandiae*		Masked Owl	V,P,3		2	
Animalia	Aves	Tytonidae	9924	*^^Tyto tenebricosa*		Sooty Owl	V,P,3		1	

Animalia	Aves	Climacteridae	8127	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subspecies)	V,P		18	
Animalia	Aves	Acanthizidae	0504	*Chthonicola sagittata*	Speckled Warbler	V,P		73	
Animalia	Aves	Meliphagidae	0603	*Anthochaera phrygia*	Regent Honeyeater	E4A,P	CE	4	
Animalia	Aves	Meliphagidae	0598	*Grantiella picta*	Painted Honeyeater	V,P	V	4	
Animalia	Aves	Meliphagidae	8303	*Melithreptus gularis gularis*	Black-chinned Honeyeater (eastern subspecies)	V,P		3	
Animalia	Aves	Pomatostomidae	8388	*Pomatostomus temporalis temporalis*	Grey-crowned Babbler (eastern subspecies)	V,P		169	
Animalia	Aves	Neosittidae	0549	*Daphoenositta chrysoptera*	Varied Sittella	V,P		20	
Animalia	Aves	Petroicidae	8367	*Melanodryas cucullata cucullata*	Hooded Robin (south-eastern form)	V,P		12	
Animalia	Aves	Petroicidae	0380	*Petroica boodang*	Scarlet Robin	V,P		6	
Animalia	Aves	Estrildidae	0652	*Stagonopleura guttata*	Diamond Firetail	V,P		7	
Animalia	Mammalia	Dasyuridae	1008	*Dasyurus maculatus*	Spotted-tailed Quoll	V,P	E	24	
Animalia	Mammalia	Dasyuridae	1017	*Phascogale tapoatafa*	Brush-tailed Phascogale	V,P		10	
Animalia	Mammalia	Phascolarctidae	1162	*Phascolarctos cinereus*	Koala	V,P	V	16	
Animalia	Mammalia	Petauridae	1136	*Petaurus australis*	Yellow-bellied Glider	V,P		1	
Animalia	Mammalia	Petauridae	1137	*Petaurus norfolcensis*	Squirrel Glider	V,P		28	
Animalia	Mammalia	Pteropodidae	1280	*Pteropus poliocephalus*	Grey-headed Flying-fox	V,P	V	88	
Animalia	Mammalia	Emballonuridae	1321	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V,P		3	
Animalia	Mammalia	Molossidae	1329	*Mormopterus norfolkensis*	Eastern Freetail-bat	V,P		37	

Data from the BioNet Atlas of NSW Wildlife website, which holds records from a number of custodians. The data are only indicative and cannot be considered a comprehensive inventory, and may contain errors and omissions. Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1Â°; ^^ rounded to 0.01Â°). Copyright the State of NSW through the Office of Environment and Heritage. Search criteria : Public Report of all Valid Records of Threatened (listed on TSC Act 1995) or Commonwealth listed Plants in selected area [North: -32.49 West: 151.09 East: 151.44 South: -32.76] returned a total of 460 records of 14 species.
Report generated on 11/04/2016 10:06 AM

Kingdom	Class	Family	Species Code	Scientific Name	Exotic	Common Name	NSW status	Comm. status	Records	Info
Plantae	Flora	Apocynaceae	1226	*Cynanchum elegans*		White-flowered Wax Plant	E1,P	E	8	
Plantae	Flora	Asteraceae	1643	*Rutidosis heterogama*		Heath Wrinklewort	V,P	V	3	
Plantae	Flora	Fabaceae (Mimosoideae)	3728	*Acacia bynoeana*		Bynoe's Wattle	E1,P	V	5	
Plantae	Flora	Fabaceae (Mimosoideae)	3848	*Acacia pendula*		Acacia pendula population in the Hunter catchment	E2		2	
Plantae	Flora	Lamiaceae	3401	*Prostanthera cineolifera*		Singleton Mint Bush	V,P	V	4	
Plantae	Flora	Myrtaceae	9619	*Angophora inopina*		Charmhaven Apple	V,P	V	1	
Plantae	Flora	Myrtaceae	6360	*Eucalyptus camaldulensis*		Eucalyptus camaldulensis population in the Hunter catchment	E2		62	
Plantae	Flora	Myrtaceae	11612	*Eucalyptus castrensis*		Singleton Mallee	E1,P		14	
Plantae	Flora	Myrtaceae	9720	*Eucalyptus fracta*		Broken Back Ironbark	V,P		3	
Plantae	Flora	Myrtaceae	4096	*Eucalyptus glaucina*		Slaty Red Gum	V,P	V	255	
Plantae	Flora	Myrtaceae	9163	*Eucalyptus parramattensis subsp. decadens*			V,P	V	6	
Plantae	Flora	Myrtaceae	4164	*Eucalyptus pumila*		Pokolbin Mallee	V,P	V	5	

Plantae	Flora	Orchidaceae	6399	^*Cymbidium canaliculatum*	Cymbidium canaliculatum population in the Hunter Catchment	E2,P,2		2	
Plantae	Flora	Proteaceae	10723	^^*Persoonia pauciflora*	North Rothbury Persoonia	E4A,P,3	CE	90	

Animalia	Mammalia	Vespertilionidae	1353	*Chalinolobus dwyeri*	Large-eared Pied Bat	V,P	V	14	
Animalia	Mammalia	Vespertilionidae	1372	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V,P		6	
Animalia	Mammalia	Vespertilionidae	1346	*Miniopterus australis*	Little Bentwing-bat	V,P		14	
Animalia	Mammalia	Vespertilionidae	1834	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	V,P		51	
Animalia	Mammalia	Vespertilionidae	1357	*Myotis macropus*	Southern Myotis	V,P		11	
Animalia	Mammalia	Vespertilionidae	1361	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V,P		8	
Animalia	Mammalia	Vespertilionidae	1025	*Vespadelus troughtoni*	Eastern Cave Bat	V,P		9	
Animalia	Mammalia	Muridae	1455	*Pseudomys novaehollandiae*	New Holland Mouse	P	V	11	

Data from the BioNet Atlas of NSW Wildlife website, which holds records from a number of custodians. The data are only indicative and cannot be considered a comprehensive inventory, and may contain errors and omissions. Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1Â°; ^^ rounded to 0.01Â°). Copyright the State of NSW through the Office of Environment and Heritage. Search criteria : Public Report of all Valid Records of Threatened (listed on TSC Act 1995) or Commonwealth listed Communities in selected area [North: -32.49 West: 151.09 East: 151.44 South: -32.76] returned 0 records for 20 entities.
Report generated on 11/04/2016 9:50 AM

Kingdom	Class	Family	Species	Scientific Name	Exotic	Common Name	NSW status	Comm. status	Records	Info
Community				*Central Hunter Grey Box-Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions*		Central Hunter Grey Box-Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions	E3	CE	K	
Community				*Central Hunter Ironbark-Spotted Gum-Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions*		Central Hunter Ironbark-Spotted Gum-Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions	E3	CE	K	
Community				*Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*		Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	V	P	

Community	*Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*	Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3		K	
Community	*Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions*	Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions	E3		K	
Community	*Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions*	Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions	E3		K	
Community	*Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion*	Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion	V2	CE	K	
Community	*Hunter Valley Vine Thicket in the NSW North Coast and Sydney Basin Bioregions*	Hunter Valley Vine Thicket in the NSW North Coast and Sydney Basin Bioregions	E3		K	

Community	*Hunter Valley Weeping Myall Woodland in the Sydney Basin Bioregion*	Hunter Valley Weeping Myall Woodland in the Sydney Basin Bioregion	E4B	CE	K	
Community	*Kurri Sand Swamp Woodland in the Sydney Basin Bioregion*	Kurri Sand Swamp Woodland in the Sydney Basin Bioregion	E3		K	
Community	*Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*	Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	CE	P	
Community	*Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion*	Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion	E3		K	
Community	*Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions*	Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions	V2		K	
Community	*Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions*	Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	E3	CE	K	

Community	*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	E3		K	
Community	*Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3		K	
Community	*Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3		K	
Community	*Sydney Freshwater Wetlands in the Sydney Basin Bioregion*	Sydney Freshwater Wetlands in the Sydney Basin Bioregion	E3		K	
Community	*Warkworth Sands Woodland in the Sydney Basin Bioregion*	Warkworth Sands Woodland in the Sydney Basin Bioregion	E3		K	
Community	*White Box Yellow Box Blakelyâ€™s Red Gum Woodland*	White Box Yellow Box Blakelyâ€™s Red Gum Woodland	E3	CE	K	

Critical habitat register

This page provides links to declarations of critical habitat, and maps of these sites, that are currently in force under sections 53-55 of the *Threatened Species Conservation Act 1995*.

- There are currently no draft critical habitat recommendations.

Critical habitat declarations in NSW

Gould's Petrel - critical habitat declaration
(GouldsPetrelCriticalHabitatSmall.pdf, 1.45MB)

Little penguin population in Sydney's North Harbour - critical habitat declaration - Find out which areas around Manly have been declared critical habitat, what this means, and how you can help Sydney's little penguins.

Mitchell's Rainforest Snail in Stotts Island Nature Reserve - critical habitat declaration

Wollemi Pine - critical habitat declaration
(wollemiCriticalHabitatDetermination.pdf, 2.21MB)

Page last updated: 12 March 2015

NEW SOUTH WALES **FLORA** ONLINE

Search Result

Click on a name to see the page for that taxon.
* denotes an introduced species
+ denotes a species listed on the schedules of the Threatened Species Conservation Act (TSCA)
◊ denotes a ROTAP listed species
‡ denotes a gazetted weed.

TSCA listed species collected in a 25 km radius around Branxton (151.35,-32.66666)

Apocynaceae	*Cynanchum*	◊+	*elegans*
Asteraceae	*Rutidosis*	◊+	*heterogama*
Fabaceae - Mimosoideae	*Acacia*	◊+	*bynoeana*
Lamiaceae	*Prostanthera*	◊+	*cineolifera*
Myrtaceae	*Angophora*	◊+	*inopina*
	Callistemon	◊+	*linearifolius*
	Eucalyptus	+	*castrensis*
		◊+	*fracta*
		◊+	*glaucina*
		◊+	*parramattensis subsp. decadens*
		◊+	*pumila*
	Syzygium	◊+	*paniculatum*
Orchidaceae	*Diuris*	◊+	*pedunculata*
Proteaceae	*Grevillea*	+	*parviflora subsp. parviflora*
Zannichelliaceae	*Zannichellia*	◊+	*palustris*

Threatened & protected species - records viewer

Records for this map are from the NSW Department of Primary Industries research surveys, they do not indicate the entire distribution of the species and there may be errors and omissions.
To view the records using Google Earth you must download and install the Google Earth Plugin.

NOTE: The map depicts the expected distribution of this species in NSW. The records indicate locations where the species has been found.

Records

Records search

Step 1

Select an area type to search by:

- Statewide
- Catchment Management Authority
- Local Government Area

LGA: SINGLETON

Step 2

Select a species:

Macquarie perch

Step 3

Select a time period:

- pre 1980
- post 1980
- all records

Search

Appendix 2

Species of Flora Recorded

Life Form	Family	Species	Common Name	TSC Act	EPBC Act	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7		Plot 8		Plot 9		Plot 10		Plot 11		Random Meander
						% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	Cover %	Abundance	
Tree	Myrtaceae	*Angophora floribunda*	Rough-barked Apple	'	'																							x
Tree	Casuarinaceae	*Casuarina glauca*	Swamp Oak	'	'					70	30															70	47	x
Tree	Myrtaceae	*Corymbia maculata*	Spotted Gum	'	'	60	28					5	1															x
Tree	Myrtaceae	*Eucalyptus crebra*	Narrow-leaved Ironbark	'	'	4	1									5	6	15	9	25	19			20	27			x
Tree	Myrtaceae	*Eucalyptus fibrosa*	Red Ironbark	'	'									20	10													x
Tree	Myrtaceae	*Eucalyptus moluccana*	Grey Box	'	'			20	2			15	3			20	4					60	7	20	1			x
Tree	Myrtaceae	*Eucalyptus sideroxylon*	Mugga Ironbark	'	'																							x
Tree	Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum	'	'							15	3	5	1	45	13	15	7	10	10							x
Tree	Salicaceae	*Populus x canadensis**	Canadian Poplar	'	'																							x
Small Tree	Casuarinaceae	*Allocasuarina luehmannii*	Bulloak	'	'							3	5															x
Small Tree	Santalaceae	*Exocarpus cupressiformis*	Native Cherry	'	'																							x
Mistletoe	Loranthaceae	*Amyema cambagei*	Mistletoe species	'	'																							x
Mistletoe	Loranthaceae	*Muellerina eucalyptoides*	Mistletoe species	'	'													1	1									x
Shrub	Malvaceae	*Abutilon oxycarpum*	Straggly Lantern-bush	'	'																			1	30			x
Shrub	Fabaceae Mimosoideae	*Acacia decurrens*	Black Wattle	'	'																							x
Shrub	Fabaceae Mimosoideae	*Acacia falcata*	Hickory Wattle	'	'							1	1	5	6													x
Shrub	Fabaceae Mimosoideae	*Acacia parvipinnula*	Silver-stemmed Wattle	'	'	3	3					3	3	5	5			8	8									x
Shrub	Pittosporaceae	*Bursaria spinosa*	Blackthorn	'	'									15	25													x
Shrub	Asteraceae	*Cassinia aculeata*	Dogwood	'	'							1	2			5	15	1	4	1	3							x
Shrub	Asteraceae	*Cassinia uncata*	Sticky Cassinia	'	'																							x
Shrub	Fabaceae	*Daviesia ulicifolia*	Gorse Bitter Pea	'	'									10	100	2	5	1	1									x
Shrub	Ericaceae	*Ericaceae sp.*																										x
Shrub	Scrophulariaceae	*Eremophila debilis*	Winter Apple	'	'																			1	20			x

Life Form	Family	Species	Common Name	TSC Act	EPBC Act	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7		Plot 8		Plot 9		Plot 10		Plot 11		Random Meander
						% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	Cover %	Abundance	
Shrub	Apocynaceae	*Gomphocarpus physocarpus**	Balloon Cotton Bush	'	'			1	15	1	2			2	10	1	2											x
Shrub	Proteaceae	*Hakea sericea*	Needlebush	'	'																							x
Shrub	Fabaceae	*Indigofera australis*	Australian indigo	'	'	1	5																					x
Shrub	Verbenaceae	*Lantana camara**	Lantana	'	'															1	1							x
Shrub	Santalaceae	*Leptomeria acida*	Native Currant	'	'																							x
Shrub	Oleaceae	*Olea europaea subsp. Cuspidata**	African Olive	'	'	1	1	5	10	2	4	2	1			25	13	5	4	3	7			10	17			x
Shrub	Asteraceae	*Olearia elliptica*	Sticky Daisy-bush	'	'																							x
Shrub	Cactaceae	*Opuntia aurantiaca**	Tiger Pear	'	'			1	2																			x
Shrub	Cactaceae	*Opuntia stricta**	Common Prickly Pear	'	'	1	10																					x
Shrub	Malvaceae	*Pavonia hastata**		'	'									7	50			10	250									x
Shrub	Fabaceae	*Pultenaea spinosa*	Spiny Bush-pea	'	'									70	300	1	1											x
Shrub	Fabaceae	*Pultenaea spinosa*	Spiny Bush-pea	'	'																							x
Shrub	Euphorbiaceae	*Ricinus communis**	Castor Oil Plant	'	'																							x
Shrub	Lamiaceae	*Spartothamnella juncea*	Bead Bush	'	'																							x
Sub-shrub	Rubiaceae	*Pomax umbellata*	Pomax	'	'									2	500	2	80											x
Sedge	Cyperaceae	*Bolboschoenus caldwellii*		'	'																			1	15			x
Sedge	Cyperaceae	*Carex inversa*		'	'																			1	10			x
Sedge	Cyperaceae	*Cyperus aggregatus**		'	'																							x
Sedge	Cyperaceae	*Cyperus brevifolius**	Mullumbim-by Couch																									x
Sedge	Cyperaceae	*Cyperus eragrostis**	Umbrella Sedge	'	'																							x
Sedge	Cyperaceae	*Cyperus gracilis*	Slender Flat-sedge	'	'			8	30	2	50													1	25			x
Sedge	Cyperaceae	*Cyperus haspan subsp. haspan*		'	'																							x
Sedge	Cyperaceae	*Cyperus polystachyos*		'	'																							x
Sedge	Cyperaceae	*Eleocharis acuta*		'	'																							x

Life Form	Family	Species	Common Name	TSC Act	EPBC Act	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7		Plot 8		Plot 9		Plot 10		Plot 11		Random Meander
						% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	Cover %	Abundance	
Sedge	Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-sedge	'	'			5	50							2	50			1	20			3	70			x
Sedge	Cyperaceae	*Lepidosperma laterale*		'	'	1	15																					x
Sedge	Cyperaceae	*Schoenoplectiella mucronata*		'	'																							x
Sedge	Cyperaceae	*Schoenus brevifolius*	Zig-zag Bog-rush	'	'																							x
Rush	Juncaceae	*Juncus acutus**	Sharp Rush	'	'			2	20																			x
Rush	Juncaceae	*Juncus planifolius*	Broad-leaf Rush	'	'																							x
Rush	Juncaceae	*Juncus usitatus*																										x
Herb	Brassicaceae	*Alyssum linifolium**	Flax-leaf Alyssum	'	'			1	15																			x
Herb	Asteraceae	*Anthemis cotula**	Stinking Mayweed	'	'																							x
Herb	Apiaceae	*Anethum graveolens**	Dill	'	'			5	200																			x
Herb	Asteraceae	*Artemisia verlotiorum**	Chinese Wormwood	'	'																							x
Herb	Asteraceae	*Aster subulatus**	Wild Aster	'	'																							x
Herb	Asteraceae	*Bidens pilosa**	Cobbler's Pegs	'	'	1	30			10	200	2	50	3	100			2	50	1	10					1	30	x
Herb	Acanthaceae	*Brunoniella australis*	Blue Trumpet	'	'							15	500			5	100	2	30									x
Herb	Asteraceae	*Calotis cuneifolia*	Purple Burr-daisy	'	'							1	10	1	30													x
Herb	Asteraceae	*Calotis lappulacea*	Yellow Burr-daisy	'	'							3	100			1	50	1	50									x
Herb	Asteraceae	*Carduus tenuiflorus**	Winged Slender Thistle	'	'																							x
Herb	Gentianaceae	*Centaurium erythraea**	Common Centaury	'	'																							x
Herb	Apiaceae	*Centella asiatica*	Indian Pennywort	'	'					8	500																	x
Herb	Asteraceae	*Chrysocephalum apiculatum*	Yellow Buttons	'	'			1	20															10	300			x
Herb	Asteraceae	*Chrysocephalum semipapposum*	Yellow Buttons	'	'																							x
Herb	Asteraceae	*Cirsium vulgare**	Spear Thistle	'	'													2	40									x
Herb	Commelinaceae	*Commelina cyanea*	Native Wandering Jew	'	'	2	50					2	50			1	30			2	70			1	10			x

Life Form	Family	Species	Common Name	TSC Act	EPBC Act	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7		Plot 8		Plot 9		Plot 10		Plot 11		Random Meander
						% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	Cover %	Abundance	
Herb	Asteraceae	*Conyza bonariensis**	Flaxleaf Fleabane	'	'			1	30	1	10			1	30			1	10			3	100	3	100			x
Herb	Asteraceae	*Conyza canadensis**		'	'																							x
Herb		*Conyza spp.**	Fleabane	'	'																							x
Herb	Apiaceae	*Cyclospermum leptophyllum**	Slender Celery	'	'					5	100													2	80			x
Herb	Phormiaceae	*Dianella longifolia*	Blueberry Lily	'	'															1	10							x
Herb	Convolvulaceae	*Dichondra repens*	Kidney Weed	'	'	30	1000	2	150	10	1000	2	100	20	1000	2	500	20	1000					15	1000	2	200	x
Herb	Anthericaceae	*Dichopogon fimbriatus*	Nodding Chocolate Lily	'	'							1	1															x
Herb	Asteraceae	*Euchiton sphaericus*	Cudweed	'	'									3	100													x
Herb	Apiaceae	*Foeniculum vulgare**	Fennel	'	'																							x
Herb	Asteraceae	*Gamochaeta americana**	Cudweed	'	'																							x
Herb	Asteraceae	*Gamochaeta calviceps**	Cudweed	'	'																			1	10			x
Herb	Asteraceae	*Gamochaeta purpurea**	Purple Cudweed	'	'			4	150	1	30																	x
Herb	Geraniaceae	*Geranium neglectum*	Crane's Bill	'	'													1	150									x
Herb	Geraniaceae	*Geranium solanderi var. solanderi*	Austral Cranesbill	'	'	1	30																					x
Herb	Goodeniaceae	*Goodenia hederacea*	Forest Goodenia	'	'							1	30															x
Herb	Boraginaceae	*Heliotropium amplexicaule**	Blue Heliotrope	'	'																							x
Herb	Asteraceae	*Hypochaeris glabra**	Smooth Catsear	'	'							5	300							1	20							x
Herb	Asteraceae	*Hypochaeris radicata**	Cats Ear or Flatweed	'	'	3	100	1	150	10	500			2	30	5	50	2	50	2	50			1	30			x
Herb	Brassicaceae	*Lepidium africanum**		'	'																			1	10			x
Herb	Lomandraceae	*Lomandra multiflora subsp. Multiflora*	Many-flowered Mat-rush	'	'							3	10					1	1									x
Herb	Commelinaceae	*Murdannia graminea*	Grass Lily	'	'															1	15							x
Herb	Alliaceae	*Nothoscordum gracile**	Onion Weed	'	'																	1	20					x
Herb	Oxalidaceae	*Oxalis corniculata**	Clover Sorrel	'	'			1	200	1	200					3	500	1	200	1	50					1	60	x

Life Form	Family	Species	Common Name	TSC Act	EPBC Act	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7		Plot 8		Plot 9		Plot 10		Plot 11		Random Meander
						% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	Cover %	Abundance	
Herb	Oxalidaceae	*Oxalis perennans*		'	'																			1	50			x
Herb	Polygonaceae	*Persicaria decipiens*	Slender Knotweed	'	'					8	50																	x
Herb	Polygonaceae	*Persicaria hydropiper*	Water Pepper	'	'																							x
Herb	Plantaginaceae	*Plantago lanceolata**	Lamb's Tongues	'	'	2	50	15	150	5	100	10	500	2	50	1	30	8	750	3	150	4	200					x
Herb	Lamiaceae	*Plectranthus amboinicus**	Five Seasons Herb	'	'																					1	5	x
Herb	Lobeliaceae	*Pratia purpurascens*	Whiteroot	'	'	10	500			2	200			5	1000	20	1000	10	1000							1	100	x
Herb	Rubiaceae	*Richardia stellaris**		'	'																							x
Herb	Polygonaceae	*Rumex brownii*	Swamp Dock	'	'			1	10																			x
Herb	Polygonaceae	*Rumex crispus**	Curled Dock	'	'																							x
Herb	Asteraceae	*Senecio madagascariensis**	Fireweed	'	'	1	10	15	100					3	30	1	20			1	20	2	50					x
Herb	Malvaceae	*Sida rhombifolia**	Paddy's Lucerne	'	'	8	50	5	50	2	100							20	200			1	20	10	500	3	150	x
Herb	Solanaceae	*Solanum americanum*	Glossy Nightshade	'	'																			1	1	1	1	x
Herb	Solanaceae	*Solanum prinophyllum*	Forest Nightshade	'	'	1	10	1	5			1	30			2	150							1	2			x
Herb	Asteraceae	*Sonchus oleraceus**	Common Sowthistle	'	'					1	5																	x
Herb	Stackhousiaceae	*Stackhousia nuda*		'	'											1	20											x
Herb	Asteraceae	*Taraxacum officinale**	Dandelion	'	'			1	30	2	50																	x
Herb	Asteraceae	*Tolpis barbata**	Yellow Hawkweed	'	'																							x
Herb	Anthericaceae	*Tricoryne elatior*	Yellow Autumn-lily	'	'							1	2			1	30	2	50	2	200							x
Herb	Fabaceae	*Trifolium repens**	White Clover	'	'																							x
Herb	Caryophyllaceae	*Vaccaria hispanica**	Bladder Soapwort	'	'					1	1																	x
Herb	Verbenaceae	*Verbena bonariensis**		'	'					10	60											1	30			2	50	x
Herb	Verbenaceae	*Verbena x brasiliensis**		'	'									1	10													x
Herb	Verbenaceae	*Verbena litoralis**		'	'																							x
Herb	Verbenaceae	*Verbena officinalis**	Common Verbena	'	'																							x

Life Form	Family	Species	Common Name	TSC Act	EPBC Act	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7		Plot 8		Plot 9		Plot 10		Plot 11		Random Meander
						% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	Cover %	Abundance	
Herb	Verbenaceae	*Verbena rigida**	Veined Verbena	'	'	1	20	4	20			2	50					5	150	2	40	1	30	2	60			x
Herb	Plantaginaceae	*Veronica plebeia*	Trailing Speedwell	'	'	10	500																					x
Herb	Asteraceae	*Vittadinia cuneata*	Fuzzweed	'	'	2	20																					x
Herb	Campanulaceae	*Wahlenbergia gracilis*	Sprawling Bluebell	'	'															2	50			1	50			x
Herb	Campanulaceae	*Wahlenbergia stricta*	Australian Bluebell	'	'					1	30					1	100					1	50					x
Herb	Fabaceae	*Zornia dyctiocarpa*	Zornia	'	'											1	10											x
Grass	Poaceae	*Aristida ramosa*	Purple Wiregrass	'	'			1	50									2	30					2	80			x
Grass	Poaceae	*Aristida vagans*	Three-awned Speargrass	'	'							30	1000	3	150					2	30							x
Grass	Poaceae	*Avena barbata**	Bearded Oats	'	'																							x
Grass	Poaceae	*Axonopus fissifolius**	Narrow-leafed Carpet Grass	'	'																							x
Grass	Poaceae	*Bothriochloa macra*	Red Grass	'	'			20	200							7	50	1	10					6	200			x
Grass	Poaceae	*Briza maxima**	Blowfly Grass	'	'																							x
Grass	Poaceae	*Briza subaristata**		'	'					1	50																	x
Grass	Poaceae	*Capillipedium spicigerum*	Scented-top Grass	'	'																							x
Grass	Poaceae	*Chloris gayana**	Rhodes Grass	'	'	15	500			30	1000											20	500			10	300	x
Grass	Poaceae	*Chloris truncata*	Windmill Grass	'	'																							x
Grass	Poaceae	*Chloris ventricosa*	Plump Windmill Grass	'	'			10	100			2	50											4	50			x
Grass	Poaceae	*Cymbopogon refractus*	Barbed Wire Grass	'	'									2	100					2	40			2	50			x
Grass	Poaceae	*Cynodon dactylon*	Couch	'	'			10	400	15	1000	10	300	8	100									10	500			x
Grass	Poaceae	*Dichelachne crinita*	Longhair Plumegrass	'	'																							x
Grass	Poaceae	*Dichelachne micrantha*	Shorthair Plumegrass	'	'							3	100			8	100	3	75									x
Grass	Poaceae	*Digitaria didactyla*	Queensland Blue Couch	'	'	10	100											20	1000									x
Grass	Poaceae	*Digitaria divaricatissima*	Umbrella Grass	'	'															1	1							x
Grass	Poaceae	*Digitaria ischaemum**		'	'					30	500																	x

Life Form	Family	Species	Common Name	TSC Act	EPBC Act	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7		Plot 8		Plot 9		Plot 10		Plot 11		Random Meander
						% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	Cover %	Abundance	
Grass	Poaceae	*Echinochloa colona*	Awnless Barnyard Grass	'	'																							x
Grass	Poaceae	*Echinopogon ovatus*	Forest Hedgehog Grass	'	'					3	100					8	60											x
Grass	Poaceae	*Ehrharta erecta**	Panic Veldtgrass	'	'																					3	150	x
Grass	Poaceae	*Entolasia marginata*	Bordered Panic	'	'	3	100																					x
Grass	Poaceae	*Entolasia stricta*	Wiry Panic	'	'							3	100															x
Grass	Poaceae	*Eragrostis benthamii*		'	'															30	1000							x
Grass	Poaceae	*Eriochloa pseudoacrotricha*	Early Spring Grass	'	'			5	150																			x
Grass	Poaceae	*Hyparrhenia hirta**	Coolatai Grass	'	'									1	100													x
Grass	Poaceae	*Melinis repens**	Red Natal Grass	'	'	10	30							2	100					50	1000							x
Grass	Poaceae	*Microlaena stipoides*	Weeping Grass	'	'					10	300	7	200					40	750					2	50	10	500	x
Grass	Poaceae	*Oplismenus aemulus*	Australian Basket Grass	'	'																							x
Grass	Poaceae	*Panicum effusum*	Hairy Panic	'	'																			1	5			x
Grass	Poaceae	*Panicum maximum**	Guinea Grass	'	'																	70	1000			80	1000	x
Grass	Poaceae	*Panicum simile*	Two-colour Panic	'	'													3	50	1	1	10	200					x
Grass	Poaceae	*Paspalidium aversum*		'	'							15	500															x
Grass	Poaceae	*Paspalum dilatatum**	Paspalum	'	'			40	1000	10	100	20	500	5	100			5	100					6	200			x
Grass	Poaceae	*Paspalum distichum*	Water Couch	'	'																							x
Grass	Poaceae	*Pennisetum clandestinum**	Kikuyu Grass	'	'																							x
Grass	Poaceae	*Poa annua**		'	'					2	50																	x
Grass	Poaceae	*Rytidosperma bipartitum*	Wallaby Grass	'	'																							x
Grass	Poaceae	*Rytidosperma tenuius*	Wallaby Grass	'	'	2	50									2	100	2	100					2	30			x
Grass	Poaceae	*Setaria parviflora**	Slender Pigeon Grass	'	'			8	50	2	200			1	20			2	50					3	80			x
Grass	Poaceae	*Sorghum halepense**	Johnson Grass	'	'																							x

Life Form	Family	Species	Common Name	TSC Act	EPBC Act	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7		Plot 8		Plot 9		Plot 10		Plot 11		Random Meander
						% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	% Cover	Abundance	Cover %	Abundance	
Grass	Poaceae	*Sporobolus creber*	Western Rat-tail Grass	'	'			5	30																			x
Grass	Poaceae	*Sporobolus elongatus*	Slender Rat's Tail Grass	'	'																			2	50			x
Grass	Poaceae	*Themeda triandra*	Kangaroo Grass	'	'							2	50			1	30											x
Fern	Pteridaceae	*Adiantum formosum*	Giant Maidenhair	'	'																							x
Fern	Pteridaceae	*Cheilanthes sieberi subsp. Sieberi*	Poison Rock Fern	'	'	2	50			1	100	7	200	10	500	1	20	1	30	15	1000			2	80			x
Climber	Basellaceae	*Anredera cordifolia**	Madeira Vine	'	'																					25	30	x
Climber	Sapindaceae	*Cardiospermum grandiflorum**	Balloon Vine	'	'																							x
Climber	Ranunculaceae	*Clematis aristata*	Old Man's Beard	'	'																							x
Climber	Fabaceae	*Desmodium rhytidophyllum*		'	'											1	20											x
Climber	Fabaceae	*Glycine clandestina*		'	'											2	50	5	500									x
Climber	Fabaceae	*Glycine microphylla*	Small-leaf Glycine	'	'	2	100									1	30	3	200	2	50			4	100			x
Climber	Fabaceae	*Glycine tabacina*		'	'							3	100	2	200	2	70							3	150			x
Climber	Fabaceae	*Hardenbergia violacea*	False Sarsparilla	'	'	1	30																					x
Climber	Convolvulaceae	*Ipomoea indica**	Morning Glory	'	'																							x
Climber	Apocynaceae	*Mandevilla laxa**	Chilean Jasmine	'	'																							x
Climber	Apocynaceae	*Marsdenia rostrata*	Milk Vine	'	'																					10	50	x
Aquatic	Salviniaceae	*Azolla pinnata*	Free floating fern	'	'																							x
Aquatic	Cyperaceae	*Eleocharis sphacelata*		'	'																							x
Aquatic	Onagraceae	*Ludwigia peploides subsp. montevidensis*	Water Primrose	'	'																							x
Aquatic	Typhaceae	*Typha orientalis*	Broadleaf Cumbungi	'	'																							x

Appendix 3

Animal Species Recorded

Life Form	Family	Species	Common Name	TSC Act[1]	EPBC Act[2]	Introduced Species	Observation Type [1]
Bird	Acanthizidae	*Acanthiza nana nana*	Yellow Thornbill				O
Bird	Acanthizidae	*Acanthiza pusilla*	Brown Thornbill				O
Bird	**Acanthizidae**	***Chthonicola sagittata***	**Speckled Warbler**	**V**			**O**
Bird	Accipitridae	*Aviceda subcristata*	Pacific Baza				O
Bird	Acrocephalidae	*Acrocephalus australis*	Australian Reed-warbler				O
Bird	Accipitridae	*Aquila audax*	Wedge-tailed Eagle				O W
Bird	Alcedinidae	*Dacelo novaeguineae*	Laughing Kookaburra				O W
Bird	Alcedinidae	*Todiramphus macleayii*	Forest Kingfisher				O
Bird	Anatidae	*Anas castanea*	Chestnut Teal				O
Bird	Anatidae	*Anas superciliosa*	Pacific Black Duck				O
Bird	Anatidae	*Chenonetta jubata*	Australian Wood Duck				O
Bird	Apodidae	*Hirundapus caudacutus*	White-throated Needletail		M		O
Bird	Ardeidae	*Ardea modesta*	Eastern Great Egret				O W
Bird	Ardeidae	*Egretta novaehollandiae*	White-faced Heron				O
Bird	Artamidae	*Cracticus nigrogularis*	Pied Butcherbird				O
Bird	Artamidae	*Cracticus tibicen*	Australian Magpie				O W
Bird	Artamidae	*Cracticus torquatus*	Grey Butcherbird				O
Bird	Artamidae	*Strepera graculina*	Pied Currawong				OW
Bird	Cacatuidae	*Eolophus roseicapilla*	Galah				OW
Bird	Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike				O W
Bird	Charadriidae	*Vanellus miles*	Masked Lapwing				O
Bird	Columbidae	*Ocyphaps lophotes*	Crested Pigeon				O W

Life Form	Family	Species	Common Name	TSC Act[1]	EPBC Act[2]	Introduced Species	Observation Type [1]
Bird	Corcoracidae	*Corcorax melanorhamphos*	White-winged Chough				O W
Bird	Corvidae	*Corvus coronoides*	Australian Raven				O
Bird	Cuculidae	*Scythrops novaehollandiae*	Channel-billed Cuckoo				W
Bird	Falconidae	*Falco cenchroides*	Nankeen Kestrel				O
Bird	Halcyonidae	*Todiramphus sanctus*	Sacred Kingfisher				O
Bird	Hirundinidae	*Hirundo neoxena neoxena*	Welcome Swallow				E O
Bird	Maluridae	*Malurus cyaneus*	Superb Fairy-wren				O
Bird	Meliphagidae	*Anthochaera chrysoptera*	Little Wattlebird				O W
Bird	Meliphagidae	*Lichenostomus chrysops*	Yellow-faced Honeyeater				O W
Bird	Meliphagidae	*Manorina melanocephala*	Noisy Miner				O W
Bird	Monarchidae	*Grallina cyanoleuca*	Australian Magpie-lark				O W
Bird	Oriolidae	*Oriolus sagittatus*	Olive-backed Oriole				O
Bird	Oriolidae	*Sphecotheres vieilloti*	Australasian Figbird				O
Bird	Pardalotidae	*Pardalotus striatus*	Striated Pardalote				O W
Bird	Petroicidae	*Eopsaltria australis*	Eastern Yellow Robin				O
Bird	Phalacrocoracidae	*Phalacrocorax varius*	Pied Cormorant				O
Bird	Podargidae	*Podargus strigoides*	Tawny Frogmouth				O
Bird	**Pomatostomidae**	***Pomatostomus temporalis temporalis***	**Grey-crowned Babbler (eastern subspecies)**	**V**			**O W**
Bird	Psittacidae	*Glossopsitta concinna concinna*	Musk Lorikeet				O W
Bird	Psittacidae	*Trichoglossus haematodus*	Rainbow Lorikeet				O
Bird	Psittaculidae	*Alisterus scapularis*	King Parrot				O W

Life Form	Family	Species	Common Name	TSC Act[1]	EPBC Act[2]	Introduced Species	Observation Type [1]
Bird	Psittaculidae	*Platycercus eximius*	Eastern Rosella				O W
Bird	Rallidae	*Fulica atra*	Eurasian Coot				O
Bird	Rallidae	*Gallinula tenebrosa*	Dusky Moorhen				O
Bird	Rallidae	*Porphyrio porphyrio*	Purple Swamphen				O W
Bird	Rhipiduridae	*Rhipidura albiscapa*	Grey Fantail				O W
Bird	Rhipiduridae	*Rhipidura leucophrys*	Willy Wagtail				O
Bird	Sturnidae	*Acridotheres tristis*	Indian Mynah			x	O
Bird	Sturnidae	*Sturnus vulgaris*	Common Starling			x	O
Bird	Timaliidae	*Zosterops lateralis*	Silvereye				O
Bird	Threskiornithidae	*Threskiornis spinicollis*	Straw-necked Ibis				O
Mammal	Canidae	*Vulpes vulpes*	European Fox			x	F
Mammal	Dasyuridae	*Antechinus stuartii*	Brown Antechinus				T
Mammal	Macropodidae	*Macropus giganteus*	Eastern Grey Kangaroo				O
Mammal	Muridae	*Rattus rattus*	Black Rat			x	T
Mammal	**Petauridae**	***Petaurus norfolcensis***	**Squirrel Glider**	**V**			**O**
Mammal	**Pteropodidae**	***Pteropus poliocephalus***	**Grey-headed Flying Fox**	**V**	**V**		**O**
Mammal	Phalangeridae	*Trichosurus vulpecula*	Common Brushtail Possum				O F
Mammal	**Miniopteridae**	***Miniopterus schreibersii (orianae) oceanensis***	**Eastern Bentwing-bat**	**V**			**U**
Mammal	**Molossidae**	***Mormopterus norfolkensis***	**Eastern Freetail-bat**	**V**			**U**
Mammal	Molossidae	*Mormopterus planiceps*	Little Mastiff-bat				U
Mammal	Molossidae	*Mormopterus ridei*	Eastern Little Freetail-bat				U

Life Form	Family	Species	Common Name	TSC Act[1]	EPBC Act[2]	Introduced Species	Observation Type [1]
Mammal	Molossidae	*Tadarida australis*	White-striped Free-tailed Bat				U
Mammal	Rhinolophidae	*Rhinolophus megaphyllus*	Smaller Horseshoe Bat				U
Mammal	Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat				U
Mammal	Vespertilionidae	*Scotorepens balstoni*	Inland Broad-nosed Bat				U
Mammal	Vespertilionidae	*Scotorepens orion*	Eastern Broad-nosed Bat				U
Mammal	Vespertilionidae	*Vespadelus pumilus*	Eastern Forest Bat				U
Frog	Hylidae	*Litoria fallax*	Dwarf Tree Frog				W O
Frog	Hylidae	*Litoria peronii*	Peron's Tree Frog				W O
Frog	Myobatrachidae	*Crinia signifera*	Common Eastern Froglet				W
Frog	Myobatrachidae	*Limnodynastes peronii*	Striped Marsh Frog				W
Reptile	Elapidae	*Pseudonaja textilis*	Eastern Brown Snake				O
Reptile	Scincidae	*Eulamprus quoyii*	Eastern Water Skink				O

1 – V = Listed as vulnerable under the TSC Act
2 – V = vulnerable, M = Listed as migratory under the EPBC Act
3 – E = Nest, F = scratch, O = Observed, T = Trapped, U = Anabat detection, W = Heard

Appendix 4

Threatened Flora and Fauna

Table 1 Threatened species of fauna

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat Description	Records[3]	Likelihood of occurrence	Impact assessment Required
Amphibians							
Litoria booroolongensis	Booroolong Frog	E1	E	Live along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses. Adults occur on or near cobble banks and other rock structures within stream margins. Shelter under rocks or amongst vegetation near the ground on the stream edge.	P	Low. No habitat in the study area.	No
Litoria aurea	Green and Golden Bell Frog	E1	V	Distributed from NSW north coast near Brunswick Heads, southwards along NSW coast to Victoria where it extends into east Gippsland. Inhabits marshes, dams and stream-sides, particularly those containing bulrushes or spikerushes. Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available.	P	Moderate. Small dams exist with some fringing Typha. Not recorded despite targeted surveys.	Yes

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat Description	Records[3]	Likelihood of occurrence	Impact assessment Required
Mixophyes balbus	Stuttering Frog	E1	V	Stuttering Frogs occur along the east coast of Australia from southern QLD to north-eastern Victoria. Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Outside the breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor.	P	Low. No habitat in the study area.	No
Heleioporus australiacus	Giant Burrowing Frog	V	V	Distributed in south-eastern NSW and Victoria, a northern population largely confined to the sandstone geology of the Sydney Basin and extending as far south as Ulladulla. Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except clay based. Breeding habitat is generally soaks or pools within first or second order streams.	1	Low. No habitat in the study area.	No
Litoria littlejohni	Littlejohn's Tree Frog, Heath Frog	V	V	Distribution includes the plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest south to Buchan in Victoria. This species breeds in the upper reaches of permanent streams and in perched swamps. Non-breeding habitat is heath based forests and woodlands where it shelters under leaf litter and low vegetation.	P	Low. No habitat in the study area.	No

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat Description	Records[3]	Likelihood of occurrence	Impact assessment Required
Birds							
Ardea ibis	Cattle Egret	-	M	The Cattle Egret occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. High numbers have been observed in moist, low-lying poorly drained pastures with an abundance of high grass; it avoids low grass pastures. It has been recorded on earthen dam walls and ploughed fields. It is commonly associated with the habitats of farm animals, particularly cattle. It uses predominately shallow, open and fresh wetlands including meadows and swamps with low emergent vegetation and abundant aquatic flora.	P	Moderate. Habitat occurs in grasslands and farm dams. Impact would be low due to small minor area of habitat to be removed.	Yes, an impact assessment for this species is provided in Section 5.6 of the main report.
Monarcha melanopsis	Black-faced Monarch	-	M	Wet forest specialist, found mainly in rainforest and wet sclerophyll forest, especially in sheltered gullies and slopes with a dense understorey of ferns and/or shrubs.	P	Low. No habitat recorded.	No
Monarcha trivirgatus	Speckled Monarch		M	Habitat includes dense vegetation, mainly in rainforest but also in moist forest or wet sclerophyll and occasionally in other dense vegetation such as mangroves, drier forest and woodlands.	P	Low. No habitat recorded.	No

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat Description	Records[3]	Likelihood of occurrence	Impact assessment Required
Apus pacificus	Fork-tailed Swift	-	M	Non-breeding habitat only: Found across a range of habitats, from inland open plains to wooded areas, where it is exclusively aerial. The Fork-tailed Swift is a medium to large member of the Apodidae Family. It has a length of 18–21 cm, a wingspan of 40–42 cm and weighs around 30–40 g. It is a medium-sized Swift, with a slim body with long scythe-shaped wings that taper to finely pointed tips. It is characterized by a long and deeply forked tail. There is also a white patch on the chin and throat. The body, tail and upper-wings are black-brown and they have a faint pale scaling to the saddle and white scalloping to the underbody. The sexes are alike with no seasonal variation. Juveniles are also indistinguishable in the field.	P	Moderate. No breeding habitat in Australia winter foraging only. Foraging habitat likely to be restricted to catching insects in the air.	Yes, an impact assessment for this species is provided in Section 5.6 of the main report.
Ardea alba	Eastern Great Egret	-	M	The Eastern Great Egret has been reported in a wide range of wetland habitats. These include swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pastures or agricultural lands; reservoirs; sewage treatment ponds; drainage channels; salt pans and salt lakes; salt marshes; estuarine mudflats, tidal streams; mangrove swamps; coastal lagoons; and offshore reefs The species usually frequents shallow waters.	P	Low. No habitat within the study area.	No

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat Description	Records[3]	Likelihood of occurrence	Impact assessment Required
Cuculus optatus	Oriental Cuckoo	-	M	Habitat is monsoonal rainforest, vine thickets, wet sclerophyll forest or open Casuarina, Acacia or Eucalyptus woodlands. Frequently at edges or ecotones between habitat types. Riparian forest is favoured habitat in the Kimberley region.	P	Low. No habitat in the study area.	No
Hieraaetus caudacutus	White-throated Needletail	-	M	Non-breeding habitat only: Found across a range of habitats, more often over wooded areas, where it is almost exclusively aerial. Large tracts of native vegetation, particularly forest, may be a key habitat requirement for species. Found to roost in tree hollows in tall trees on ridge-tops, on bark or rock faces. Appears to have traditional roost sites.	P	Recorded.	Yes, an impact assessment for this species is provided in Section 5.6 of the main report.
Merops ornatus	Rainbow Bee-eater	-	M	This species occurs throughout Australia. Habitat includes woodlands, grasslands, open forests and cleared areas. Insectivorous species and nests throughout Australia.	P	Moderate. Potential habitat within the study area. Impact would be small as a small area of potential habitat to be removed. Large areas of potential habitat within the vicinity of the study area.	Yes, an impact assessment for this species is provided in Section 5.6 of the main report.

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat Description	Records[3]	Likelihood of occurrence	Impact assessment Required
Motacilla flava	Yellow Wagtail	-	M	Non-breeding habitat only: mostly well-watered open grasslands and the fringes of wetlands. Roosts in mangroves and other dense vegetation.	P	Low. No habitat recorded.	No
Myiagra cyanoleuca	Satin Flycatcher	-	M	Eucalypt forest and woodlands, at high elevations when breeding. They are particularly common in tall wet sclerophyll forest, often in gullies or along water courses. In woodlands they prefer open, grassy woodland types. During migration, habitat preferences expand, with the species recorded in most wooded habitats except rainforests. Wintering birds in northern QLD will use rainforest – gallery forests interfaces, and birds have been recorded wintering in mangroves and paperbark swamps.	P	Low. No habitat recorded.	No
Rhipidura rufifrons	Rufous Fantail	-	M	Moist, dense habitats, including mangroves, rainforest, riparian forests and thickets, and wet eucalypt forests with a dense understorey. When on passage a wider range of habitats are used including dry eucalypt forests and woodlands and Brigalow shrublands.	P	Low. No habitat recorded.	No
Botaurus poiciloptilus	Australasian Bittern	E1	E	Inhabits terrestrial and estuarine wetlands, generally where there is permanent water. The species prefers wetlands with dense vegetation, including sedges, rushes and reeds.	K	Low. No habitat in the study area.	No

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat Description	Records[3]	Likelihood of occurrence	Impact assessment Required
Dasyornis brachypterus	Eastern Bristlebird	E1	E	Habitat is characterised by dense, low vegetation including heath and open woodland with a heathy understorey. Age of habitat since fires (fire-age) is of paramount importance to this species; Illawarra and southern populations reach maximum densities in habitat that has not been burnt for at least 15 years.	P	Low. No habitat in the study area.	No
Ephippiorhynchus asiaticus	Black-necked Stork	E1	-	Widespread in coastal and subcoastal northern and eastern Australia, south to central-eastern NSW. Mainly found on shallow, permanent, freshwater terrestrial wetlands, and surrounding marginal vegetation, including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters, as well as extending into adjacent grasslands, paddocks and open savannah woodlands.	10	Moderate. Farm dams and disturbed watercourse vegetation is present.	Yes
Lathamus discolor	Swift Parrot	E1	CE, M	Migrates to south-eastern mainland in Mar-Oct. Winter-flowering trees such as *Eucalyptus robusta*, *Corymbia maculata*, *C. gummifera*, *E. sideroxylon* and *E. albens* are important. Breeds in Tasmania.	58	Moderate. Foraging habitat for this species occurs within the study area. including *Corymbia maculata* and *Eucalyptus tereticornis* trees.	Yes

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat Description	Records[3]	Likelihood of occurrence	Impact assessment Required
Rostratula australis	Australian Painted Snipe	E1	E, M	Restricted to Australia. Most records are from the south east, particularly the Murray Darling Basin. In NSW, many records are from the Murray-Darling Basin. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	P	Moderate. Quality habitat for this species occurs in the study area.	Yes
Anthochaera phrygia	Regent Honeyeater	E4A	CE,M	Dry open forest and woodland. Particularly box-ironbark woodland and riparian forests of river sheoak. Feeds on the nectar from a wide range of eucalypts mistletoes and invertebrates. The distribution of this species is confined to Victoria and New South Wales. This species breeds in cup-like nests constructed with bark.	4	Moderate. Foraging habitat for this species occurs within the study area including *Corymbia maculata* and *Eucalyptus tereticornis.*	Yes
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	Distributed from southern Victoria through south- and central-eastern New South Wales. In summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas.	4	Low. No habitat in the study area.	No
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	Feeds almost exclusively on the seeds of *Casuarina* sp. and *Allocasuarina* sp. Open forest and woodlands up to 1000m with feed trees present.	2	Low. No habitat in the study area.	No

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat Description	Records[3]	Likelihood of occurrence	Impact assessment Required
Chthonicola sagittata	Speckled Warbler	V	-	Most frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast. Wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy.	68	Recorded.	Yes
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-	Eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. Mainly inhabits woodlands dominated by rough-barked eucalypts, usually with a grassy or sparse shrub understorey. Fallen timber is an important habitat component for foraging. Nests in tree hollows.	18	Moderate. Potential habitat present in forest areas of the study area, many local records. Not recorded during the survey.	Yes
Daphoenositta chrysoptera	Varied Sittella	V	-	Eucalypt forests and woodlands, particularly those with rough-barked species, mature smooth-barked gums with dead branches, mallee and Acacia woodland.	18	Moderate. Potential habitat present in forest areas of the study area, many local records. Not recorded during the survey.	Yes

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat Description	Records[3]	Likelihood of occurrence	Impact assessment Required
Falco subniger	Black Falcon	V	-	Inhabits woodland, shrubland and grassland in the arid and semi-arid zones, especially wooded watercourses and agricultural land with scattered remnant trees. The Black Falcon is usually associated with streams or wetlands, visiting them in search of prey and often using standing dead trees as lookout posts. Habitat selection is generally influenced more by prey densities than by specific aspects of habitat floristics or condition, although in agricultural landscapes, the Black Falcon tends to nest in healthy, riparian woodland remnants with a diverse avifauna.	2	Moderate. Habitat for this species occurs in the study area.	Yes
Glossopsitta pusilla	Little Lorikeet	V	-	Forages in flowering eucalypts and Melaleuca sp. Riparian habitats are used, due to higher soil fertility and greater productivity. Nests in tree hollows.	20	Moderate. Habitat for this species occurs in the study area.	Yes
Grantiella picta	Painted Honeyeater	V	V	Nomadic bird that occurs at low densities throughout its range. Greatest concentrating of birds and almost all breeding of birds on the inland slopes of the Great Dividing Range in NSW, VIC and southern QLD. Inhabits Boree, Brigalow and Box-gum Woodlands and Bo-Ironbark Forests.	4	Moderate. Habitat for this species occurs in the study area.	Yes

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat Description	Records[3]	Likelihood of occurrence	Impact assessment Required
Hieraaetus morphnoides	Little Eagle	V	-	Found throughout the Australian mainland except in the most densely forested parts of the Dividing Range escarpment. Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used.	2	Moderate habitat for this species was recorded in the study area.	Yes
Lophoictinia isura	Square-tailed Kite	V	-	Timbered habitats including dry woodlands and open forests. Prefers timbered watercourses. Specialist hunter of passerines and insects.	1	Moderate. Habitat for this species occurs in the study area.	Yes
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	-	Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Often perches on low dead stumps and fallen timber or on low-hanging branches. The nest is a small, neat cup of bark and grasses bound with webs, in a tree fork or crevice, from less than 1m to 5m above the ground.	12	Moderate. Habitat for this species occurs in the study area.	Yes

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat Description	Records[3]	Likelihood of occurrence	Impact assessment Required
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Inland Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) and Forest Red Gum (*E. tereticornis*). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees.	3	Moderate. Habitat for this species occurs in the study area.	Yes
Neophema pulchella	Turquoise Parrot	V	-	Range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland.	1	Moderate. Habitat for this species occurs within the study area.	Yes
Ninox connivens	Barking Owl	V	-	Woodland and open forest including fragmented remnants and partly cleared farmland. Preferentially hunts small arboreal mammals such as squirrel gliders and ringtail possums. But as prey decreases becomes reliant on birds, invertebrates and terrestrial mammals such as rodents and rabbits. Large tree hollows are used for nesting.	1	Moderate. Habitat for this species occurs in the study area.	Yes

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat Description	Records[3]	Likelihood of occurrence	Impact assessment Required
Ninox strenua	Powerful Owl	V	-	Endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range. Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest.	3	Moderate. Habitat for this species occurs in the study area.	Yes
Petroica boodang	Scarlet Robin	V	-	Dry eucalypt forests and woodland with open grassy understorey with few scattered shrubs. Occurs in both mature and regrowth forests and occasionally occurs in mallee, wet forests, wetlands and tea-tree swamps.	6	Moderate. Habitat for this species occurs in the study area.	Yes
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	-	Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains.	157	Recorded.	Yes
Stagonopleura guttata	Diamond Firetail	V	-	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Eucalyptus pauciflora Woodlands. Also in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Also found in riparian areas, and sometimes in lightly wooded farmland. Birds roost in dense shrubs or in smaller nests built especially for roosting.	7	Moderate. Habitat for this species occurs in the study area.	Yes

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat Description	Records[3]	Likelihood of occurrence	Impact assessment Required
Tyto novaehollandiae	Masked Owl	V	-	Extends from the coast where it is most abundant to the western plains. Lives in dry eucalypt forests and woodlands from sea level to 1100m.	2	Moderate. Habitat for this species occurs in the study area.	Yes
Tyto tenebricosa	Sooty Owl	V	-	Occurring on the coast, coastal escarpment and eastern tablelands. There is no seasonal variation in its distribution. Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Roosts by day in the hollow of a tall forest tree or in heavy vegetation.	1	Low. No habitat in the study area.	No
Fish[3]							
Macquaria australasica	Macquarie Perch	E (FM Act)[4]	-	The Macquarie Perch is a riverine, schooling species. It prefers clear water and deep, rocky holes with lots of cover. As well as aquatic vegetation, additional cover may comprise of large boulders, debris and overhanging banks.	P	Low. No habitat in the study area.	No
Mammals							
Pseudomys novaehollandiae	New Holland Mouse	-	V	Known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes. Social animal, living predominantly in burrows shared with others.	11	Low. No habitat in the study area.	No

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat Description	Records[3]	Likelihood of occurrence	Impact assessment Required
Pseudomys oralis	Hastings River Mouse	E1	E	Inhabits a variety of dry open forests type with dense, low ground cover and a diverse mixture of ferns, grass, sedges and herbs within the Great Dividing Range from the Hunter Valley south of Mt Royal, north to Bunya Mountains and near Kingaroy in south-east QLD, at elevations between 300-1100 metres.	P	Low. No habitat in the study area.	No
Dasyurus maculatus	Spotted-tailed Quoll	V	E	A variety of vegetation such as rainforest, open forest, woodland, coastal heath, inland riparian forest. Have home ranges of 750 - 3500 ha. Den sites may be located in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky cliffs.	24	Moderate. Habitat for this species occurs in the study area.	Yes
Phascogale tapoatafa	Brush-tailed Phascogale	V	-	Mostly found in dry sclerophyll open forest with sparse groundcover, east of the Great Dividing Range. However, has been recorded in heath, swamps, rainforest and wet sclerophyll forest. Nest and shelter in tree hollows with small entrances (2.5 - 4cm).	10	Moderate. Habitat for this species occurs in the study area.	Yes
Phascolarctos cinereus	Koala (NSW, ACT & QLD - excluding SE QLD)	V	V	Found in eucalypt woodlands and forest foraging on preferred food trees. Koalas will feed almost exclusively on a small number of preferred species. The preferred tree species vary widely on a regional and local basis. Some preferred species in NSW.	12	Moderate. Habitat for this species occurs in the study area. No evidence was recorded.	Yes.

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat Description	Records[3]	Likelihood of occurrence	Impact assessment Required
Phascolarctos cinereus	Koala	E2		Three endangered populations for the Koala include the following: 1. Koala in the Pittwater Local Government Area. 2. Koala *Phascolarctos cinereus* (Goldfuss, 1817) between the Tweed and Brunswick Rivers east of the Pacific Highway 3. Koala Hawks Nest and Tea Gardens Population	0	The study area does not occur in any of the endangered populations locations.	No
Petrogale penicillata	Brush-tailed Rock-wallaby	E1	V	Rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges often facing north.	K	Low. No habitat in the study area.	No
Potorous tridactylus	Long-nosed Potoroo	V	V	Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature.	P	Low. No habitat in the study area.	No
Petaurus australis	Yellow-bellied Glider	V	-	Tall mature eucalypt forest, generally in areas with high rainfall and nutrient rich soils. Feed primarily on nectar, sap, honeydew and manna with pollen and insects also taken. Often leave a distinctive V-shaped feeding scar on tree trunks. Den in tree hollows of large trees.	1	Low. No habitat for this species.	No

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat Description	Records[3]	Likelihood of occurrence	Impact assessment Required
Petaurus norfolcensis	Squirrel Glider	V	-	Inhabits mature or old growth box, box-ironbark woodlands and river red gum forest west of the Great Dividing Range. Prefers mixed species stands with a shrub or Acacia mid-storey. Uses tree hollows as den sites.	27	Recorded	Yes
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	This species is generally found within 200 km of Australia's eastern coast. Generally occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are commonly found in gullies, close to water, in vegetation with a dense canopy.	85	Recorded	Yes
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	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.	3	Moderate. Habitat for this species occurs in the study area	Yes
Mormopterus norfolkensis	Eastern Freetail-bat	V	-	The Eastern Freetail-bat is found along the east coast from south QLD to southern NSW. Occurs in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark.	35	Recorded	Yes

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat Description	Records[3]	Likelihood of occurrence	Impact assessment Required
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin, frequenting low to mid-elevation dry open forest and woodland close to these features. Also found in well-timbered areas containing gullies.	12	Moderate. Foraging habitat for this species occurs in the study area.	Yes
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	Found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania. Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings.	3	Moderate habitat for this species occurs within the study area.	Yes
Austronomus australis	Little Bent-wing Bat	V	-	Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	14	Recorded.	Yes
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	Forages in a range of habitat types. Roosts in caves, derelict mines, culverts and other man-made structures. Form maternity colonies that are faithful to particular caves.	47	Recorded.	Yes

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat Description	Records[3]	Likelihood of occurrence	Impact assessment Required
Myotis macropus	Southern Myotis	V	-	Forages over streams and pools catching insects and small fish by raking their feet across the water surface. Roost close to water in caves, mine shafts, tree hollows and man-made structures.	9	Moderate. Foraging habitat for this species occurs in the study area.	Yes
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. This species usually roosts in tree hollows.	7	Moderate. Habitat for this species occurs in the study area.	Yes
Vespadelus troughtoni	Eastern Cave Bat	V	-	A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. Occasionally found along cliff-lines in wet eucalypt forest and rainforest.	9	Moderate. Foraging Habitat for this species occurs in the study area.	Yes
Nyctophilus corbeni	Corben's Long eared Bat	V	V	Inhabits a variety of vegetation types, including mallee, bulloke *Allocasuarina leuhmanni* and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland.	P	Low. No habitat in the study area.	No

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat Description	Records[3]	Likelihood of occurrence	Impact assessment Required
Reptiles							
Hoplocephalus bungaroides	Broad-headed Snake	E1	V	The Broad-headed Snake is largely confined to Triassic and Permian sandstones. Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges. Moves from the sandstone rocks to shelters in hollows in large trees within 200m of escarpments in summer.	P	Low. No habitat in the study area.	No

Notes

1: V= Vulnerable, E1 = Endangered species, E2 = Endangered population, E4a = Critically endangered as listed on the TSC Act,

2: V = Vulnerable, E = Endangered, CE = Critically Endangered as listed under the EPBC Act.

3 P = Predicted, K = Known by database searches

4 E (FM Act) = Endangered under the *Fisheries Management Act*.

Table 2 Threatened species of flora

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat Description	Records[3]	Likelihood of occurrence	Potential Impacts
Acacia bynoeana	Bynoe's Wattle	E1	V	Occurs in heath or dry sclerophyll forest on sandy soils. Prefer opens, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia and Narrow-leaved Apple.	5	Low. No habitat for this species occurs within the study area.	Low
Acacia pendula	Acacia pendula population in the Hunter catchment	E2	-	Occurs on the western slopes and plains of far west NSW. The Hunter population typically occurs on heavy soils and marginal floodplains. May also occur in undulating locations.	2	Low. Degraded habitat occurs within the study area.	Low. No individuals of this species were recorded within the study area.
Allocasuarina glareicola	-	E1	E	Can be found in Castlereagh woodland on lateritic soil. Found within open woodland with *Eucalyptus parramattensis*, *Eucalyptus fibrosa*, *Angophora bakeri*, *Eucalyptus sclerophylla* and *Melaleuca decora*.	P	Low. No habitat in the study area	Low

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat Description	Records[3]	Likelihood of occurrence	Potential Impacts
Angophora inopina	Charmhaven Apple	V	V	Located in the Central Coast region of NSW. Occurs most frequently in four main vegetation communities: (i) *Eucalyptus haemastoma–Corymbia gummifera–Angophora inopina* woodland/forest; (ii) *Hakea teretifolia–Banksia oblongifolia* wet heath; (iii) *Eucalyptus resinifera–Melaleuca sieberi–Angophora inopina* sedge woodland; (iv) *Eucalyptus capitellata–Corymbia gummifera–Angophora inopina* woodland/forest.	1	Low. No habitat in the study area.	Low
Asterolasia elegans	-	E1	E	Occurs on Hawkesbury sandstone. Can be found in sheltered forests on mid to low slopes and valleys and in areas of sheltered forest.	P	Low. No habitat in the study area.	Low
Cryptostylis hunteriana	Leafless Tongue-orchid	V	V	Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. The larger populations typically occur in woodland dominated by Scribbly Gum, Silvertop Ash, Red Bloodwood and Black Sheoak; appears to prefer open areas in the understorey and is often found in association with the Large Tongue Orchid and the Tartan Tongue Orchid.	P	Low. No habitat in the study area.	Low

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat Description	Records[3]	Likelihood of occurrence	Potential Impacts
Cymbidium canaliculatum	Cymbidium canaliculatum population in the Hunter Catchment	E2	-	Can be found in hollows, fissures, forks and trunks of trees located in dry sclerophyll forest or woodland. Host trees typically occur on Permian Sediments of the Hunter Valley floor.	2	Low. This species is known to occur on Eucalypt trees in the area. However, no individuals were recorded.	Low
Cynanchum elegans	White-flowered Wax Plant	E1	E	Occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest, coastal tea tree and coastal banksia coastal scrub, forest red gum aligned open forest and woodland, spotted gum aligned open forest and woodland and bracelet honey myrtle scrub to open scrub. Restricted to eastern NSW where it is distributed from Brunswick Heads on the north coast to Gerroa in the Illawarra region. Been recorded as far west as Merriwa in the upper Hunter river valley.	8	Low. No habitat in the study area.	Low
Eucalyptus camaldulensis	Eucalyptus camaldulensis population in the Hunter catchment	E2	-	Population found in the Hunter Catchment.	62	Low. This species was not recorded in the study area. The riparian habitats recorded in the study area are high degraded.	Low

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat Description	Records[3]	Likelihood of occurrence	Potential Impacts
Eucalyptus castrensis	Singleton Mallee	E1	-	Only known to occur near Singleton and the lower Hunter Valley. Occurs as a dense mallee strand on loam over standstone.	14	Low. No habitat in the study area	Low
Eucalyptus fracta	Broken Back Ironbark	V	-	Only known to occur in the northern Broken Back Range near Cessnock NSW. The dominant tree in a narrow band along the upper edge of a sandstone escarpment. Occurs in dry eucalypt woodland in shallow soils.	3	Low. No habitat in the study area.	Low
Eucalyptus glaucina	Slaty Red Gum	V	V	Grows in grassy woodland and dry eucalypt forest on deep moderately fertile and well-watered soils.	254	Moderate-high. This species is known to occur in large numbers in close proximity to the study area. However, no specimens were recorded despite targeted surveys.	Low
Eucalyptus parramattensis subsp. decadens	Earp's Gum	V	V	Found in the Hunter Region in dry sclerophyll woodland on sandy soils, often in low wet locations.	5	Low. No habitat in the study area	Low

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat Description	Records[3]	Likelihood of occurrence	Potential Impacts
Eucalyptus pumila	Pokolbin Mallee	V	V	Known only to be found in a single population in the Hunter Valley near western Pokolbin. The single known population occupies north-west-facing slopes derived from sandstone. Present as a mid-canopy species to a height of 6 metres within dry sclerophyll woodland which has a canopy comprising Eucalyptus fibrosa, Callitris endlicheri and, to a lesser extent, Corymbia maculata.	5	Low. No habitat in the study area.	Low
Euphrasia arguta	-	E4a	CE	Historically found in sub-humid open forests around Bathurst as well as open grassy country and meadows near rivers. Nundle area hosts plants in eucalypt forest with grassy understorey.	P	Low. No habitat in the study area.	Low
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	V	V	Distributed sporadically in Sydney Basin and Hunter area. Found in light sandy soils over thin shales with lateritic ironstone gravels. Occurs in a wide range of vegetation types from heath and shrubby woodland to open forests.	K	Low. Degraded habitat occurs in the study area. However, the closest record is at Kurri Kurri.	Low
Pelargonium sp. Striatellum (G.W.Carr 10345)	Omeo Stork's-bill	-	E	Known to occur in habitat located above high water level of irregularly inundated or ephemeral lakes.	P	Low. No habitat in the study area.	Low

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat Description	Records[3]	Likelihood of occurrence	Potential Impacts
Persoonia pauciflora	North Rothbury Persoonia	E4A	CE	Found restrictedly in the Rothbury area. Occurs in dry open forest or woodland.	89	Low. No habitat in the study area.	Low
Prostanthera cineolifera	Singleton Mint Bush	V	V	Grows in open woodlands and exposed sandstone ridges. Usually found with shallow or skeletal sands. Known only to occur in a few locations near Walcha, Scone, Cessnock and St Albans.	4	Low. No habitat in the study area.	Low
Pterostylis gibbosa	Illawarra Greenhood	E1	E	In the Illawarra region, grows in woodland dominated by Forest Red Gum *Eucalyptus tereticornis*, Woollybutt *E. longifolia* and White Feather Honey-myrtle Melaleuca decora. Near Nowra, grows in an open forest of Spotted Gum Corymbia maculata, Forest Red Gum and Grey Ironbark *E. paniculata*. In the Hunter region, grows in open woodland dominated by Narrow-leaved Ironbark *E. crebra*, Forest Red Gum and Black Cypress Pine *Callitris endlicheri*.	P	Low. No habitat in the study area.	Low
Rutidosis heterogama	Heath Wrinklewort	V	V	Grows in heath on sandy soils and moist areas in open forest, and has been recorded along disturbed roadsides.	1	Low. Degraded habitat occurs within the study area. However, no records occur in the vicinity of the study area with the closest record at Kurri Kurri.	Low

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat Description	Records[3]	Likelihood of occurrence	Potential Impacts
Syzygium paniculatum	Magenta Lilly Pilly	V	V	On the South Coast, the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the Central Coast, Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	P	Low. No habitat in the study area.	Low
Thesium australe	Austral Toadflax	V	V	Found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Grows in association with *Themeda australis*.	P	Low. Minor habitat for this species occurs in the study area. The species was not recorded despite surveys in the correct season.	Low

Notes

1: V= Vulnerable, E1 = Endangered species, E2 = Endangered population, E4a = Critically endangered as listed on the TSC Act,

2: V = Vulnerable, E = Endangered, CE = Critically Endangered as listed under the EPBC Act.

3: P = Predicted by database searches

Appendix 5

Threatened Ecological Communities

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Central Hunter Grey Box-Ironbark Woodland in the NSW North Coast and Sydney Bioregions	E3	CE	Found in the Central Hunter Valley between Singleton and Muswellbrook occurring in area of relatively low rainfall and high temperatures. Associated with Permian lithology and situated on gently undulating hills, slopes and valleys and occasionally on rocky knolls. Characterised by the presence of Narrow-leaved Ironbark (*Eucalyptus crebra*), Kurrajong (*Brachychiton populneus subsp. populneus*) and Grey Box (*Eucalyptus moluccana*). Other tree species such as Rough-barked Apple (*Angophora floribunda*) and Black Cypress Pine (*Callitris endlicheri*) may be present and occasionally dominate or co-dominate. The understorey in intact sites is often present and common shrub species include Velvet Mock Olive (*Notelaea microcarpa var. microcarpa*), Coffee Bush (*Breynia oblongifolia*), Blackthorn (*Bursaria spinosa subsp. spinosa*), *Cassinia quinquefar*ia and Sticky Hop-bush (*Dodonaea viscosa*). Subshrubs may also be common and include Narrawa Burr (*Solanum cinereum*), *Phyllanthus virgatus* and Small-leaf Bluebush (*Maireana microphylla*). Ground cover can be moderately dense to dense, and consist of numerous forbs and grass species as well as a small number of ferns, sedges and twiners.	K	Low. Two of the dominant species occur within the study area being *Eucalyptus crebra* and *Eucalyptus moluccana*. These two species were present however, *Corymbia maculata* dominated with *Eucalyptus crebra* which is defined as Central Hunter Spotted Gum Ironbark Forest.	Low.

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Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Central Hunter Ironbark-Spotted Gum-Grey Box Forest in the NSW North Coast and Sydney Bioregions Listed as *Central Hunter Valley eucalypt forest and woodland* on the EPBC Act	E3	CE	Found in the Central Hunter Valley mainly between Maitland and Muswellbrook, occurring in areas of undulating country including low rises and slopes on all aspects. Mostly occurs on clayey soils on Permian sediments, may also occur on alluvial and colluvial soils in valleys. Characterised by Narrow-leaved Ironbark (*Eucalyptus crebra*), Spotted Gum (*Corymbia maculata*) and Grey Box (*Eucalyptus moluccana*) forming an open forest. Other tree species such as Red Ironbark (*Eucalyptus fibrosa*) and Forest Red Gum (*Eucalyptus tereticornis*) may be present, and occasionally dominate or co-dominate. A sparse layer of small trees including Bulloak (*Allocasuarina luehmannii*) or Silver-stemmed Wattle (*Acacia parvipinnula*) may be present in some areas. The shrub layer varies from sparse to moderately dense. Common shrub species include Gorse Bitter Pea (*Daviesia ulicifolia subsp. ulicifolia*), Grey Bush-pea (*Pultenaea spinosa*), Coffee Bush (*Breynia oblongifolia*), Needlebush (*Hakea sericea*) and Blackthorn (*Bursaria spinosa* subsp. *spinosa*). Ground cover can be sparse to moderately dense and consists of numerous forbs, a few grass species and occasional ferns and sedges.	K	Recorded. This EEC was recorded within the study area. Portions of this community meet the criteria for the critically endangered community listed on the EPBC Act.	High. Significance impact assessment is required for this community.

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	V	Coastal Saltmarsh occurs in the intertidal zone on the shores of estuaries and lagoons that are permanently or intermittently open to the sea. Characteristic plants include Baumea juncea, Sea Rush (*Juncus krausii* subsp. *australiensis*), Samphire (*Sarcocornia quinqueflora* subsp. *quinqueflora*), Marine Couch (*Sporobolus virginicus*), treaked Arrowgrass (*Triglochin striata*), Knobby Club-rush (*Ficinia nodosa*), Creeping Brookweed (*Samolus epens*), Swamp Weed (*Selliera radicans*), Seablite (*Suaeda australis*) and Prickly Couch (*Zoysia macrantha*).	P	Low. None of the associated estuarine species occur within or adjacent to the study area.	Low.

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Freshwater Wetlands on Coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions	E3	-	Found along the majority of the NSW coast, however distinct from the Sydney Freshwater Wetlands. Associated with coastal areas subject to periodic flooding. Standing 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 the floodplains, alluvial flats, depressions, drainage lines, backswamps, lagoons and lakes. May also occur in backbarrier landforms where floodplains adjoin coastal sandplains. Dominated by herbaceous plants and have very few woody species. Those that lack standing water most of the time are usually dominated by dense grassland or sedgeland vegetation, often forming a turf less than 0.5 metre tall and dominated by amphibious plants including *Paspalum distichum* (water couch), *Leersia hexandra* (swamp rice-grass), *Pseudoraphis spinescens* (mud grass) and *Carex appressa* (tussock sedge).	K	Low. None of the associated wetland species occur within or adjacent to the study area.	Low.
Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions	E3	-	Found within the Central Hunter Valley geographic distribution, occurring on floodplains and floodplain rises. This community is known to contain the endangered River Red Gum population. Characterised by very tall woodland, occurring on floodplain and associated rises along the Hunter River and tributaries. Generally dominated by *Eucalyptus camaldulensis* (River Red Gum) in combinations with *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus melliodora* (Yellow Box) and *Angophora floribunda* (Rough-barked Apple).	K	Low. None of the associated tree species occur within or adjacent to the study area.	Low.

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Hunter Lowland Red Gum Forest in the Sydney Basin and NSW North Coast Bioregions	E3	-	Found between Muswellbrook, Beresfield, Mulbring and Cessnock in the Lower Hunter, occurring on the Permian sediments of the Hunter Valley on gentle slopes of depressions and drainage flats. Characterised by the open forest of *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).	K	Low. None of the associated tree species occur within or adjacent to the study area.	Low.
Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion	V2	CE	Found in the Hunter Valley from Bulga to Bylong/Goulburn River National Park and known to occur in Singleton, Muswellbrook and the Upper Hunter local government areas. Occurring on colluvial soils on exposed footslopes associated with the interface between Triassic Narrabeen sandstones and Permian sediments. Characterised by the typically dominated by *Eucalyptus dawsonii* (Slaty Gum) and/or *Eucalyptus moluccana* (Grey Box). *Acacia salicina* (Cooba) and *Allocasuarina luehmannii* (Bulloak). Other trees which may be present include *Brachychiton populneus* subsp. *populneus* (Kurrajong), *Callitris endlicheri* (Black Cypress Pine), *Eucalyptus crebra* (Narrow-leaved Ironbark) and *Eucalyptus punctata* (Grey Gum).	K	Low. None of the associated tree species occur within or adjacent to the subject site.	Low.

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Hunter Valley Vine Thicket in the NSW North Coast and Sydney Basin Bioregions	E3	-	This community occurs strictly within the central Hunter Valley area. The canopy may include *Elaeodendron australe* (Red Olive Plum), *Geijera parviflora* (Wilga), *Notelaea microcarpa* var. *microcarpa* (Native Olive), *Alectryon oleifolius* subsp. *elongatus* (Western Rosewood), *Melia azedarach* (White Cedar) and *Brachychiton populneus* subsp. *populneus* (Kurrajong). Emergent eucalypts are common and include *Eucalyptus albens* (White Box), E. dawsonii (Slaty Box) and *E. crebra* (Narrow-leaved Ironbark). A shrub stratum is usually present and includes *Olearia elliptica* subsp. *elliptica* (Sticky Daisy Bush) and *Rhagodia parabolica* (Mealy Saltbush).	K	Low. None of the associated tree species occur within or adjacent to the study area.	Low.
Hunter Valley Weeping Myall Woodland of the Sydney Basin Bioregion	E3	CE	Found in the Hunter Valley associated with heavy clay soils on depositional landforms in the south-western part of the Hunter River valley floor. Characterised by the dense open tree canopy about 15 m tall and with the most common tree being *Acacia pendula* (Weeping Myall), which may occur with *Eucalyptus crebra* (Narrow-leaved Ironbark), *A. salicina* (Cooba) and/or trees within the *A. homalophylla - A. melvillei* complex. Understorey shrubs may include *Canthium buxifolium* (Stiff Canthium), *Dodonaea viscosa* (Sticky Hopbush), *Geijera parviflora* (Wilga), *Notelaea microphylla* var. *microphylla* (Native Olive) and *Senna zygophylla*	K	Low. None of the associated tree species occur within or adjacent to the study area.	Low.

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Kurri Sand Swamp Woodland in the Sydney Basin Bioregion	E3	-	Occurs within the Kurri Kurri – Cessnock area in the Hunter Valley. Occurs on soils developed on poorly-drained Tertiary sand deposits that blanket Permian sediments. The overstorey is usually dominated by *Eucalyptus parramattensis* subsp. *decadens* (Parramatta Red Gum) and *Angophora bakeri* (Narrow-leaved Apple) while other tree species that occur less frequently include *E. racemosa* (Narrow-leaved Scribbly Gum), *E. fibrosa* (Red Ironbark), E. sp. aff. *agglomerata* and *Corymbia gummifera* (Red Bloodwood). The shrub layer is typified by *Banksia spinulosa* (Hairpin Banksia), *Dillwynia retorta*, *Jacksonia scoparia* (Dogwood), *Hakea dactyloides* (Finger Hakea), *Acacia ulicifolia* (Prickly Moses), *Grevillea parviflora* subsp. *parviflora*, *Melaleuca nodosa* (Prickly-leaved Paperbark), *A. elongata* (Swamp Wattle) and *Lambertia formosa* (Mountain Devil). The common ground species include *Entolasia stricta* (Wiry Panic), *Ptilothrix deusta*, *Pimelea linifolia* (Slender Rice Flower), *Aristida warburgii*, *Lomandra cylindrica* (Needle Mat-rush), *Lomandra glauca* (Pale Mat-rush) and *Anisopogon avenaceus* (Oat Speargrass).	K	Low. None of the associated tree species occur within or adjacent to the study area.	Low.

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	CE	Found along the NSW east coast, this EEC is considered very rare and occurs in many small stands. Predominantly rainforest species, where the canopy is dominated by scattered emergent individuals of sclerophyll species, such as *Angophora costata*, *Banksia intergrifolia*, *Eucalyptus botryoides* and *Eucalyptus tetricornis*. Several floristic variations between strands and in particular areas localised variants may be recognised.	P	Low. None of the associated tree species occur within or adjacent to the study area.	Low.
Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion	E3	-	Occurs principally on Permian geology in the central to lower Hunter Valley. The Permian substrates most commonly supporting the community belong to the Dalwood Group, the Maitland Group and the Greta and Tomago Coal Measures, although smaller areas of the community may also occur on the Permian Singleton and Newcastle Coal Measures and the Triassic Narrabeen Group. Characterised by the dominant Spotted Gum (*Corymbia maculata*) and Broad-leaved Ironbark (*Eucalyptus fibrosa*), while Grey Gum (*E. punctate*) and Grey Ironbark (*E. crebra*) occur occasionally. A number of other eucalypt species occur at low frequency, but may be locally common in the community	K	Low. Two of the associated tree species occur within the study area, *Eucalyptus fibrosa* and *Corymbia maculate.*	Low.

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions	V2	-	Found in the Lower Hunter Valley, mainly occurring on the Barrington footslopes but is known to occur or have occurred in the Muswellbrook, Singleton, Dungog and Upper hunter local government areas. This community occurs on the Carboniferous sediments in gullies and on steep hillslopes with south facing aspects. Characterised by the common canopy trees, *Elaeocarpus obovatus* (Hard Quandong), *Baloghia inophylla* (Brush Bloodwood), *Streblus brunonianus* (Whalebone Tree), *Mallotus philippensis* (Red Kamala), *Capparis arborea* (Brush Caper Berry), *Olea paniculata* (Native Olive) and *Dendrocnide excelsa* (Giant Stinging Tree). Emergent trees 20 to 30m tall such as *Brachychiton populneus* subsp. *populneus* (Kurrajong), *Corymbia maculata* (Spotted Gum), *Brachychiton discolor* (Lacebark) and *Ficus rubiginosa* (Port Jackson Fig) are often present.	K	Low. None of the associated tree species occur within or adjacent to the study area.	Low.

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	E3	CE	The Hawkesbury River notionally marks the southern limit of this EEC in the NSW North Coast and Sydney Basin Bioregions. This EEC is a community of subtropical rainforest and some related, structurally complex forms of dry rainforest. Lowland Rainforest in a relatively undisturbed state has a closed canopy, characterised by a high diversity of trees whose leaves may be mesophyllous and encompass a waide variety of shapes and sizes. Includes palms, vines, and vascular epiphytes. In disturbed strands of this community the canopy may be broken or the canopy be smothered by exotic vines.	K	Low. None of the associated tree species occur within or adjacent to the study area.	Low.
Lowland Rainforest of Subtropical Australia	-	CE	The ecological community primarily occurs from Maryborough in Queensland to the Clarence River (near Grafton) in New South Wales (NSW). The ecological community also includes isolated areas between the Clarence River and Hunter River such as the Bellinger and Hastings valley. The ecological community occurs on basalt and alluvial soils, including sand and old or elevated alluvial soils as well as floodplain alluvia. It also occurs occasionally on enriched rhyolitic soils and basaltically enriched metasediments. Lowland Rainforest mostly occurs in areas <300 m above sea level.	P	Low. None of the associated tree species occur within or adjacent to the study area.	Low.

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
River-flat Eucalypt Forest of Coastal Floodplains of the NSW North Coast, Sydney Basin and South East corner Bioregions	E3	-	Found in many local government areas in NSW, including Singleton, Maitland and Cessnock, this community is associated with silts, clay-loams and sandy loams on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Characterised by an open tree layer of *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) and *E. elata* (river peppermint) may be common south from Sydney, *E. ovata* (swamp gum) occurs on the far south coast, *E. saligna* (Sydney blue gum) and *E. grandis* (flooded gum) may occur north of Sydney, while *E. benthamii* is restricted to the Hawkesbury floodplain.	K	Low. One of the main associated tree species of this EEC, Forest Red Gum (*Eucalyptus tereticornis*) and the associated species, Swamp Oak (*Casuarina glauca*) occur within the study area. However this species was not dominant and the co-dominant species were absent within the study area.	Low.
Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East corner Bioregions	E3	-	Found on the coastal floodplains of NSW occurring on the fringes of coastal estuaries on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. Associated with grey-black clay-loams and sandy loams where the groundwater is saline or sub-saline. 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.	K	Recorded. This endangered community was recorded in the north of the study area.	Moderate. A significant impact assessment will be required for this community.

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East corner Bioregions	E3	-	Found on humic clay loams and sandy loams on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Characterised by the open to dense tree layer of *Eucalyptus robusta* (swamp mahogany), *Melaleuca quinquenervia* (paperbark) and, south from Sydney, *Eucalyptus botryoides* (bangalay) and *Eucalyptus longifolia* (woollybutt). Codominate species include *Callistemon salignus* (sweet willow bottlebrush), *Casuarina glauca* (swamp oak) and *Eucalyptus resinifera* subsp. *hemilampra* (red mahogany), *Livistona australis* (cabbage palm) and *Lophostemon suaveolens* (swamp turpentine).	K	Low. None of the associated tree species occur within or adjacent to the study area.	Low.
Sydney Freshwater Wetlands in the Sydney Basin Bioregion	E3	-	Found on the Warriewood and Tuggerah soil landscapes, this community is largely restricted to freshwater swamps in swales and depressions on sand dunes and low nutrient sandplains. Characterised by the lack of saline influence and complex vegetation types restricted of freshwater swamps in coastal areas. Species include sedges and aquatic plants such as *Baumea* species, *Eleocharis sphacelata*, *Gahnia* species, *Ludwigia peploides* subsp. *montevidensis* and *Persicaria* species. Areas of open water may occur where drainage conditions have been altered and there may also be patches of emergent trees and shrubs.	K	Low. No wetlands occur within or adjacent to the study area.	Low.

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Warkworth Sands Woodland in the Sydney Basin Bioregion	E3	-	Confined to a small area near Warkworth occurring on aeolilan sand deposits south of Singleton. Characterised by the low woodland dominated by *Angophora floribunda* (Rough-barked Apple) and *Banksia integrifolia* subsp. *integrifolia* (Coast Banksia). Other tree species may be present such as *Eucalyptus tereticornis* (Forest Red Gum)and *E. glaucina* (Slaty Red Gum). The understorey consists of shrub and ground layer species, including *Acacia filicifolia* (Fern-leaved Wattle), *Melaleuca thymifolia* (Thyme Honey-myrtle), *Brachyloma daphnoides* (Daphne Heath), *Pteridium esculentum* (Bracken), *Pimelea linifolia* (Slender Rice Flower), *Imperata cylindrica* var. *major* (Blady Grass), *Chrysocephalum apiculatum* (Common Everlasting) and *Glycine clandestina*. Small drainage lines within the area occupied by this community may support the presence or higher abundance of certain species (such as *Melaleuca thymifolia*) and the absence or lower abundance of others (such as *Banksia integrifolia* subsp. *integrifolia*).	K	Low. None of the associated tree species occur within or adjacent to the study area.	Low.

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
White Box Yellow Box Blakely's Red Gum Woodland (TSC Act) White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act)	E3	CE	Found from the Queensland border in the north, to the Victorian border in the south. It occurs in the tablelands and western slopes of NSW. Characterised by the presence or prior occurrence of White Box, Yellow Box and/or Blakely's Red Gum. Commonly co-occurring eucalypts include Apple Box (*E. bridgesiana*), Red Box (*E. polyanthemos*), Candlebark (*E. rubida*), Snow Gum (*E. pauciflora*), Argyle Apple (*E. cinerea*), Brittle Gum (*E. mannifera*), Red Stringybark (*E. macrorhyncha*), Grey Box (*E. microcarpa*), Cabbage Gum (*E. amplifolia*) and others. The understorey in intact sites is characterised by native grasses and a high diversity of herbs; the most commonly encountered include Kangaroo Grass (*Themeda australis*), Poa Tussock (*Poa sieberiana*), wallaby grasses (*Austrodanthonia* spp.), spear-grasses (*Austrostipa* spp.), Common Everlasting (*Chrysocephalum apiculatum*), Scrambled Eggs (*Goodenia pinnatifida*), Small St John's Wort (*Hypericum gramineum*), Narrow-leafed New Holland Daisy (*Vittadinia muelleri*) and blue-bells (*Wahlenbergia* spp.).	P	Low. None of the associated tree species occur within or adjacent to the subject site.	Low.

Appendix 6

Key Threatening Processes

Key Threatening Process	NSW Act	EPBC Act	FM Act	Likelihood of occurrence	Potential Impacts
Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners (*Manorina melanocephala*)	KTP	KTP	-	Recorded. A small number of Noisy Miners were recorded within the study area.	Low. The removal of the comparatively small area of habitat that will occur as a result of the project, is unlikely to further exacerbate this KTP to any significant degree in the locality.
Alteration of habitat following subsidence due to longwall mining	KTP	-	-	Low. No alteration due to longwall mining.	Low.
Alteration to the natural flow regimes of rivers and streams, and their floodplains and wetlands	KTP	-	KTP	High. Alteration of natural flow regimes is currently occurring from existing culverts.	Low. The project will increase the length of the current culverts. However, this will not further exacerbate this KTP to any significant degree.
Anthropogenic climate change	KTP	KTP	KTP	Low - Moderate. The project will have a minor contribution to overall greenhouse gas emission during construction.	Low. The proposal will result in a small incremental impact on anthropogenic climate change for all threatened biodiversity. An assessment of the impact as a result of the proposal is conducted in Appendix 7.
Bushrock removal	KTP	-	-	Low. The study area contains only a small amount of bushrock.	Low. The proposal will remove a minor amount of bushrock. Impacted threatened fauna have been assessed in Appendix 7.
Clearing of native vegetation	KTP	KTP	-	Moderate. The proposal will require the removal of a portion of native vegetation (12ha).	Moderate. The proposal will clear native vegetation. An assessment of the impact as a result of the proposal is conducted in Appendix 7.
Competition and grazing by the feral European Rabbit, (*Oryctolagus cuniculus*)	KTP	KTP	-	Low. The proposal is not likely to exacerbate the competition and grazing by rabbits.	Low.

Key Threatening Process	NSW Act	EPBC Act	FM Act	Likelihood of occurrence	Potential Impacts
Competition and habitat degradation by Feral Goats, (*Capra hircus*)	KTP	KTP	-	Low. The proposal is not likely to exacerbate the competition and grazing by goats.	Low.
Competition from feral honey bees, (*Apis mellifera)*	KTP	-	-	Low. The proposal will remove hollow bearing trees; however, no feral honeybees were recorded in any of the hollows recorded.	Low.
Degradation of native riparian vegetation along New South Wales watercourses	-	-	KTP	High. The current riparian vegetation along the watercourses have been degraded as a result of past agricultural land practices.	Low. The project will remove a small area of degraded riparian vegetation. Mitigation measures such as weed, erosion and sediment control are unlikely to further exacerbate this KTP.
Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners (*Manorina melanophrys*)	KTP	-	-	Low. The proposal will not provide further habitat for Bell Miners.	Low.
Introduction of fish to fresh waters within a river catchment outside of its natural range	-	-	KTP	Low. The proposal will not exacerbate introduce fish to a river catchment outside of is natural range	Low.
Herbivory and environmental degradation caused by feral deer	KTP	-	-	Low. The proposal will not exacerbate herbivory by feral deer.	Low.
High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition	KTP	-	-	Low. The proposal is not likely to result in high frequency fire.	Low.

Key Threatening Process	NSW Act	EPBC Act	FM Act	Likelihood of occurrence	Potential Impacts
Importation of Red Imported Fire Ants (*Solenopsis invicta)*	KTP	KTP	-	Low. The proposal does not include importing Red Imported Fire Ants.	Low.
Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations	KTP	KTP	-	Low. The proposal is not likely to transmit bird diseases.	Low. The proposal is unlikely to spread this disease.
Infection of frogs by amphibian chytrid causing chytridiomycosis disease	KTP	KTP	-	Low. The proposal is not likely to transmit this disease.	Moderate. Implementation of equipment washdowns and hygiene protocols have been recommended.
Infection of native plants by *Phytophthora cinnamomi*	KTP	KTP	-	Moderate. The proposal may facilitate the transmission of plant diseases through machinery transportation during construction.	Moderate. Pre-clearing surveys by ecologist will be conducted which would detect new occurrences of this disease prior to construction. Equipment washdowns and hygiene protocols have been recommended in any case.
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae	KTP	-	-	Moderate. No evidence of the purple or yellow spores of myrtle rust fungus was observed on any plants of the Myrtaceae family. The proposal may facilitate the transmission of plant parts through machinery transportation during construction.	Moderate. Pre-clearing surveys by ecologist will be conducted which would detect new occurrences of this disease prior to construction. Equipment washdowns and hygiene protocols have been recommended in any case.
Introduction of the Large Earth Bumblebee (*Bombus terrestris*)	KTP	-	-	Low. The proposal does not include importing bees or any associated activities that could cause the introduction of bees.	Low.
Invasion and establishment of exotic vines and scramblers	KTP	-	-	Low - Moderate. The proposal may facilitate the transmission of plant parts through machinery transportation during construction.	Moderate. The Swamp Oak Floodplain Forest currently has high weed infestations for exotic vines. Washdowns and hygiene protocols will be implemented and the proposal is unlikely to further exacerbate this KTP.

Key Threatening Process	NSW Act	EPBC Act	FM Act	Likelihood of occurrence	Potential Impacts
Invasion and establishment of Scotch Broom (*Cytisus scoparius*)	KTP	-	-	Low. Scotch Broom was not recorded within the site. However the proposal may facilitate the transmission of plant parts through machinery transportation during construction.	Low. Washdowns and hygiene protocols will be implemented and the proposal is unlikely to further exacerbate this KTP.
Invasion and establishment of the Cane Toad (*Bufo marinus*)	KTP	KTP	-	Low. The proposal will not involve the transportation of frogs.	Low.
Invasion of native plant communities by African Olive (*Olea europaea* L. subsp. *cuspidate)*	KTP	-	-	Recorded. African Olive was recorded within the study area. The proposal may facilitate the transmission of plant parts through machinery transportation during construction.	Moderate. The vegetation within the study area has infestations of African Olive. The Impact assessments for these communities have been undertaken for the affected threatened communities. Equipment washdowns and hygiene protocols have been recommended.
Invasion of native plant communities by *Chrysanthemoides monilifera*	KTP	-	-	Low - Moderate. The proposal may facilitate the transmission of plant parts through machinery transportation during construction.	Low.
Invasion of native plant communities by exotic perennial grasses	KTP	-	-	Low - Moderate. The proposal may facilitate the transmission of plant parts through machinery transportation during construction.	Low.
Invasion of the Yellow Crazy Ant (*Anoplolepis gracilipes*) into NSW	KTP	-	-	Low. The proposal does not include importing fire ants or any associated activities that could lead to the invasion of yellow crazy ants.	Low.
Invasion, establishment and spread of Lantana (*Lantana camara* L. *sens. lat*)	KTP	-	-	Low - Moderate. The proposal may facilitate the transmission of plant parts through machinery transportation during construction.	Low

Key Threatening Process	NSW Act	EPBC Act	FM Act	Likelihood of occurrence	Potential Impacts
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants	KTP	KTP	-	Low - Moderate. The proposal may facilitate the transmission of plant parts through machinery transportation during construction.	Low.
Loss of hollow-bearing trees	KTP	-	-	Recorded. 18 hollow bearing trees will be removed as a result of the project.	Moderate. The proposal will remove 18 hollow-bearing Trees. Nest boxes will be installed to mitigate the loss of hollows for hollow dependant fauna. Impact assessments have been undertaken for threatened species which may be affected by the removal of hollow trees.
Loss and/or degradation of sites used for hill-topping by butterflies	KTP	-	-	Low. The proposal will occupy only a small area and is unlikely to exacerbate this KTP.	Low.
Predation and hybridisation by Feral Dogs (*Canis lupus familiaris)*	KTP	-	-	Low. The proposal is unlikely to enhance this KTP.	Low.
Predation by Plague Minnow or Mosquito Fish *(Gambusia holbrooki*)	KTP	-	-	Low. The subject site is not located near a waterway.	Low.
Predation by the European Red Fox (*Vulpes vulpes)*	KTP	KTP	-	Recorded. The European Fox was recorded within the study area.	Low. The project is unlikely to exacerbate this KTP as the landscape has been modified due to agricultural practices and is unlikely further exacerbate this KTP.
Predation by the Feral Cat (*Felis catus)*	KTP	KTP	-	Low. The proposal is unlikely to enhance this KTP.	Low.
Predation, habitat degradation, competition and disease transmission by Feral Pigs (*Sus scrofa)*	KTP	KTP	-	Low. The proposal is unlikely to enhance this KTP.	Low.

Key Threatening Process	NSW Act	EPBC Act	FM Act	Likelihood of occurrence	Potential Impacts
Removal of dead wood and dead trees	KTP	-	-	Recorded. Dead wood and dead trees were observed within the study area.	Moderate. The proposal will remove dead trees and dead wood such as fallen timber. A number of fauna utilise fallen timber and dead wood for foraging. The loss of dead wood and dead trees has been assessed in impact assessments for these species. Mitigation measures include relocating the dead wood and trees in habitat outside the study area.
Removal of large woody debris from NSW Rivers and Streams	-	-	KTP	Low. No woody debris was recorded within the creeklines within the study area	Low. Large woody debris will be removed as part of the proposal.

Appendix 7

Significance Assessments

EPS

SIGNIFICANCE ASSESSMENTS

Prepared by Environmental Property Services

ENVIRONMENTAL PROPERTY SERVICES
Reference No. 11232
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1 SIGNIFICANCE ASSESSMENTS FOR TSC ACT COMMUNITIES

1.1 Central Hunter Ironbark Spotted Gum – Grey Box Forest

Central Hunter Ironbark Spotted Gum – Grey Box Forest – Seven part Test TSC Act	**Response**
Profile: Central Hunter Ironbark Spotted Gum Grey Box Forest is listed as endangered under the TSC Act. Found in the Central Hunter Valley mainly between Maitland and Muswellbrook, occurring in areas of undulating country including low rises and slopes on all aspects. Mostly occurs on clayey soils on Permian sediments, may also occur on alluvial and colluvial soils in valleys. Characterised by Narrow-leaved Ironbark (Eucalyptus crebra), Spotted Gum (Corymbia maculata) and Grey Box (Eucalyptus moluccana) forming an open forest. Other tree species such as Red Ironbark (Eucalyptus fibrosa) and Forest Red Gum (Eucalyptus tereticornis) may be present, and occasionally dominate or co-dominate.	
a) In the case of a threatened species, whether an action is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	Not Applicable
(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	Not Applicable
(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or* *(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*	(i) The community is of generally of Moderate to Good quality within the study area, with some areas being in better condition than others, as shown in the BAR mapping. Peake (2006) has mapped 15,605 ha of this community within the Singleton LGA and 18,305 ha within the Central Hunter. As shown in the BAR mapping, the vast majority of the extensive remnant vegetation in the immediate locality is comprised of this community. The removal of 10.40 ha of this community equates to 0.06 % removal in the locality and 0.07 % of the extent of this community in the Central Hunter. Extensive areas of this community in the immediate locality adjoining the study area. Therefore, it is considered that the removal of a comparatively minor area of this community is not likely to place the local occurrence of this community at risk of extinction. (ii) The proposal will remove a comparatively small linear strip of this community as described in point (i).

Central Hunter Ironbark Spotted Gum – Grey Box Forest – Seven part Test TSC Act	Response
	Furthermore, the vegetation within the study area is also already modified as a result of previous agricultural practices and roadside management. The proposal is therefore unlikely 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.
(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, and* *(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* *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality*	(i) The proposal will remove or modify a maximum of 10.40 ha of this Central Hunter Ironbark Spotted Gum Forest in various conditions. (ii) The impacts of the project will increase the distance between remnants of this community to the north and south of the existing New England Highway and Golden Highway within the study area. However the existing highways have already created separations in this regard. It is considered unlikely that the results of the project will significantly increase the existing fragmentation or isolation of this community in the locality. To the north and south of the study area this community will remain well connected to other extensive areas of the same community. (iii) The community within the study area has minimal understorey with a moderate to high weed invasion. A comparatively narrow linear section of this community will be removed. The importance of the habitat to be removed to the long-term survival of this community in the locality is considered to be low, due to the extensive areas that are connected to and surround the study area.
(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	The study area is not located near any declared areas of critical habitat listed on the TSC Act
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	No recovery plan or threatened abatement plan has been written for this community. No specific strategy for managing this ecological community has been developed under the Saving Our Species program.
(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	The proposal may increase the operation of the Key Threatening Process ('KTP'), "Clearing of vegetation". However, the comparative impacts in a local context area considered to be minor. The proposal may increase the operation of the KTP "Invasion of native plant communities by African Olive (*Olea europaea L. subsp. Cuspidate*)" as this species was present within this community. The proposal will remove

Central Hunter Ironbark Spotted Gum – Grey Box Forest – Seven part Test TSC Act	Response
	the species during clearing operations. However, mitigation measures such as washdown sites, and disposing of contaminated soil and plant material offsite in an approved disposal area will further reduce the spread of this weed. Therefore, the proposal may potentially result in a very minor contribution to this KTP although this can be managed through on-site management.
Conclusion	The proposal is unlikely to have a significant impact upon the Central Hunter Ironbark Spotted Gum – Grey Box Forest due to the reasons outlined above.

1.2 Swamp Oak Floodplain Forest

Swamp Oak Floodplain Forest – Seven part Test TSC Act	Response
Profile: Swamp Oak Floodplain forest is listed as endangered under the TSC Act. Found on the coastal floodplains of NSW occurring on the fringes of coastal estuaries on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. Associated with grey-black clay-loams and sandy loams where the groundwater is saline or sub-saline. This community is dominated by *Casuarina glauca* with occasional occurrences of *Eucalyptus tereticornis*. 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.	
a) In the case of a threatened species, whether an action is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	Not Applicable.
(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	Not Applicable.

Swamp Oak Floodplain Forest – Seven part Test TSC Act	Response
(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*	(i) The ecological community is of moderate quality in some areas, however, Peake (2006) has mapped 1,168 ha of this community within the Singleton LGA and 1,217 ha within the Central Hunter. The removal of 0.83 ha of this community equates to 0.07 % removal in the locality and 0.06 % of the extent of this community in the Central Hunter. Therefore, it is considered unlikely 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. ii) The proposal will remove a small linear strip of this community. Furthermore, the vegetation within the study area is already modified as a result of previous agricultural practices. Therefore, the proposal is unlikely to substantially and adversely modify the composition of the community more than what is already occurring. It is considered unlikely that the local occurrence will 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, and* *(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* *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality*	(i) The proposal will remove or modify a maximum of 0.8 ha of this community. (ii) The proposal will not substantially fragment or isolate habitat this community further, as it is already relatively fragmented. It will remain connected to contiguous areas of the same community to the north and south of the study area. (iii) The community within the study area has minimal understorey with a high to moderate weed invasion. A linear section of this community will be removed and it is unlikely to result in further modification, fragmentation or isolation to a level that would impact on the long term survival of this community.
(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	The study area is not located near any declared areas of critical habitat.
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	No recovery plan or threatened abatement plan has bene written for Swamp Oak Floodplain Forest.

Swamp Oak Floodplain Forest – Seven part Test TSC Act	Response
(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	The proposal may increase the operation of the KTP "Clearing of native vegetation" however, the proposal will remove a maximum of 0.8 ha of low quality habitat as such we consider that this is a very small contribution to this KTP. The proposal may increase the operation of the KTP "Invasion of native plant communities by African Olive (*Olea europaea L. subsp. Cuspidate*)" as this species was present within this community. The proposal will remove the species during clearing operations, however mitigation measures such as washdown sites, and disposing of contaminated soil and plant material offsite in an approved disposal area will reduce the further spread of this weed. Therefore, the proposal may result in a very small contribution to this KTP.
Conclusion	The proposal is unlikely to have a significant impact upon Swamp Oak Floodplain Forest.

2 SIGNIFICANCE ASSESSMENT FOR TSC ACT SPECIES

2.1 Amphibians

2.1.1 Green and Golden Bell Frog

Green and Golden Bell Frog – Seven part Test TSC Act	Response
Profile: GGBF is listed as Vulnerable on the TSC Act. Distributed from NSW north coast near Brunswick Heads, southwards along NSW coast to Victoria where it extends into east Gippsland. Inhabits marshes, dams and stream-sides, particularly those containing bulrushes or spikerushes. Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas.	
a) In the case of a threatened species, whether an action is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	No evidence of occurrence was observed despite detailed targeted surveys over four nights during good conditions. While the small farm dams potentially provide breeding and foraging habitat, the actual likelihood of this species presence is considered to be low. The proposal will remove only a very small portion of low quality potential foraging habitat available to the species. The dams and existing creeklines will be retained in the post-construction landscape. The proposal is not considered likely to have an adverse effect on the life cycle of this species such that a viable local population will 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	Not Applicable.

Green and Golden Bell Frog – Seven part Test TSC Act	Response
(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*	Not Applicable.
(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, and* *(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* *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality*	(i) The proposal will remove or modify a maximum of 0.30 ha of low quality potential foraging habitat along the constructed dams, degraded ephemeral depressions and creeklines. The dams and creeklines will remain in existence post-construction. (ii) The proposal will not fragment or isolate habitat for the species substantially more than that which is already occurring within the study area. (iii) The habitat is considered to be of low importance, as the potential habitat is within the constructed dams, degraded ephemeral depressions and creeklines. It is considered that the habitat to be affected is not significant for the long-term survival of this species.
(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	The study area is not located near any declared areas of critical habitat.
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	The proposal will remove a small area of low quality vegetation. This could be seen to contradict recovery strategies listed in documents such as the 2005 Draft Green and the Golden Bell Frog Recovery Plan. The impacts of the project are relatively minor in nature and are not expected to interfere with the recovery of this species.

Green and Golden Bell Frog – Seven part Test TSC Act	Response
(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	The proposal may increase the operation of the KTP "Clearing of native vegetation" however, the proposal will remove a maximum of 0.30 ha of low quality habitat. We consider that this is a very small contribution to this KTP. Infection of frogs by amphibian chytrid causing the disease chytridiomycosis is a KTP which may affect the GGBF. The proposal is not likely to exacerbate this KTP. Hygiene protocols such as wearing gloves when handling frogs would be used to mitigate the spread of this disease.
Conclusion	The proposal is unlikely to have a significant impact upon the Green and Golden Bell Frog.

2.2 Birds

2.2.1 Australian Painted Snipe

Australian Painted Snipe – Seven part Test TSC Act	Response
Profile: Australian Painted Snipe is listed as Endangered on the TSC Act. Restricted to Australia. Most records are from the south east, particularly the Murray Darling Basin. In NSW, many records are from the Murray-Darling Basin. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	
a) In the case of a threatened species, whether an action is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	This species was not recorded within the study area. Minor habitat occurs in the farm dams and disturbed watercourses within the study area. This species feeds at night on crustaceans and seeds. The proposal will affect a minor portion of low quality potential aquatic habitat for this species. A large expanse of high quality habitat occurs nearby on the Hunter River and its tributaries provides potential foraging, breeding and roosting habitat for this species. The farm dams and creeklines will remain post-construction. Whilst the proposal will affect minor habitat for this species, it is considered unlikely to have an adverse effect on the life cycle of the Australian Painted Snipe, such that a viable local population will be placed at risk of extinction.

Australian Painted Snipe – Seven part Test TSC Act	Response
(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	Not Applicable.
(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or* *(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*	Not Applicable.
(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, and* *(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* *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality*	(i) The proposal will remove or modify a maximum of 0.30 ha of habitat within the study area. The farm dams and creeklines will remain post-construction. (ii) The proposal will widen the existing riparian habitat. However, this species is highly mobile and the removal of a small linear area of habitat will only cause the habitat to become further fragmented than it already is. (iii) The proposal will remove a small area of linear habitat. This habitat is restricted to disturbed riparian and farm dams and the Hunter River to the south. North of the study area contains better quality habitat than the habitat within the study area. As there are large areas of habitat remaining in the vicinity of the study area, it is not considered significant for the long-term survival of this species.

Australian Painted Snipe – Seven part Test TSC Act	Response
(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	The study area is not located near any declared areas of critical habitat.
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery plan for this species.
(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	The proposal may increase the operation of the KTP "Clearing of native vegetation" however, the proposal will remove a maximum of 0.30 ha of habitat as such we consider that this is a very small contribution to this KTP. The proposal may increase the spread of exotic vines and scramblers. Exotic vines are currently within the riparian habitats within the study area. Clearing of these vines may spread exotic vines within the riparian areas of the study area. Weed control measures will be enacted for the project.
Conclusion	The proposal is unlikely to have a significant impact upon the Australian Painted Snipe.

2.2.2 Black-necked Stork

Black-necked Stork – Seven part Test TSC Act	Response
Profile: The Black-necked Stork is listed as Endangered on the TSC Act. Widespread in coastal and subcoastal northern and eastern Australia, south to central-eastern NSW. Mainly found on shallow, permanent, freshwater terrestrial wetlands, and surrounding marginal vegetation, including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters, as well as extending into adjacent grasslands, paddocks and open savannah woodlands.	
a) In the case of a threatened species, whether an action is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	This species was not recorded within the study area. Habitat occurs in the farm dams and disturbed watercourses. This species feeds on fish, crustaceans and amphibians. The farm dams and creeklines will remain post-construction. The proposal will remove a small portion of aquatic habitat for this species. A large expanse of high quality habitat occurs in close proximity within the Hunter River and its tributaries plus extensive farm dams, which provide foraging, breeding and roosting habitat for this species. Whilst the proposal will affect minor habitat for this species it is considered unlikely to have an adverse effect on the life

Black-necked Stork – Seven part Test TSC Act	Response
	cycle of the Black-necked Stork such that a viable local population will 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	Not Applicable.
(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or* *(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*	Not Applicable.
(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, and* *(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* *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality*	(i) The proposal will remove or modify a maximum of 0.30 ha of habitat within the study area. The farm dams and creeklines will remain post-construction. (ii) The proposal will affect minor existing riparian habitat. However, this species is highly mobile and the removal of a small linear area of habitat will only cause the habitat to become further fragmented than it already is. (iii) The proposal will remove a small area linear habitat. This habitat is restricted to disturbed riparian and farm dams. The Hunter River to the north of the study area would contain better quality habitat than the habitat within the study area. As there are large areas of habitat remaining in the vicinity of the study area, it is not considered significant for the long-term survival of this species.

Black-necked Stork – Seven part Test TSC Act	Response
(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	The study area is not located near any declared areas of critical habitat.
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery plan for this species.
(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	The proposal may increase the operation of the KTP "Clearing of native vegetation" however, the proposal will remove a maximum of 0.30 ha of habitat. We consider that this is a very small contribution to this KTP. The proposal may increase the spread of exotic vines and scramblers. Exotic vines are currently in the riparian habitats within the study area. Clearing of these vines may spread exotic vines within the riparian areas of the study area. Weed control measures will be enacted for the project.
Conclusion	The proposal is unlikely to have a significant impact upon the Black-necked Stork.

2.2.3 Little Lorikeet

Little Lorikeet – Seven part Test TSC Act	Response
Profile: The Little Lorikeet Glossopsitta pusilla is listed as Vulnerable on the TSC Act. Nomadic species that forages in flowering eucalypts and Melaleuca sp. Riparian habitats are used, due to higher soil fertility and greater productivity. Nests in tree hollows. This species feeds on nectar and pollen and occasionally on fruit. Travels in small flocks and roosts in tree tops.	
a) In the case of a threatened species, whether an action is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The open forest and woodland provides foraging, roosting and breeding habitat for this species within the study area. The proposal will remove a small area linear habitat for this species, which will result in a minor reduction in habitat for this species within the locality. From a total of 40 hollow-bearing trees, 18 (45%) are required to be removed for the project. A large expanse of higher quality habitat occurs within the vicinity of the New England Highway, which provides habitat for this species. Whilst the proposal will remove habitat for this species, it is considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population will be placed at risk of extinction.

Little Lorikeet – Seven part Test TSC Act	Response
(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	Not Applicable.
(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or* *(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*	Not Applicable.
(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, and* *(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* *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality*	(i) The proposal will remove or modify a maximum of 11.23 ha of habitat within the study area for this species. (ii) The proposal will widen the existing habitat gap. However, this is unlikely to fragment or isolate the majority of local habitat from other areas of habitat for this species more than which is already occurring. (iii) The proposal will remove a small area linear habitat. As there is a large area of better quality habitat remaining in the vicinity of the study area, the habitat to be affected is not considered significant for the long-term survival of the Little Lorikeet.
(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	The study area is not located near any declared areas of critical habitat.

Little Lorikeet – Seven part Test TSC Act	Response
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery plan for this species.
(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	The proposal will increase the operation of the KTP's "Clearing of native vegetation" and "Loss of hollow-bearing trees" to a degree.
Conclusion	The proposal is unlikely to have a significant impact upon the Little Lorikeet.

2.2.4 Painted Honeyeater

Painted Honeyeater – Seven part Test TSC Act	Response
Profile: The Painted Honeyeater as Vulnerable on the TSC Act. Nomadic bird, that occurs at low densities throughout its range, with seasonal movements that follow flowering mistletoes. Greatest concentrating of birds and almost all breeding of birds on the inland slopes of the Great Dividing Range in NSW, Victoria and Southern QLD. Inhabits Boree, Brigalow and Box-gum Woodlands and Box-Ironbark Forests. This species nests in trees and mainly feeds on mistletoe flowers.	
a) In the case of a threatened species, whether an action is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	This species was not recorded within the study area. Habitat for this species occurs in the woodland in occasional mistletoes and flowering eucalypts. This species nests in trees and is nomadic. The nesting and foraging habitat within the study area are limited due to the disturbed nature of the habitat and low abundance of mistletoes within the study area. Better quality habitat for this species occurs to the west near Broke within the Howes Valley. This species may occur within the study area intermittently. However, the project impacts are considered unlikely to have an adverse effect on the life cycle of the such that a viable local population will 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	Not Applicable.

Painted Honeyeater – Seven part Test TSC Act	Response
(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*	Not Applicable.
(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, and* *(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* *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality*	(i) The proposal will remove or modify a maximum of 11.23 ha of habitat within the study area. (ii) The proposal will widen the existing habitat gap. However, this is unlikely to fragment or isolate the majority of local habitat from other areas of habitat for this species more than that which is already is occurring. (iii) One record for this species occurs at Branxton, however this recorded is from 1977 and the remaining three records were recorded within the Howes Valley. The proposal will remove a small area of linear habitat. Large areas of high quality habitat will remain in the vicinity of the study area, and as such the impact of the project is unlikely to be significant for the long-term survival of the Painted Honeyeater.
(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	The study area is not located near any declared areas of critical habitat.
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery plan for this species.

Painted Honeyeater – Seven part Test TSC Act	Response
(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	The proposal may increase the operation of the KTP "Clearing of native vegetation". However, extensive similar habitat will remain in the locality.
Conclusion	The proposal is unlikely to have a significant impact upon the Painted Honeyeater.

2.2.5 Regent Honeyeater

Regent Honeyeater – Seven part Test TSC Act	Response
Profile: The Regent Honeyeater is listed as critically endangered on the TSC Act. The habitat for this species is within dry open forest and woodland. Particularly box-ironbark woodland and riparian forests of river sheoak. Feeds on the nectar from a wide range of eucalypts mistletoes and invertebrates. The distribution of this species is confined to Victoria and New South Wales. This species breeds in cup-like nests constructed with bark.	
a) In the case of a threatened species, whether an action is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	This species was not recorded within the study area despite extensive targeted winter surveys. However, woodland and riparian habitat occurs within the study area. The breeding pattern of this species is variable in the timing and movements. The seasonally movements of the Regent Honeyeater can be regular but in some years variability of the timing and pattern of movements and breeding can occur. This is associated with the seasonal patterns in the flowering of key eucalypt species. This species has been recorded nesting in Lower Hunter Spotted Ironbark Forest within the Hunter Valley to the south at Kurri Kurri and Cessnock region. The study area contains *Corymbia maculata* and *Eucalyptus tereticornis* which provide foraging habitat for this species. The Regent Honeyeater was recorded on Wine Country Drive at Branxton in 1977. The more recent records (2011) are at Singleton Army Base and Pokolbin State Forest. Whilst the study area does contain foraging habitat for this species, it is likely that it would use the study area on an intermit basis only. Larger, better quality foraging and nesting habitat occurs within the Singleton Army Base, the Cessnock area and west to the Howes Valley. The proposal will remove a small linear area of habitat for this species. It is considered unlikely to have an adverse effect on the life cycle of the Regent Honeyeater such that a viable local population will be placed at risk of extinction.

Regent Honeyeater – Seven part Test TSC Act	Response
(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	Not Applicable.
(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or* *(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*	Not Applicable.
(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, and* *(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* *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality*	(i) The proposal will remove or modify a maximum of 11.23 ha of habitat within the study area. (ii) The proposal will widen the existing habitat. However, this is unlikely to fragment or isolate from other areas of habitat of this species more than that which is already is occurring. (iii) the importance of the habitat to be removed by the proposal is considered to be relatively low as the habitat is currently degraded and fragmented due to current and previous agricultural practices. Compared to the extensive areas of habitat in the immediate locality, the project will remove a small linear area of habitat. As there are large areas of habitat remaining in the vicinity of the study area and the habitat within the study area is considered to be likely of generally low importance it is not significant for the long-term survival of the Regent Honeyeater in the locality.

Regent Honeyeater – Seven part Test TSC Act	Response
(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	The study area is not located near any declared areas of critical habitat.
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	The Office of Environment and Heritage has established four management sites for conservation and management of this species, including Bundarra-Barraba (Gunnedah/Gwydir and Tamworth region), Lower Hunter Valley (Cessnock), Capertee Valley (Lithgow) and Taronga Zoo as part of the saving species program. The project occurs to the north of the Cessnock management site, which provides key breeding habitat for this species. The study area contains relatively disturbed habitat and there are no records of this species within the study area. Therefore, the proposal is not likely to adversely affect any of the recovery actions of the Regent Honeyeater.
(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	The proposal may increase the operation of the KTP "Clearing of native vegetation" however extensive similar habitat will remain in the locality.
Conclusion	The proposal is unlikely to have a significant impact upon the Regent Honeyeater.

2.2.6 Swift Parrot

Swift Parrot – Seven part Test TSC Act	Response
Profile: The Swift Parrot is listed as endangered on the TSC Act. This species breeds in Tasmania and migrates to south-eastern mainland Australia in Mar-Oct. Winter-flowering trees such as Eucalyptus robusta, Corymbia maculata, C. gummifera, E. sideroxylon and E. albens provide foraging habitat for this species.	
a) In the case of a threatened species, whether an action is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	This species was not recorded within the study area despite targeted winter surveys. However, woodland and riparian habitat occurs within the study area. The study area contains *Corymbia maculata* and *Eucalyptus tereticornis* which provide foraging habitat for this species. The Swift Parrot has been recorded in close proximity to the study area at multiple locations at Rothbury, Singleton Army Base and Pokolbin State Forest. Whilst the study area does contain foraging habitat for this species, it is likely to use the study area on an intermit basis. Much larger better quality foraging habitat occurs within the Singleton Army Base, the Cessnock area and west to the Howes Valley.

Swift Parrot – Seven part Test TSC Act	Response
	This species breeds in Tasmania and the proposal is unlikely to affect movements of this species to and from the Tasmanian breeding grounds. Whilst the proposal will remove a linear area of foraging habitat for this species it is considered unlikely to have an adverse effect on the life cycle of the Swift Parrot such that a viable local population will 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	Not Applicable.
(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or* *(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*	Not Applicable.
(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, and* *(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* *(iii) the importance of the habitat to be removed,*	(i) The proposal will remove or modify a maximum of 11.23 ha of habitat within the study area. (ii) The proposal will widen the existing habitat. However, this is unlikely to fragment or isolate from other areas of habitat of this species more than that which is already is occurring. (iii) The importance of the habitat to be removed by the proposal is considered to be relatively low as the habitat is currently degraded and fragmented due to current and previous agricultural practices. Compared to the extensive areas of habitat in the immediate locality, the project will

Swift Parrot – Seven part Test TSC Act	Response
modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	remove a small linear area of habitat. As there are large areas of habitat remaining in the vicinity of the study area and the habitat within the study area, it is considered to be likely of generally low importance that it is not significant for the long-term survival of the Swift Parrot in the locality.
(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	The study area is not located near any declared areas of critical habitat.
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery plan for this species. The saving our species programs identifies 6 management actions in regard to the Swift Parrot. The proposal Is unlikely to affect any of these management actions.
(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	The proposal may increase the operation of the KTP "Clearing of native vegetation" however extensive similar habitat will remain in the locality.
Conclusion	The proposal is unlikely to have a significant impact upon the Swift Parrot.

2.2.7 Speckled Warbler

Speckled Warbler – Seven part Test TSC Act	Response
Profile: The Speckled Warbler is listed as Vulnerable on the TSC Act. Most frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast. Wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy.	
a) In the case of a threatened species, whether an action is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	This species was recorded at seven locations on both sides of the New England Highway. The Speckled Warbler was observed foraging in dense understorey in open forest and woodland habitat within the study area. The study area provides known foraging, roosting and breeding habitat for this species. The Speckled Warbler is a sedentary woodland species and the proposal will remove a small linear portion of habitat for this species. A large expanse of higher quality habitat occurs to the north of the New England Highway, which provides foraging, breeding and roosting habitat for this species. Whilst the proposal will remove known habitat for this species, it is considered unlikely to have an adverse

Speckled Warbler – Seven part Test TSC Act	Response
	effect on the life cycle of the Speckled Warbler such that a viable local population will be placed at risk of extinction. The local population is highly likely to extend in all directions immediately outside of the study area.
(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	Not Applicable.
(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or* *(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*	Not Applicable.
(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, and* *(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* *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species,*	(i) The proposal will remove or modify a maximum of 11.23 ha of habitat within the study area. (ii) The proposal will widen the existing habitat. However, this is unlikely to fragment or isolate from other areas of habitat of this species more than that which is already occurring. (iii) Compared to the extensive areas of habitat in the immediate locality, the project will remove a small linear area of habitat. As there are large areas of habitat remaining in the vicinity of the study area and the habitat within the study area is considered to be likely of contextually low importance, the habitat is not considered

Speckled Warbler – Seven part Test TSC Act	Response
population or ecological community in the locality	to be significant for the long-term survival of the Speckled Warbler in the locality.
(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	The study area is not located near any declared areas of critical habitat.
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery plan for this species.
(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	The proposal may increase the operation of the KTP "Clearing of native vegetation" however extensive similar habitat will remain in the locality.
Conclusion	The proposal is unlikely to have a significant impact upon the Speckled Warbler.

2.2.8 Grey-crowned Babbler

Grey-crowned Babbler – Seven part Test TSC Act	Response
Profile: The Grey-crowned Babbler is listed as Vulnerable on the TSC Act. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Grey-crowned Babblers occupy open woodlands dominated by mature eucalypts, with regenerating trees, tall shrubs, and an intact ground cover of grass and forbs. The species builds conspicuous dome-shaped nests and breeds co-operatively in sedentary family groups of 2-13 birds (Davidson and Robinson 1992). Grey-crowned Babblers are insectivorous and forage in leaf litter, on bark of trees, trunks and branches of eucalypts and other woodland trees, or on the ground, digging and probing amongst litter and tussock grasses.	
a) In the case of a threatened species, whether an action is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	This species was recorded at five locations on both sides of the New England Highway. The Grey-crowned Babbler was observed foraging within the forested habitat within the study area. Six Grey-crowned Babbler nests were recorded in the study area. The study area provides foraging, roosting and breeding habitat for this species. A large expanse of high quality habitat occurs to the north of the New England Highway, which provides contiguous foraging, breeding and roosting habitat for this species. Whilst the proposal will remove habitat for this species, it is considered unlikely to have an adverse effect on the life cycle of the Grey-crowned Babbler such that a viable local

Grey-crowned Babbler – Seven part Test TSC Act	Response
	population will be placed at risk of extinction. Extensive habitat will remain in the immediate locality.
(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	Not Applicable.
(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or* *(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*	Not Applicable.
(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, and* *(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* *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality*	(i) The proposal will remove or modify a maximum of 11.23 ha of habitat within the study area. (ii) The proposal will widen the existing habitat. However, this is unlikely to fragment or isolate from other areas of habitat of this species more than that which is already occurring. (iii) Compared to the extensive areas of habitat in the immediate locality, the project will remove a small linear area of habitat. As there are large areas of habitat remaining in the vicinity of the study area and the habitat within the study area is considered to be likely of contextually low importance, the habitat is not considered to be significant for the long-term survival of the Grey-crowned Babbler in the locality.

Grey-crowned Babbler – Seven part Test TSC Act	Response
(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	The study area is not located near any declared areas of critical habitat.
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery plan for this species.
(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	The proposal may increase the operation of the KTP "Clearing of native vegetation" however extensive similar habitat will remain in the locality.
Conclusion	The proposal is unlikely to have a significant impact upon the Grey-crowned Babbler.

2.2.9 Other Woodland Birds

The following woodland birds have similar habitat requirements and have been assessed together. The Speckled Warbler and the Grey-crowned Babbler have been assessed separately as both of these species were actually recorded within the study area.

Other Woodland Birds – Seven part Test TSC Act	Response
Profile: Black-chinned Honeyeater (Eastern subspecies) is listed as Vulnerable on the TSC Act. Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Inland Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) and Forest Red Gum (*E. tereticornis*). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees. **Profile: Brown Treecreeper (Eastern subspecies) is listed as Vulnerable on the TSC Act.** Eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. Mainly inhabits woodlands dominated by rough-barked eucalypts, usually with a grassy or sparse shrub understorey. Fallen timber is an important habitat component for foraging. Nests in tree hollows. **Profile: Diamond Firetail is listed as Vulnerable on the TSC Act.** Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Eucalyptus pauciflora Woodlands. Also in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Also found in riparian areas, and sometimes in lightly wooded farmland. Birds roost in dense shrubs or in smaller nests built especially for roosting.	

Other Woodland Birds – Seven part Test TSC Act	Response
Profile: Hooded Robin (Eastern subspecies) is listed as Vulnerable on the TSC Act. Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Often perches on low dead stumps and fallen timber or on low-hanging branches. The nest is a small, neat cup of bark and grasses bound with webs, in a tree fork or crevice, from less than 1m to 5m above the ground. **Profile: Scarlet Robin is listed as Vulnerable on the TSC Act.** Dry eucalypt forests and woodland with open grassy understorey with few scattered shrubs. Occurs in both mature and regrowth forests and occasionally occurs in mallee, wet forests, wetlands and tea-tree swamps. **Profile: Turquoise Parrot is listed as Vulnerable on the TSC Act.** Range extends from Southern Queensland through to Northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. **Profile: Varied Sittella is listed as Vulnerable on the TSC Act.** Eucalypt forests and woodlands, particularly those with rough-barked species, mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy. Builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years. This species is sedentary and inhabits the majority of mainland Australia.	
a) In the case of a threatened species, whether an action is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	These woodland bird species forage on nectar, arthropods, insects, seeds and herbs. The study area provides foraging, roosting and breeding habitat for these species, although none were recorded. The Brown Treecreeper breeds in tree hollows and the project will remove 18 hollow-bearing trees which provide potential breeding habitat for this species. The remainder of these species built nests for breeding. The proposal will remove a small area of linear habitat for these species. A large expanse of high quality habitat occurs to the north of the New England Highway, which provides extensive foraging, breeding and roosting habitat for these species. Whilst the proposal will remove habitat for this species it is considered unlikely to have an adverse effect on the life cycle of these woodland birds such that viable local populations will 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	Not Applicable.

Other Woodland Birds – Seven part Test TSC Act	Response
the endangered population such that a viable local population of the species is likely to be placed at risk of extinction	
(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*	Not Applicable.
(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, and* *(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* *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality*	(i) The proposal will remove or modify a maximum of 11.23 ha of habitat within the study area. (ii) The proposal will widen the existing habitat. However, this is unlikely to fragment or isolate from other areas of habitat of these species more than that which is already is occurring. (iii) Compared to the extensive areas of habitat in the immediate locality, the project will remove a small linear area of habitat. As there are large areas of habitat remaining in the vicinity of the study area and the habitat within the study area is considered to be likely of contextually low importance, the habitat is not considered to be significant for the long-term survival of these species in the locality.
(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	The study area is not located near any declared areas of critical habitat.
(f) whether the action proposed is consistent with the objectives or actions	There is no recovery plan for this species.

Other Woodland Birds – Seven part Test TSC Act	Response
of a recovery plan or threat abatement plan	
(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	The proposal may increase the operation of the KTP "Clearing of native vegetation" however extensive similar habitat will remain in the locality. In relation to the Brown Treecreeper, the proposal may increase the operation of the KTP "Loss of hollow-bearing trees", though not to a significant degree in the local context. The proposal may increase the operation of the KTP "Removal of dead wood and dead trees" however, the proposal will relocate dead wood and trees into adjoining habitat. We consider that this is a very small contribution to this KTP.
Conclusion	The proposal is unlikely to have a significant impact upon the Black-chinned Honeyeater, Hooded Robin, Brown Treecreeper, Diamond Firetail, Scarlet Robin, Varied Sittella or Turquoise Parrot.

2.2.10 Birds of Prey

The following birds of prey have been assessed together as they have similar habitat requirements.

Birds of Prey – Seven part Test TSC Act	Response
Profile: Black Falcon is listed as Vulnerable on the TSC Act Inhabits woodland, shrubland and grassland in the arid and semi-arid zones, especially wooded watercourses and agricultural land with scattered remnant trees. The Black Falcon is usually associated with streams or wetlands, visiting them in search of prey and often using standing dead trees as lookout posts. Habitat selection is generally influenced more by prey densities than by specific aspects of habitat floristics or condition. Although, in agricultural landscapes, the Black Falcon tends to nest in healthy, riparian woodland remnants with a diverse avifauna. The Black Falcon prey includes small mammals, passerine birds, insects and reptiles. **Profile: Little Eagle is listed as Vulnerable on the TSC Act.** Found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia	

Birds of Prey – Seven part Test TSC Act	Response
woodlands and riparian woodlands of interior NSW are also used. Prey species include small mammals, rabbits and insects. This species nest in open woodland and riparian environments. **Profile: Square-tailed Kite is listed as Vulnerable on the TSC Act.** Timbered habitats including dry woodlands and open forests. Prefers timbered watercourses. Specialist hunter of passerines and insects.	
a) In the case of a threatened species, whether an action is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The study area provides potential foraging, roosting and breeding habitat for these species, although none were recorded. Prey species such as small mammals, passerine birds and reptiles were recorded within the study area. Nesting and roosting habitat occurs in the riparian and woodland vegetation within the study area. A large expanse of high quality habitat occurs to the north of the New England Highway, which provides foraging, breeding and roosting habitat for these species. Open forest, woodland and riparian habitat will be removed as part of the proposal which will reduce the foraging, nesting and roosting habitat for these species. Whilst the proposal will remove habitat for birds of prey it is considered unlikely to have an adverse effect on the life cycle of these species, such that a viable local population will 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	Not Applicable.
(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or* *(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*	Not Applicable.

Birds of Prey – Seven part Test TSC Act	Response
(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, and* *(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* *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality*	(i) The proposal will remove or modify a maximum of 27.73 ha of forested and open habitat within the study area. (ii) The proposal will widen the existing habitat. However, this is unlikely to fragment or isolate from other areas of habitat for these species more than that which is already is occurring. (iii) The proposal will remove a small area linear habitat. As there are large areas of habitat remaining in the vicinity of the study area, the habitat is not considered significant for the long-term survival of these birds of prey in the locality.
(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	The study area is not located near any declared areas of critical habitat.
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery plan for this species.
(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	The proposal may increase the operation of the KTP "Clearing of native vegetation" however extensive similar habitat will remain in the locality.
Conclusion	The proposal is unlikely to have a significant impact upon the Black Falcon, Little Eagle or Square-tailed Kite.

2.2.11 Forest Owls

Forest Owls – Seven part Test TSC Act	Response
Profile: Powerful Owl is listed as Vulnerable on the TSC Act Endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range. Inhabits a range of vegetation types, from woodland and open Sclerophyll forest to tall open wet forest and rainforest. **Profile: Masked Owl is listed as Vulnerable on the TSC Act.** Extends from the coast where it is most abundant to the western plains. Lives in dry eucalypt forests and woodlands from sea level to 1100m. **Profile: Barking Owl is listed as Vulnerable on the TSC Act.** Woodland and open forest including fragmented remnants and partly cleared farmland. Preferentially hunts small arboreal mammals such as squirrel gliders and ringtail possums. But as prey decreases, becomes reliant on birds, invertebrates and terrestrial mammals such as rodents and rabbits. Large tree hollows are used for nesting.	
a) In the case of a threatened species, whether an action is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The study area provides foraging, roosting and breeding habitat for these species, although none were recorded. Prey species such as Squirrel Gliders, possums and small terrestrial mammals were recorded within the study area. Hollow-bearing trees with large hollows were recorded in the study area which could provide breeding habitat for these species, although none were considered to be ideal for forest owls. A large expanse of high quality habitat occurs to the north of the New England Highway, which provides foraging, breeding and roosting habitat for these species. Open forest and woodland habitat will be removed as part of the proposal, which will reduce the foraging habitat for these species. Whilst the proposal will remove habitat for forest owls, it is considered unlikely to have an adverse effect on the life cycle of these species such that a viable local population will 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	Not Applicable.
(c) in the case of an endangered ecological community or critically	Not Applicable.

Forest Owls – Seven part Test TSC Act	Response
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*	
(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, and* *(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* *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality*	(i) The proposal will remove or modify a maximum of 11.23 ha of habitat within the study area. (ii) The proposal will widen the existing habitat. However, this is unlikely to fragment or isolate from other areas of habitat of these forest owls more than that which is already is occurring. (iii) The proposal will remove a small area linear habitat. As there are large areas of habitat remaining in the vicinity of the study area, it is not considered significant for the long-term survival of these forest owls.
(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	The study area is not located near any declared areas of critical habitat.
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery plan for this species.
(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the	The proposal may increase the operation of the KTP "Clearing of native vegetation" however extensive similar habitat will remain in the locality.

Forest Owls – Seven part Test TSC Act	Response
operation of, or increase the impact of, a key threatening process	The proposal will result in the KTP "Loss of hollow-bearing trees". The proposal will remove a small amount of trees that may be suitable for breeding for these species, and there a large number of hollows in the vicinity of the study area. Therefore, the removal of hollows as part of the proposal is unlikely to exacerbate this KTP. The proposal may increase the operation of the KTP "Removal of dead wood and dead trees". However, the proposal will relocate dead wood and trees into adjoining habitat and we consider that this is a very small contribution to this KTP.
Conclusion	The proposal is unlikely to have a significant impact upon the Masked Owl, Barking Owl or Powerful Owl.

2.3 Mammals

2.3.1 Brush-tailed Phascogale

Brush-tailed Phascogale – Seven part Test TSC Act	Response
Profile: The Brush-tailed Phascogale is listed as Vulnerable on the TSC Act. Mostly found in dry sclerophyll open forest with sparse groundcover, east of the Great Dividing Range. However, has been recorded in heath, swamps, rainforest and wet sclerophyll forest. Nest and shelter in tree hollows with small entrances (2.5 - 4cm).	
a) In the case of a threatened species, whether an action is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	This species was not recorded during the field surveys. The study area provides foraging, roosting and breeding habitat for this species. The Brush-tailed Phascogale nests and shelters in tree hollows and the proposal will hollow-bearing trees. It is proposed to replace these hollows with nest boxes to mitigate the removal of hollows, as a result of the proposal. A large expanse of high quality habitat occurs to the north of the New England Highway, which provides foraging, breeding and roosting habitat for this species. The proposal will remove hollow-bearing trees which would reduce sheltering and breeding sites for this species. The proposal will remove a small linear area of habitat and is unlikely to have an adverse effect on the lifecycle of this species such that a viable local population will be placed at risk of extinction.

Brush-tailed Phascogale – Seven part Test TSC Act	Response
(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	Not Applicable.
(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or* *(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*	Not Applicable.
(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, and* *(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* *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality*	(i) The proposal will remove or modify a maximum of 11.23 ha of habitat within the study area. (ii) The proposal will widen the existing habitat. However, this is unlikely to fragment or isolate from other areas of habitat of the Brush-tailed Phascogale than already is occurring. (iii) The proposal will remove a small area linear habitat. As there are large areas of habitat remaining in the vicinity of the study area, it is not considered significant for the long-term survival of the Brush-tailed Phascogale.
(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	The study area is not located near any declared areas of critical habitat.

Brush-tailed Phascogale – Seven part Test TSC Act	Response
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery plan for this species.
(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	
Conclusion	The proposal is unlikely to have a significant impact upon the Brush-tailed Phascogale.

2.3.2 Koala

Koala – Seven part Test TSC Act	Response
Profile: The Koala is listed as Vulnerable on the TSC Act. Found in eucalypt woodlands and forest foraging on preferred food trees. Koalas will feed almost exclusively on a small number of preferred species. The preferred tree species vary widely on a regional and local basis. Some preferred and supplementary feed tree species in the Hunter Valley region include *Eucalyptus tereticornis, Eucalyptus robusta, Eucalyptus punctata, Eucalyptus pilularis* and *Eucalyptus canaliculata*.	
a) In the case of a threatened species, whether an action is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	This species was not recorded within the study area despite targeted nocturnal surveys and koala searches. No scats or scratches of this species were recorded. One supplementary Koala feed tree Eucalyptus tereticornis was recorded within the study area in generally low densities. A large expanse of high quality habitat occurs to the north of the New England Highway, which provides foraging, breeding and roosting habitat for this species. The proposal will remove a small linear area of habitat and is unlikely to have an adverse effect on the lifecycle of this species such that a viable local population will 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	The study area does not occur within the locality of any of the endangered populations for this species.

Koala – Seven part Test TSC Act	Response
(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*	Not Applicable.
(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, and* *(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* *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality*	(i) The proposal will remove or modify a maximum of 11.23 ha of habitat within the study area. (ii) The proposal will widen the existing habitat. However this is unlikely to fragment or isolate from other areas of habitat of the Koala than already is occurring. (iii) The proposal will remove a comparatively small area of linear habitat. As there is large areas of habitat remaining in the vicinity of the study area and it is not considered significant for the long-term survival of the Koala.
(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	The study area is not located near any declared areas of critical habitat.
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	The recovery plan that has been prepared for the Koala and aims to: • reverse the decline of the koala in NSW; • ensure adequate protection, management and restoration of Koala habitat; and

Koala – Seven part Test TSC Act	Response
	• maintain healthy and breeding populations of koalas are present throughout their current range. Specific objectives of the plan are to: • conserve koalas in their existing habitat; • rehabilitate and restore koala habitat and populations; • develop a better understanding of the conservation biology of koalas; • ensure that the community has access to factual information about the distribution, conservation and management of koalas at a national, state and local scale; • manage captive, sick or injured koalas and orphaned wild koalas to ensure consistent and high standards of care; and • manage over-browsing to prevent both koala starvation and ecosystem damage in discrete patches of habitat. Although the proposal would include removal of a small area of potential habitat for the Koala, it is unlikely to affect the conservation of koalas or interfere with any of the other objectives of the recovery plan.
(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	The proposal may increase the operation of the KTP "Clearing of native vegetation" however extensive similar habitat will remain in the locality.
Conclusion	The proposal is unlikely to have a significant impact upon the Koala.

2.3.3 Spotted-tailed Quoll

Spotted-tail Quoll – Seven part Test TSC Act	Response
Profile: The Spotted-tailed Quoll is listed as Vulnerable on the TSC Act. A variety of vegetation such as rainforest, open forest, woodland, coastal heath, inland riparian forest. Have home ranges 750 - 3500 ha. Den sites may be located in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky cliffs. The Spotted-tailed Quoll will hunt possums and gliders in tree hollows and prey on roosting birds. A generalist predator with a preference for medium-sized (500g-5kg) mammals. Consumes a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits, reptiles and insects.	
a) In the case of a threatened species, whether an action is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	This species was not recorded during the field surveys despite targeted surveys. The study area provides foraging, roosting and breeding habitat for this species. The Spotted-tailed Quoll den sites can be located in hollow-bearing trees and fallen timber, both of which were present within the study area. From a total of 40 hollow-bearing trees, 18 (45%) are required to be removed for the project. A range of prey species was also recorded within the study area. A large expanse of high quality habitat occurs to the north of the New England Highway, which provides foraging, breeding and roosting habitat for this species. The proposal will remove hollow-bearing trees which would reduce sheltering and breeding sites for this species. The proposal will remove a small linear area of habitat, and is unlikely to have an adverse effect on the lifecycle of this species such that a viable local population will 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	Not Applicable.
(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or* *(ii) is likely to substantially and adversely modify the*	Not Applicable.

Spotted-tail Quoll – Seven part Test TSC Act	Response
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, and* *(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* *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality*	(i) The proposal will remove or modify a maximum of 11.23 ha of habitat within the study area. (ii) The proposal will widen the existing habitat. However, this is unlikely to fragment or isolate other areas of habitat for the Spotted-tailed Quoll other than that which is already occurring. (iii) The proposal will remove a small area of linear habitat. As there are large areas of habitat remaining in the vicinity of the study area, it is not considered significant for the long-term survival of the Spotted-tailed Quoll.
(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	The study area is not located near any declared areas of critical habitat.
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery plan for this species.
(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	The proposal may increase the operation of the KTP "Clearing of native vegetation" however extensive similar habitat will remain in the locality. The proposal may increase the operation of the KTP "Removal of dead wood and dead trees" however, the proposal will relocate dead wood and trees into adjoining habitat. We consider that this is a very small contribution to this KTP. The proposal may increase the operation of the KTP "Bushrock removal". However, the proposal will relocate

Spotted-tail Quoll – Seven part Test TSC Act	Response
	any bushrock into adjoining habitat and we consider that this is a very small contribution to this KTP. The proposal will increase the operation of the KTP "Loss of hollow-bearing trees". The proposal will remove a small amount of trees that are suitable for breeding for these species, and there a large number of hollows in the vicinity of the study area. Therefore, the removal of hollows for the proposal is unlikely to exacerbate this KTP.
Conclusion	The proposal is unlikely to have a significant impact upon the Spotted-tailed Quoll.

2.3.4 Squirrel Glider

Squirrel Glider – Seven part Test TSC Act	Response
Profile: The Squirrel Glider is listed as Vulnerable on the TSC Act. Inhabits mature or old growth box, box-ironbark woodlands and river red gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia mid-storey. Uses tree hollows as den sites. Diet varies seasonally and consists of Acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein.	
a) In the case of a threatened species, whether an action is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	This species was recorded at two locations on the northern side of the New England Highway. The Squirrel Glider was observed foraging in flowering Eucalypts in the forested habitat within the study area. A large number of hollow-bearing trees with suitable hollows for this species were recorded in the study area. From a total of 40 hollow-bearing trees, 18 (45%) are required to be removed for the project. The study area provides foraging, roosting and breeding habitat for this species. A large expanse of high quality habitat occurs to the north of the New England Highway, which provides foraging, breeding and roosting habitat for this species. The proposal will remove hollow-bearing trees which would reduce breeding habitat for this species. The widening of the New England Highway as a result of the proposal would widen the barrier for this species to access foraging and breeding habitat on the south side of New England Highway. The proposal is considered unlikely to result in an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of

Squirrel Glider – Seven part Test TSC Act	Response
	extinction. This is primarily due to the extensive habitat that extends to the north and south of the study area. However, it is considered that existing connectivity for the Squirrel Glider across the existing New England Highway, which is as close as 15m currently (a distance over which the species could glide) would be widened to over 50m. If connection structures such as glider poles or arboreal rope crossings are installed, this would mitigate any impacts to the life cycle of the Squirrel Glider such that a viable local population will 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	Not Applicable.
(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or* *(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*	Not Applicable.
(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, and* *(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*	(i) The proposal will remove or modify a maximum of 11.23 ha of habitat within the study area. (ii) The proposal will widen the existing habitat. However, this is unlikely to fragment or isolate from other areas of habitat for this species more than already is occurring provided that connectivity structures such as arboreal rope crossings or glider poles are installed.

Squirrel Glider – Seven part Test TSC Act	Response
(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	(iii) Whilst the study area is currently occupied by this species, the proposal will remove a small area of linear habitat. As there are large areas of habitat remaining in the vicinity of the study area, it is not considered significant for the long-term survival of the Squirrel Glider.
(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	The study area is not located near any declared areas of critical habitat.
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery plan for this species.
(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	The proposal may increase the operation of the KTP "Clearing of native vegetation" however extensive similar habitat will remain in the locality. The proposal may increase the operation of the KTP "Loss of hollow-bearing trees". It is proposed to install nest boxes to mitigate the removal of hollows and therefore the proposal is unlikely to exacerbate this KTP. The proposal may increase the operation of the KTP "Removal of dead wood and dead trees". However, the proposal will relocate dead wood and trees into adjoining habitat. We consider that this is a very small contribution to this KTP.
Conclusion	The proposal is unlikely to have a significant impact upon the Squirrel Glider. If the proposed connectivity structures are installed it will assist in retaining linkages to habitat that current occurs.

2.3.5 Grey-headed Flying Fox

Grey-headed Flying Fox – Seven part Test TSC Act	Response
Profile: The Grey-headed Flying-Fox is listed as Vulnerable on the TSC Act. This species is generally found within 200 km of Australia's eastern coast. Generally, occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are commonly found in gullies, close to water, in vegetation with a dense canopy.	
a) In the case of a threatened species, whether an action is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	This species was recorded at one location on the southern side of the New England Highway. The Grey-headed Flying Fox was observed foraging on flowering eucalypts within the study area. Two deceased Grey-headed Flying Fox were also observed at the junction of Lot 21 DP 1014307 and Lot 4 DP 621020 entangled on barbed wire strung across a farm dam. The study area provides foraging, habitat for this species however, no camps are in the study area. A large expanse of high quality habitat occurs to the north of the New England Highway, which provides foraging habitat for this species. No breeding or roosting habitat such as camps were recorded in the study area. Whilst the proposal will remove habitat for this species, it is considered unlikely to have an adverse effect on the life cycle of the Grey-headed Flying Fox such that a viable local population will 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	Not Applicable.
(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or* *(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local*	Not Applicable.

Grey-headed Flying Fox – Seven part Test TSC Act	Response
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, and* *(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* *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality*	(i) The proposal will remove or modify a maximum of 11.23 ha of habitat within the study area. (ii) The proposal will widen the existing habitat. However, this is unlikely to fragment or isolate from other areas of habitat of this species than already is occurring. (iii) The study area provides foraging habitat for this species. However, the proposal will remove a small area of linear habitat. As there are large areas of habitat remaining in the vicinity of the study area, it is not considered significant for the long-term survival of the Grey-headed Flying Fox.
(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	The study area is not located near any declared areas of critical habitat.
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	The proposal will remove a small area of low quality vegetation, and this could be seen to contradict recovery strategies listed in documents such as the Grey-headed Flying Fox Recovery Plan. However, the impacts of the project are relatively minor in nature and are not expected to interfere with the recovery of this species.
(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	The proposal may increase the operation of the KTP "Clearing of native vegetation" however extensive similar habitat will remain in the locality.
Conclusion	The proposal is unlikely to have a significant impact upon the Grey-headed Flying Fox.

2.4 Microchiropteran Bats

2.4.1 Hollow-bearing Tree Bats

Hollow-bearing Tree Bats – Seven part Test TSC Act	Response
Profile: Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) listed as Vulnerable on the TSC Act. Found on the south-east coast and ranges of Australia, from Southern Queensland to Victoria and Tasmania. Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. **Profile: Eastern Freetail Bat (*Mormopterus norfolkensis*) listed as Vulnerable on the TSC Act.** The Eastern Freetail-Bat is found along the east coast from Southern QLD to Southern NSW. Occurs in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark. **Profile: Little Bent-wing Bat (*Austronomus australis*) listed as Vulnerable on the TSC Act.** Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Little Bentwing-Bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. **Profile: Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*) listed as Vulnerable on the TSC Act.** 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. **Profile: Greater Broad-nosed Bat (*Scoteanax rueppellii*) listed as Vulnerable on the TSC Act.** Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. This species usually roosts in tree hollows.	
a) In the case of a threatened species, whether an action is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	One of these species, Eastern Freetail-Bat, was recorded by Anabat within the study area. The study area provides foraging, roosting and breeding habitat for all five of these species. A large number of hollow-bearing trees were recorded within the study area (40) which contain suitable hollows for breeding and roosting for these bats. The proposal will remove 18 hollow-bearing trees which would reduce roosting sites for these species. These species are insectivorous and the reduction in a small amount of foraging habitat is unlikely to impact on the availability of foraging resources. A large expanse of high quality habitat occurs to the north of the New England Highway, which provides foraging,

Hollow-bearing Tree Bats – Seven part Test TSC Act	Response
	breeding and roosting habitat for this species. The proposal is unlikely to impact on the lifecycle of these species such that a viable local population, will 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	Not Applicable.
(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or* *(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*	Not Applicable.
(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, and* *(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* *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species,*	(i) The proposal will remove or modify a maximum of 11.23 ha of habitat within the study area plus the open areas and dams. (ii) The proposal will widen the existing habitat gap. However, this is unlikely to fragment or isolate other areas of habitat for these species other than that which is already occurring. (iii) The study area provides foraging, breeding and roosting habitat for these species. However, the proposal will remove a small area of linear habitat. 18 hollow-bearing trees will be removed as part of the proposal. As there are large areas of habitat remaining in the immediate vicinity of

Hollow-bearing Tree Bats – Seven part Test TSC Act	Response
population or ecological community in the locality	the study area, the affected habitat is not considered likely significant for the long-term survival of these species.
(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	The study area is not located near any declared areas of critical habitat.
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There are no recovery plans for these species.
(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	The proposal may increase the operation of the KTP "Clearing of native vegetation" however extensive similar habitat will remain in the locality. The proposal will increase the operation of the KTP "Loss of hollow-bearing trees". The proposal may increase the operation of the KTP "removal of dead wood and trees" however, the proposal will relocate dead wood and trees into adjoining habitat and we consider that this is a very small contribution to this KTP.
Conclusion	The proposal is unlikely to have a significant impact upon the Eastern False Pipistrelle, Eastern Freetail Bat, Little Bent-wing Bat, Yellow-bellied Sheathtail Bat and Greater Broad-nosed Bat.

2.4.2 Cave Bats

Hollow-bearing Tree Bats – Seven part Test TSC Act	Response
Profile: Large-eared Pied Bat (*Chalinolobus dwyeri*) listed as Vulnerable on the TSC Act. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin, frequenting low to mid-elevation dry open forest and woodland close to these features. Also found in well-timbered areas containing gullies. **Profile: Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*) listed as Vulnerable on the TSC Act.** Forages in a range of habitat types. Roosts in caves, derelict mines, culverts and other man-made structures. Form maternity colonies that are faithful to particular caves. **Profile: Eastern Cave Bat (*Vespadelus troughtoni*) listed as Vulnerable on the TSC Act.** A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. Occasionally found along cliff-lines in wet eucalypt forest and rainforest. **Profile: Southern Myotis (*Saccolaimus flaviventris*) listed as Vulnerable on the TSC Act.** Forages over streams and pools catching insects and small fish by raking their feet across the water surface. Roost close to water in caves, mine shafts, tree hollows and man-made structures.	
a) In the case of a threatened species, whether an action is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	One of these species, Eastern Bent-wing Bat were recorded by Anabat within the study area. The study area provides foraging habitat for these four species. No roosting or breeding habitat in the form of caves and other structures such as mine shafts were recorded within the study area. These species are insectivorous and the reduction in a small amount of foraging habitat is unlikely to impact on the availability of foraging resources. A large expanse of high quality habitat occurs to the north of the New England Highway, which provides foraging, habitat for these species. The proposal is unlikely to effect on the lifecycle of these species such that of a viable local population, will 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	Not Applicable.

Hollow-bearing Tree Bats – Seven part Test TSC Act	Response
(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*	Not Applicable.
(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, and* *(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* *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality*	(i) The proposal will remove or modify a maximum of 11.23 ha of habitat within the study area plus open areas and dams. (ii) The proposal will widen the existing habitat gap. However, this is unlikely to fragment or isolate other areas of habitat for these species other than already is occurring. (iii) The study area provides foraging, breeding and roosting habitat for these species. However, the proposal will remove a small area linear habitat. 18 hollow-bearing trees will be removed as part of the proposal. As there are large areas of habitat remaining in the immediate vicinity of the study area, the affected habitat is not considered likely to be significant for the long-term survival of these species.
(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	The study area is not located near any declared areas of critical habitat.
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There are no recovery plans for these species.

Hollow-bearing Tree Bats – Seven part Test TSC Act	Response
(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	The proposal may increase the operation of the KTP "Clearing of native vegetation" however extensive similar habitat will remain in the locality.
Conclusion	The proposal is unlikely to have a significant impact upon the Large-eared Pied Bat, Eastern Bent-wing Bat, Eastern Cave Bat or the Southern Myotis.

3 SIGNIFICANCE ASSESSMENTS FOR EPBC ACT SPECIES

3.1 Critically Endangered Species

3.1.1 Regent Honeyeater

Regent Honeyeater – EPBC Act Assessment	Response
Profile: The Regent Honeyeater is listed as critically endangered and migratory on the EPBC Act. The habitat for this species is within dry open forest and woodland. Particularly box-ironbark woodland and riparian forests of river sheoak. Feeds on the nectar from a wide range of eucalypts mistletoes and invertebrates. The distribution of this species is confined to Victoria and New South Wales. This species breeds in cup-like nests constructed with bark.	
Lead to a long term decrease in size of a population	The proposal will remove a small area of potential foraging, roosting and nesting habitat within the woodland habitat within the study area. The area of habitat is small in relation to large extant of habitat in the local area, and therefore the proposal is unlikely to lead to a long term decrease in size of a population of this species.
Reduce the area of occupancy of the species	The Regent Honeyeater has not been recorded within the study area. The Regent Honeyeater has been recorded in close proximity to the study area at Rothbury, Singleton Army Base and Pokolbin State Forest. Whist the study area does contain foraging habitat for this species, it is likely to use the study area on an intermittent basis. Larger better quality foraging habitat occurs within the Singleton Army Base, Belford National Park, the Cessnock area and west to the Howes Valley. The proposal is unlikely to reduce an area of occupancy of this species.
Fragment an existing population into two or more populations	Whilst the proposal will further fragment habitat to a minor degree, since the species is mobile, it will not fragment any populations of this species.
Adversely affect critically habitat to the survival of the species	The Regent Honeyeater National Recovery Plan has identified key breeding habitat for this species. The Cessnock area including the Singleton Army Base has been identified as a key breeding habitat for this species. The study area has not been identified as a key breeding area. It is unlikely that the proposal will impact upon the critical habitat of this species due to the degraded nature of the habitat and the larger area of high quality habitat within the vicinity of the study area.
Disrupt the breeding cycle of an population	The Regent Honeyeater recovery plan has identified three key breeding areas in NSW and these include Bundarra-Barraba, Capertee Valley and the Hunter Valley. The proposal is

Regent Honeyeater – EPBC Act Assessment	Response
	unlikely to disrupt the breeding cycle of this species, as the nesting habitat within the study area is of poor quality. Higher quality nesting habitat occurs within the vicinity of the study area.
Modify, destroy, remove or isolate or decrease the availability of habitat to the extent that the species is likely to decline	The proposal will remove a small area of potential habitat for this species which will result in the decrease in the availability of habitat. The decrease in habitat is small in comparison to the availability of habitat in the surrounding area. It is unlikely to result in the decline of this species.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species habitat	The proposal is unlikely to introduce invasive species such as introduced predators that are potentially harmful to the Regent Honeyeater.
Introduce disease that may cause the species to decline	The proposal is unlikely to introduce disease that will impact upon this species.
Interfere with the recovery of the species	The Department of the Environment has developed a draft recovery plan for this species. The objectives of this recovery plan are as follows: • Reverse the long-term population trend of decline and increase the numbers of regent honeyeaters to a level where there is a viable, wild breeding population, even in poor breeding years; and to • Maintain key regent honeyeater habitat in a condition that maximises survival and reproductive success, and provides refuge during periods of extreme environmental fluctuation. The recovery plan identifies critical foraging habitat of box-ironbark eucalypt forest and river she-oak forests. The Regent Honeyeater obtains nectar resources from a small number eucalypt species and mistletoe. A number of these species, Corymbia maculata, Eucalyptus fibrosa, Eucalyptus sideroxylon and the mistletoe Amyema cambagei were recorded within the study area. A comparatively small amount of these foraging resources are likely to be impacted upon by the proposal. The proposal will remove a small area of potential habitat, and as such this could be seen to interfere with the recovery of this species. However, the impacts of the project are relatively minor in nature and are not expected to interfere with the recovery of this species.
Conclusion	The proposal is unlikely to result in a significant impact upon the Regent Honeyeater.

3.1.2 Swift Parrot

Swift Parrot – EPBC Act Assessment	Response
Profile: The Swift Parrot is listed as critically endangered and migratory on the EPBC Act. This species breeds in Tasmania and migrates to south-eastern mainland in Mar-Oct. Winter-flowering trees such as *Eucalyptus robusta, Corymbia maculata, C. gummifera, E. sideroxylon* and *E. albens* provide foraging habitat for this species.	
Lead to a long term decrease in size of a population	The proposal will remove a small area of potential foraging habitat for the Swift Parrot within the study area. The area of habitat is small in relation to large extent of habitat in the local area. Therefore, the proposal is unlikely to lead in long term decrease in size of a population of this species.
Reduce the area of occupancy of the species	The Swift Parrot has been recorded in close proximity to the study area at Rothbury at Singleton Army Base and Pokolbin State Forest. Whist the study area does contain foraging habitat for this species, the Swift Parrot is likely to use the study area on an intermit basis. Larger better quality foraging habitat occurs within the Singleton Army Base, the Cessnock area and west to the Howes Valley. Therefore, the proposal is unlikely to reduce the area of occupancy for the Swift Parrot.
Fragment an existing population into two or more populations	Fragmentation of populations is unlikely to result from the proposal. The study area occurs on previously disturbed land due to agricultural land use. The proposal will result in the removal of 11.23 ha of foraging habitat. The proposal is therefore unlikely to fragment an existing population into two or more populations.
Adversely affect critically habitat to the survival of the species	The study area is not critically habitat for the survival of this species.
Disrupt the breeding cycle of an population	This species breeds in Tasmania and the proposal is unlikely to affect movements of this species to and from the Tasmanian breeding grounds.
Modify, destroy, remove or isolate or decrease the availability of habitat to the extent that the species is likely to decline	The proposal will remove a small area of potential habitat for this species which will result in the decrease in the availability of habitat. The decrease in habitat is small in comparison to the availability of habitat in the surrounding area. Therefore, the proposal is unlikely to decrease the availability of habitat.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species habitat	The proposal is unlikely to introduce invasive species such as introduced predators that are potentially harmful to the Swift Parrot.
Introduce disease that may cause the species to decline	The proposal is unlikely to introduce diseases that will impact upon this species.

Swift Parrot – EPBC Act Assessment	Response
Interfere with the recovery of the species	The National Recovery Plan for the Swift Parrot outlines four objectives to assist the recovery of this species as follows: • Objective 1: To identify and prioritise habitats and sites used by the species across its range, on all land tenures. • Objective 2: To implement management strategies to protect and improve habitats and sites on all land tenures. • Objective 3: To monitor and manage the incidence of collisions, competition and Beak and Feather Disease (BFD). • Objective 4: To monitor population trends and distribution throughout the range. The proposal is unlikely to affect the objectives of the national swift parrot recovery plan.
Conclusion	The proposal is unlikely to result in a significant impact upon the Swift Parrot.

3.2 Endangered Species

3.2.1 Australian Painted Snipe

Australian Painted Snipe – EPBC Act Assessment	Response
Profile: Australian Painted Snipe is listed as Endangered and Migratory on the EPBC Act. Restricted to Australia. Most records are from the south-east, particularly the Murray Darling Basin. In NSW, many records are from the Murray-Darling Basin. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	
Lead to a long term decrease in size of a population	The proposal will remove a small portion of aquatic habitat for this species. A large expanse of high quality habitat occurs nearby on the Hunter River and its tributaries provides potential foraging, breeding and roosting habitat for this species. The proposal is unlikely to decrease the size of a population of this species.
Reduce the area of occupancy of the species	The proposal will remove a small area of habitat for this species, however it represents a small area of occurrences of habitat for this species. This species is highly mobile and has access to habitat in the vicinity of the proposal. Therefore, the

Australian Painted Snipe – EPBC Act Assessment	Response
	proposal of is unlikely to reduce the area occupancy this species.
Fragment an existing population into two or more populations	Fragmentation of populations is unlikely to result from the proposal. The study area occurs on previously disturbed land due to agricultural land use. The proposal will may affect 0.30 ha of foraging habitat, although the existing dams are likely to be retained. The proposal is therefore unlikely to fragment an existing population into two or more populations.
Adversely affect critically habitat to the survival of the species	The study area is not critically habitat for the survival of this species.
Disrupt the breeding cycle of an population	The Australian Painted Snipe nests on the ground within wetland environments. The study area is unlikely to provide ideal nesting habitat due to the degraded nature of the site. Better quality nesting habitat occurs within the Hunter River. The proposal is unlikely to disrupt the breeding cycle of a population of this species.
Modify, destroy, remove or isolate or decrease the availability of habitat to the extent that the species is likely to decline	The proposal will remove minor potential habitat for this species, which will result in a decrease in the availability of habitat. The decrease in habitat is small in comparison to the availability of habitat in the surrounding area.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species habitat	The proposal is unlikely to introduce invasive species that will become established within the habitat that are harmful for the Australian Painted Snipe.
Introduce disease that may cause the species to decline	The proposal is unlikely to introduce disease that will impact upon this species.
Interfere with the recovery of the species	The proposal will remove a small area of potential habitat, and as such this could be seen to interfere with the recovery of this species. However, the impacts of the project are relatively minor in nature and are not expected to interfere with the recovery of this species.
Conclusion	The proposal is unlikely to result in a significant impact upon the Australian Painted Snipe.

3.2.2 Spotted-tailed Quoll

Spotted-tailed Quoll – EPBC Act Assessment	Response
Profile: The Spotted-tailed Quoll is listed as Endangered on the EPBC Act. A variety of vegetation such as rainforest, open forest, woodland, coastal heath, inland riparian forest. Have home ranges 750 - 3500 ha. Den sites may be located in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky cliffs. The Spotted-tailed Quoll will hunt possums and gliders in tree hollows and prey on roosting birds. A generalist predator with a preference for medium-sized (500g-5kg) mammals. Consumes a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits, reptiles and insects.	
Lead to a long term decrease in size of a population	The proposal will remove a small area of foraging and potential den sites for the Spotted-tailed Quoll. The potential habitat within the study area is low quality, due to the degraded nature of the habitat. The habitat is likely to be a small area of a larger home range. Higher quality foraging and den sites occur in the vicinity of the study area. These include Belford National Park, Pokolbin State Forest and the Howes Valley. The area of habitat is small in relation to large extant of habitat in the local area. Therefore, the proposal is unlikely to lead in long term decrease in size of a population.
Reduce the area of occupancy of the species	The proposal will impact upon a small area of habitat. This species has a large home range and therefore the proposal is unlikely to effect of occupancy of this species.
Fragment an existing population into two or more populations	Fragmentation, as a result of the proposal, is unlikely to occur due to the removal of a small linear area of vegetation adjoining the New England Highway. The study area is currently fragmented due to agricultural land use and the proposal is unlikely to fragment populations of this species.
Adversely affect critically habitat to the survival of the species	The study area is not critically habitat for the survival of this species.
Disrupt the breeding cycle of an population	The study area does contain marginal den sites for this species in the form of hollow-bearing trees and fallen timber. The proposal will impact upon hollow-bearing trees and fallen timber. Mitigation measures such as the installation of nest boxes, and the relocation of fallen timber are proposed as part of the project. Therefore, the proposal is not likely to disrupt the breeding cycle of a population.
Modify, destroy, remove or isolate or decrease the availability of habitat to the extent that the species is likely to decline	The proposal will remove a small area of potential habitat for this species which will result in a small decrease in the availability of habitat. The decrease in habitat is small in comparison to the availability of habitat in the surrounding area. The proposal is unlikely to significantly modify, destroy, isolate or decrease the availability of the habitat such that the species is likely to decline.

Spotted-tailed Quoll – EPBC Act Assessment	Response
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species habitat	The proposal is unlikely to introduce invasive species that will become established within the habitat and become harmful towards the Spotted-tailed Quoll.
Introduce disease that may cause the species to decline	The proposal is unlikely to introduce disease that will impact upon this species.
Interfere with the recovery of the species	The proposal will remove a small area of potential habitat and as such this could be seen to interfere with the recovery of this species. However, the impacts of the project are relatively minor in nature and are not expected to interfere with the recovery of this species.
Conclusion	The proposal is unlikely to result in a significant impact upon the Spotted-tailed Quoll.

3.3 Vulnerable Species

3.3.1 Green and Golden Bell Frog

Green and Golden Bell Frog – EPBC Act Assessment	Response
Profile: Green and Golden Bell Frog (GGBF) is listed as Vulnerable on the EPBC Act. Distributed from NSW north coast near Brunswick Heads, southwards along NSW coast to Victoria where it extends into east Gippsland. Inhabits marshes, dams and stream-sides, particularly those containing bulrushes or spike rushes. Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas.	
Lead to a long term decrease in size of a population	The proposal will remove a small area of low quality potential habitat available to the species. The GGBF was not recorded in the study area, and therefore the proposal is unlikely to lead in long term decrease in size of an important population.
Reduce the area of occupancy of the species	The GGBF was not recorded in the study area and therefore the proposal will not reduce an area of occupancy of an important population.
Fragment an existing population into two or more populations	No GGBF were recorded in the study area and the proposal will not fragment any populations of this species.
Adversely affect critically habitat to the survival of the species	The study area is not critical habitat for the survival of this species.

Green and Golden Bell Frog – EPBC Act Assessment	Response
Disrupt the breeding cycle of an population	The habitat is considered to be of low importance, and is unlikely to disrupt the breeding cycle of an important population.
Modify, destroy, remove or isolate or decrease the availability of habitat to the extent that the species is likely to decline	The proposal will remove a small area of potential habitat for this species, which will result in the decrease in the availability of degraded habitat. The removal of a small area of habitat is not likely to significantly decrease the availably of quality habitat that will result in the decline of this species.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species habitat	Eastern Gambusia is an exotic fish species, which predates on GGBF tadpoles. This species is unlikely to be harmful to the GGBF, as this species was not recorded in the study area.
Introduce disease that may cause the species to decline	The chytrid fungus causing the disease chytridiomycosis may affect the GGBF. The proposal is not likely to exacerbate this KTP as it may already occur in the study area. Hygiene protocols such as wearing gloves when handling frogs will be used to mitigate the spread of this disease.
Interfere with the recovery of the species	The proposal will remove a small area of potential habitat, and this could be seen to interfere with the recovery of this species. However, the impacts of the project are relatively minor in nature and are not expected to interfere with the recovery of this species.
Conclusion	The proposal is unlikely to result in a significant impact upon the GGBF.

3.3.2 Grey-headed Flying Fox

Grey-headed Flying Fox – EPBC Act Assessment	Response
Profile: The Grey-headed Flying-Fox is listed as Vulnerable on the EPBC Act. This species is generally found within 200 km of Australia's eastern coast. Generally it occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are commonly found in gullies, close to water, in vegetation with a dense canopy.	
Lead to a long term decrease in size of a population	This species was recorded at one location on north side of the New England Highway. The Grey-headed Flying Fox was observed foraging on flowering eucalypts within the study area. Two deceased Grey-headed Flying Fox were also observed at the junction of Lot 21 DP 1014307 and Lot 4 DP 621020 entangled on barbed wire strung across a farm dam.

Grey-headed Flying Fox – EPBC Act Assessment	Response
	The study area does not provide breeding or roosting habitat as no camps are in the study area. The area of habitat is small in relation to large extent of habitat in the local area. Therefore, the proposal is unlikely to lead in long term decrease in size of an important population.
Reduce the area of occupancy of the species	This species is highly mobile and therefore the proposal will not reduce the occupancy of an important population.
Fragment an existing population into two or more populations	Whilst the proposal will further fragment habitat, as the species is mobile it will not fragment any populations of this species.
Adversely affect critically habitat to the survival of the species	The study area is not critical habitat for the survival of this species.
Disrupt the breeding cycle of an population	No breeding camps were recorded in the study area, and therefore habitat is considered to be of low importance, and is unlikely to disrupt the breeding cycle of an important population.
Modify, destroy, remove or isolate or decrease the availability of habitat to the extent that the species is likely to decline	The proposal will remove a small area of potential habitat for this species which will result in the decrease in the availability of habitat. The decrease in habitat is small in comparison to the availability of habitat in the surrounding area.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species habitat	The proposal is unlikely to introduce invasive species that will impact upon this species.
Introduce disease that may cause the species to decline	The proposal is unlikely to introduce disease that will impact upon this species.
Interfere with the recovery of the species	The proposal will remove a small area of potential habitat and as such this could be seen to interfere with the recovery of this species. However, the impacts of the project are relatively minor in nature and are not expected to interfere with the recovery of this species.
Conclusion	The proposal is unlikely to result in a significant impact upon the Large-eared Pied Bat.

3.3.3 Koala

Koala – EPBC Act Assessment	Response
Profile: The Koala is listed as Vulnerable on the EPBC Act. Found in eucalypt woodlands and forest foraging on preferred food trees. Koalas will feed almost exclusively on a small number of preferred species. The preferred tree species vary widely on a regional and local basis. Some preferred and supplementary feed tree species in the Hunter Valley region include *Eucalyptus tereticornis, Eucalyptus robusta, Eucalyptus punctata, Eucalyptus pilularis* and *Eucalyptus canaliculata*.	
Lead to a long term decrease in size of a population	The study area contained one Koala feed tree and the proposal will remove a small area of potential habitat. The area of habitat is small and fairly isolated in relation to large extant of habitat in the local area. Therefore, the proposal is unlikely to lead in long term decrease in size of an important population.
Reduce the area of occupancy of the species	Whist there was a small number of Koala feed trees, this species was not recorded and no evidence of this species was observed. Habitat in the wider locality provides better quality habitat than the degraded habitat within the study area. Therefore, the proposals is unlikely to reduce the occupancy of an important population.
Fragment an existing population into two or more populations	The proposal will widen the New England Highway, however, currently the study area occurs within a fragmented landscape. Therefore, the removal of a linear area of habitat adjoining the New England Highway is unlikely to fragment an existing population.
Adversely affect critically habitat to the survival of the species	The study area is not critical habitat for the survival of this species.
Disrupt the breeding cycle of an population	The habitat is considered to be of low importance, and is unlikely to disrupt the breeding cycle of an important population.
Modify, destroy, remove or isolate or decrease the availability of habitat to the extent that the species is likely to decline	The proposal will remove a small area of potential habitat for this species, which will result in the decrease in the availability of habitat. The decrease in habitat is small in comparison to the availability of habitat in the surrounding area.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species habitat	The proposal is unlikely to introduce invasive species that will impact upon this species.
Introduce disease that may cause the species to decline	The proposal is unlikely to introduce disease that will impact upon this species.
Interfere with the recovery of the species	The proposal will remove a small area of potential habitat. This could be seen to interfere with the recovery of this

Koala – EPBC Act Assessment	Response
	species. However, the impacts of the project are relatively minor in nature and are not expected to interfere with the recovery of this species.
Conclusion	The proposal is unlikely to result in a significant impact upon the Koala.

3.3.4 Painted Honeyeater

Painted Honeyeater – EPBC Act Assessment	Response
Profile: The Painted Honeyeater is listed as Vulnerable on the EPBC Act. Nomadic bird that occurs at low densities throughout its range. Greatest concentrating of birds and almost all breeding of birds on the inland slopes of the Great Dividing Range in NSW, Victoria and in Southern QLD. Inhabits Boree, Brigalow and Box-gum Woodlands and Bo-Ironbark Forests. This species nests in trees and mainly feeds on mistletoe flowers. It is nomadic and seasonally movements will follow flowering mistletoes.	
Lead to a long term decrease in size of a population	The proposal will remove a small area of potential foraging habitat for this species. Breeding habitat is likely to be confined to the inland slopes of the Great Dividing Range in NSW. Habitat for this species is in the woodland in mistletoes and flowering eucalypts. The foraging habitat within the study area are limited due to the disturbed nature of the habitat, and the low abundance of mistletoes within the study area. Better quality habitat for this species occurs to the east near Broke within the Howes Valley. This species may occur within the study area intermittently and the study area would be a small part of the foraging habitat for this species. Therefore, the proposal is unlikely to lead in long term decrease in size of an important population.
Reduce the area of occupancy of the species	This species is highly mobile and the habitat within the study area would be a small part of the range of this species. It is unlikely that the proposal will reduce the occupancy of an important population.
Fragment an existing population into two or more populations	The proposal will widen the New England Highway, however, currently the study area occurs within a fragmented landscape. Therefore, the removal of a linear area of habitat adjoining the New England Highway is unlikely to fragment an existing population.
Adversely affect critically habitat to the survival of the species	The study area is not critical habitat for the survival of this species.

Painted Honeyeater – EPBC Act Assessment	Response
Disrupt the breeding cycle of an population	The habitat is considered to be of low importance, and is unlikely to disrupt the breeding cycle of an important population, as the main breeding location for this species occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and in Southern QLD.
Modify, destroy, remove or isolate or decrease the availability of habitat to the extent that the species is likely to decline	The proposal will remove a small area of potential habitat for this species, which will result in the decrease in the availability of habitat. The decrease in habitat is small in comparison to the availability of habitat in the surrounding area.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species habitat	The proposal will remove a small area of potential habitat for this species which will result in the decrease in the availability of habitat. The decrease in habitat is small in comparison to the availability of habitat in the surrounding area. Therefore, the proposal is unlikely to cause invasive species to be established within the study area.
Introduce disease that may cause the species to decline	The proposal is unlikely to introduce disease that will impact upon this species.
Interfere with the recovery of the species	The proposal will remove a small area of potential habitat and as such this could be seen to interfere with the recovery of this species. However, the impacts of the project are relatively minor in nature and are not expected to interfere with the recovery of this species.
Conclusion	The proposal is unlikely to result in a significant impact upon the Painted Honeyeater.

4 SIGNIFICANCE ASSESSMENT FOR EPBC ACT COMMUNITY

4.1 Central Hunter Valley Eucalypt Forest and Woodland

Central Hunter Valley Eucalypt Forest and Woodland – EPBC Act Assessment	Response
Profile: The Central Hunter Valley Eucalypt Forest and Woodland is listed as Critically Endangered on the EPBC Act. This community comprises of eucalypt woodland or forest with an open to sparse shrub understorey and grassy ground cover and mostly occurs on soils derived from Permian sediments. The community occurs in Hunter Valley and Goulburn Valley in the north east of NSW in the Hunter River Catchment. Dominant canopy species include Corymbia maculata, Eucalyptus dawsonii, Eucalyptus moluccana and Eucalyptus crebra. A shrubby understory includes Bursaria spinosa, Acacia amblygona, Acacia decora, Acacia implexa Breynia oblongifolia, Daviesia genistifolia, Daviesia ulicifolia, Notelaea microcarpa and Pultenaea spinosa. Groundlayer is grassy with species likely to occur including Cheilanthes sieberi, Desmodium varians, Dichondra repens, Eremophila debilis, Lomandra multiflora, Aristida ramosa, Cymbopogon refractus and Microlaena stipoides.	
Reduce the extent of the ecological community	The proposal will reduce the extent of the community by 8.20 ha. This community occurred in three condition classes as set out in the conservation advice. The extent of these classes within the study area is as follows. The proposal will removal the following areas of these classes: • 3.94 ha of Class A High Quality • 3.27 ha of Class B High Quality • 0.99 ha of Class C Moderate Quality The removal of this community includes vegetation that meet the criteria for high quality Class A and B. Therefore, the proposal will reduce the extent of this community.
Fragment or increase fragmentation of an ecological community	The impacts of the project will increase the distance between remnants of this community to the north and south of the existing New England Highway and Golden Highway within the study area. However, the existing highways have already created separations in this regard. It is considered unlikely that the results of the project will significantly increase the existing fragmentation of this community in the locality. To the north and south of the study area, this community will remain well connected to other extensive areas of the same community.
Adversely affect habitat critical to the survival of an ecological community	The Conservation Advice for this community identifies that areas that meet the moderate or higher condition class are critical to the survival of this community. All of the

Central Hunter Valley Eucalypt Forest and Woodland – EPBC Act Assessment	Response
	community to be removed within the construction footprint is classified as moderate or higher quality. According to the Conservation Advice the proposal will therefore reduce habitat critical to the survival of the community at a Commonwealth level.
Modify or destroy abiotic (non-living) factors necessary for the community's survival, including reduction in groundwater, or substantial alterations to surface water drainage patterns	The proposal is not likely to result in a reduction of groundwater. However, the proposal will require the extension of existing culverts. These culverts are unlikely to result in substantial alterations to surface water. Significant modification of other abiotic factors necessary for the community's survival is unlikely to occur.
Cause a substantial change in the species composition of an occurrence of an ecological community, including decline or loss of functionally important species *(i) assisting invasive species, that are harmful to the listed ecological community to become established* *(ii) causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community*	i) Currently there is a moderate weed invasion of African Olive, exotic grasses and weeds. The project will implement management measures to ensure that the weeds that currently occur are not further spread into retained areas of this community. (ii) The current land use of agricultural practices, with the use of fertilises and herbicides are currently occurring within the community. Best practice sediment, erosion and pollutant control procedures will be implemented by the project. Therefore, the project is unlikely to inhibit the growth of species that occur within this community.
Interfere with the recovery of an ecological community	The proposal is unlikely to interfere with the recovery of this ecological community, it is extensive in occurrence in the locality.
Conclusion	The proposal is reducing the extent of this ecological community by 8.2 ha and impacting upon an area considered critical to the survival of this community (as defined in the Conservation Advice), as outlined above. It is therefore considered that the project is likely to result in a significant impact on this critically endangered ecological community at a Commonwealth level. Appropriate biodiversity offsets will be provided as compensation for this impact.

Appendix 8

Bat Analysis Report

Identification of echolocation call sequences recorded at Belford.

Data

Data was received by email on the 19/02/2016 and was analysed using AnalookW v4.1z. In total 7 folders of Anabat data was received, recorded over eight (8) nights from the 25th January containing 697 files, results per folder are presented in Table1. Calls were considered to be of generally poor quality which made positive identification difficult. Calls were recorded with a division ratio of 16. The original call files display Australian Eastern Standard Time.

Reference Library

Call identification for this data set was based on call keys and descriptions for New South Wales (Pennay et al 2004) with reference to descriptions published for southern Queensland (Reinhold et al 2001).

Analysis

The reliability of identification is as follows;

Definite; one or more calls were there is no doubt about the identification of the species

Probable; most likely to be the species named, low probability of confusion with species that use similar calls

Possible; call is comparable with the named species, with a moderate to high probability of confusion with species of similar calls.

Table 1 - Anabat recording results

Species Name	Site					
	Bat data uploaded 2016-02-02			Bat data uploaded 2016-02-03	Bat data uploaded 2016-02-08	Bat data uploaded 2016-02-09
	20160125	20160126	20160127	20160202	20160203	20160208
Definite						
		Nil	Nil			no species
Austronomus australis					X	
Mormopterus planiceps	Po*			X		
Mormopterus norfolkensis	Pr#				Pr	
Mormopterus ridei	X				X	
Scotorepens balstoni	X			X	X	
Chalinolobus gouldii	X			X		
Scotorepens orion	Po					
Miniopterus orianae (schreibersii) oceanensis	X			X	X	
Vespadelus pumulis	X				X	
Rhinolophus megaphyllus						
Species composites/groups identified						
Chalinolobus gouldii/Mormopterus ridei	Pr			Pr	Pr	
Mormopterus ridei/Mormopterus norfolkensis					Pr	
Scoteanax rueppellii/Scotorepens orion/Falsistrellus tasmaniensis	Pr			Pr	Pr	
Nyctophilus sp. */Myotis macropus*	Pr					
Vespadelus regulus/Miniopterus orianae oceanensis	Pr			Pr	Pr	
Vespadelus vulturnus/V.troughtoni/V. pumilus	Pr				Pr	
Miniopterus australis/Vespadelus pumilus					Pr	

Probability assigned values are discussed in report

* possible

probable

Table 1 - Anabat recording results

Species Name	Bat data uploaded 2016-02-10 20160208	20160210	Bat data uploaded 2016-02-11 20160210	Bat data uploaded 2016-02-12 20160211
Definite				
		no species		
Austronomus australis				
Mormopterus planiceps	X			X
Mormopterus norfolkensis				X
Mormopterus ridei				
Scotorepens balstoni	X		X	X
Chalinolobus gouldii			X	
Scotorepens orion			X	
Miniopterus orianae (schreibersii) oceanensis			X	
Vespadelus pumulis				
Rhinolophus megaphyllus	X			
Species composites/groups identified				
Chalinolobus gouldii/Mormopterus ridei				Pr
Mormopterus ridei/Mormopterus norfolkensis				Pr
Scoteanax rueppellii/Scotorepens orion/Falsistrellus tasmaniensis			Pr	Pr
Nyctophilus sp. */Myotis macropus*	Pr			
Vespadelus regulus/Miniopterus orianae oceanensis				
Vespadelus vulturnus/V.troughtoni/V. pumilus			Pr	Pr
Miniopterus australis/Vespadelus pumilus				Pr

Probability assigned values are discussed in report

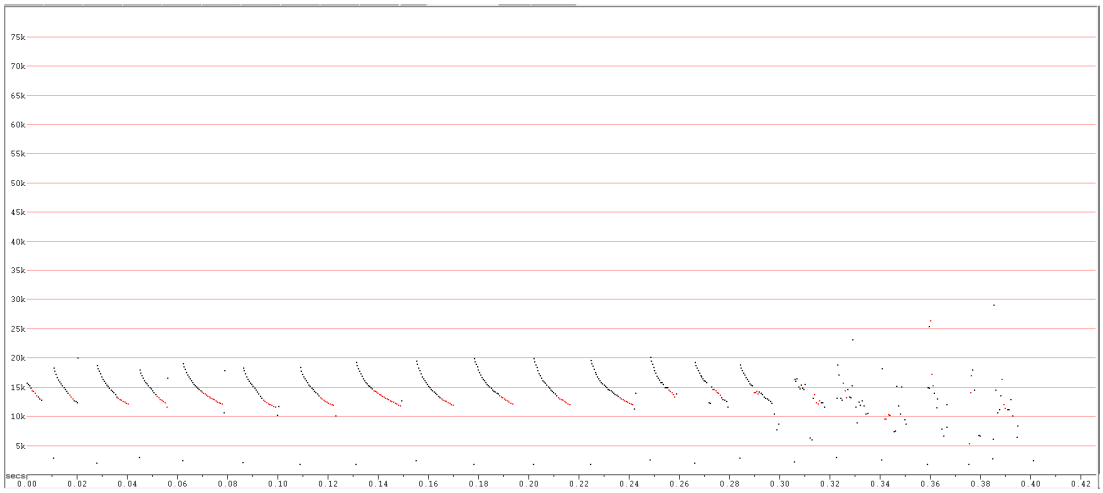
* possible

probable

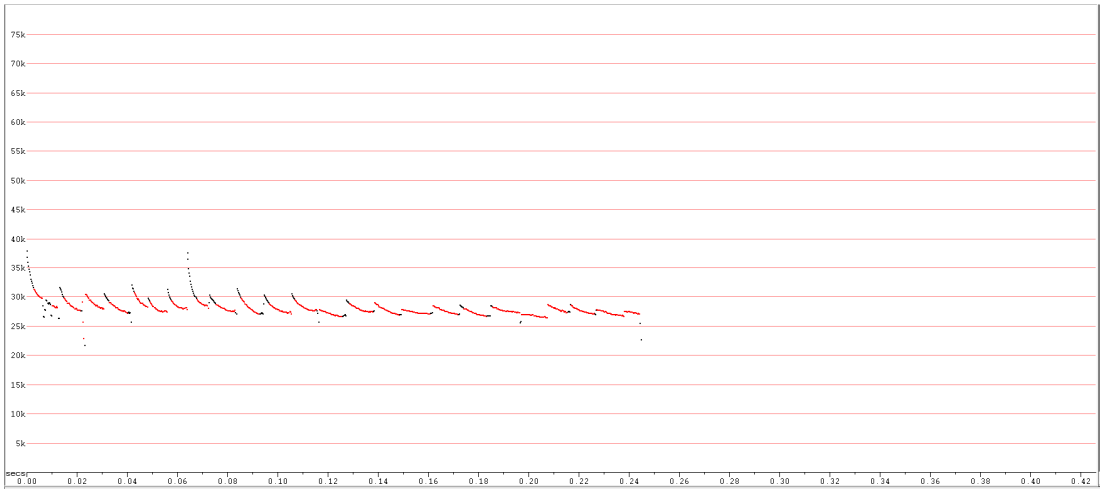
Call Examples (calls have been edited and filtered for reporting purposes)

Section 1.

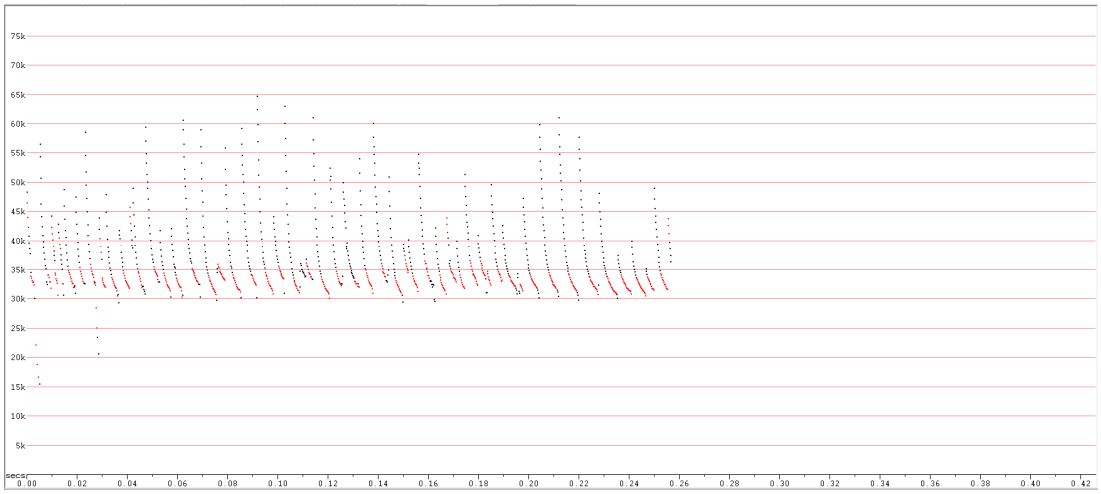
Species positively identified



Definitely *Austronomus australis*. The characteristic frequency if this species is between 10 – 15 kHz. This species may be confused with *Saccolaimus flaviventris* at its lower harmonics.

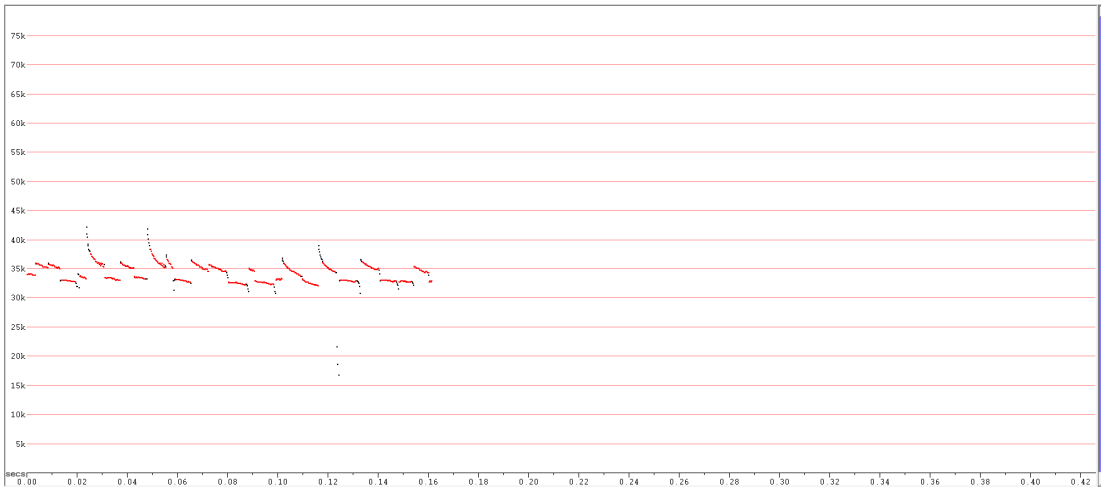


Definitely *Mormopterus planiceps*. Published descriptions of calls for this species report that it calls between 26 – 30.5 kHz, although it has been recorded lower at around 24 kHz (pers. com. Greg Ford November 2015). The calls will be flat in the lower ranges and curved at the higher limits, and dependant on activity and environment. Calls of these species overlap with *Mormopterus norfolkensis*. *M. norfolkensis* may call for several pulses without alternating. *Chalinolobus gouldii* calls are typically curved with a down sweeping tail and alternating consecutive pulses, the upper pulses may drop out in more open spaces.

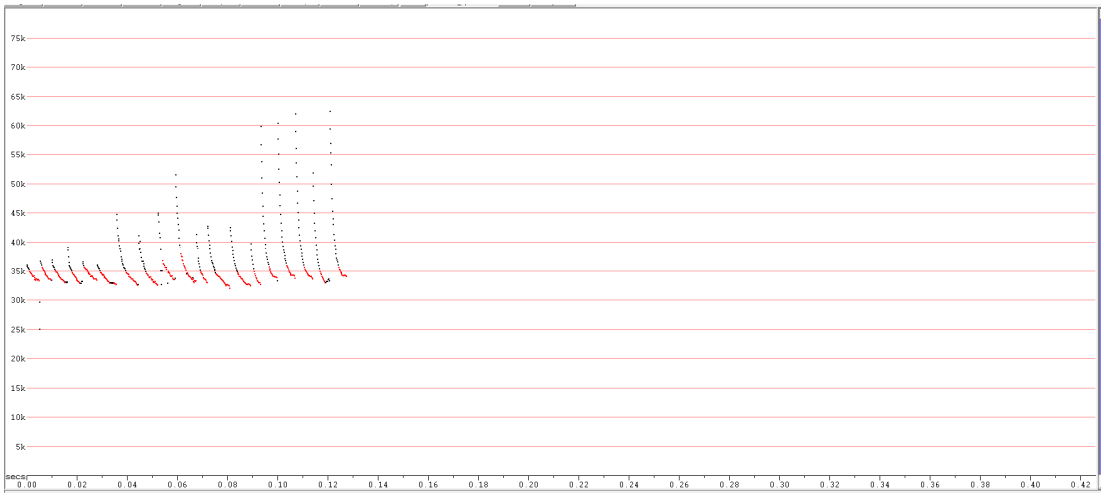


Definitely *Chalinolobus gouldii*. The call sequence is curved average characteristic frequency is between 25 and 34 KHz. Consecutive pulses alternate in frequency.

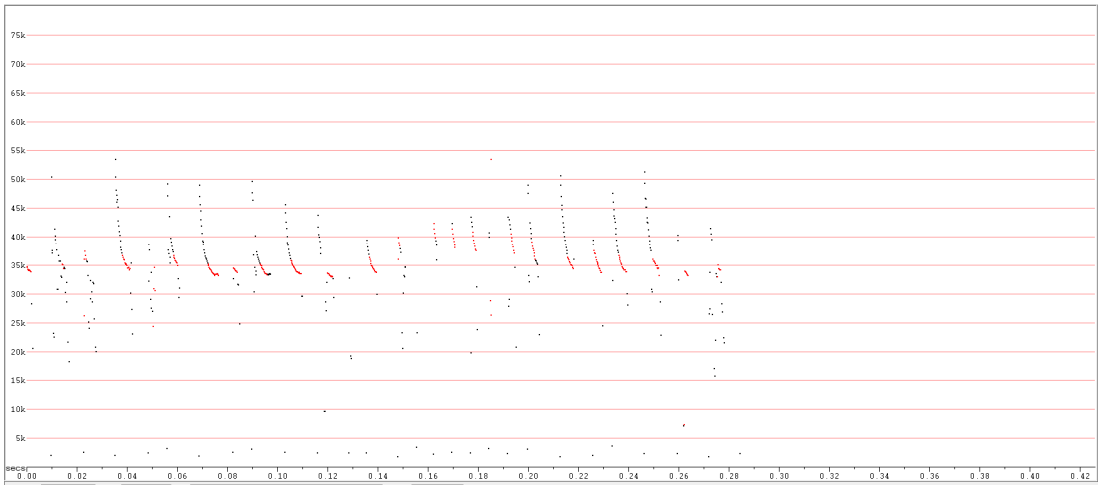
Definitely *Mormopterus ridei*. The species calls between 31 – 36 kHz. Calls of this species may overlap with *Mormopterus planiceps* in its lower frequencies, and *Mormopterus norfolkensis* between 32 – 35 kHz.



Definitely *Mormopterus norfolkensis. Mormopterus norfolkensis* has a characteristic call frequency in the Sydney Basin region of between 32 – 35 kHz, with pulses typically alternating by approximately 2 kHz. The species may call for several pulses without alternating. *Mormopterus ridei* calls overlap at this frequency.



Definitely *Scotorepens orion*. The characteristic frequency of this call is between 33 – 35 kHz, the pre characteristic drop is less than 3 kHz (1.81 KHz), suggesting that the species is *Scotorepens orion*.



Definitely *Scotorepens balstoni*. A curved call with a characteristic frequency between 28 and 35 kHz. The tail is usually down sweeping or absent, frequency of the knee 33 – 37 kHz which distinguishes it from other species calling in the same frequency including *Scoteanax rueppellii*, *Falsistrellus tasmaniensis* and *Scotorepens orion*.

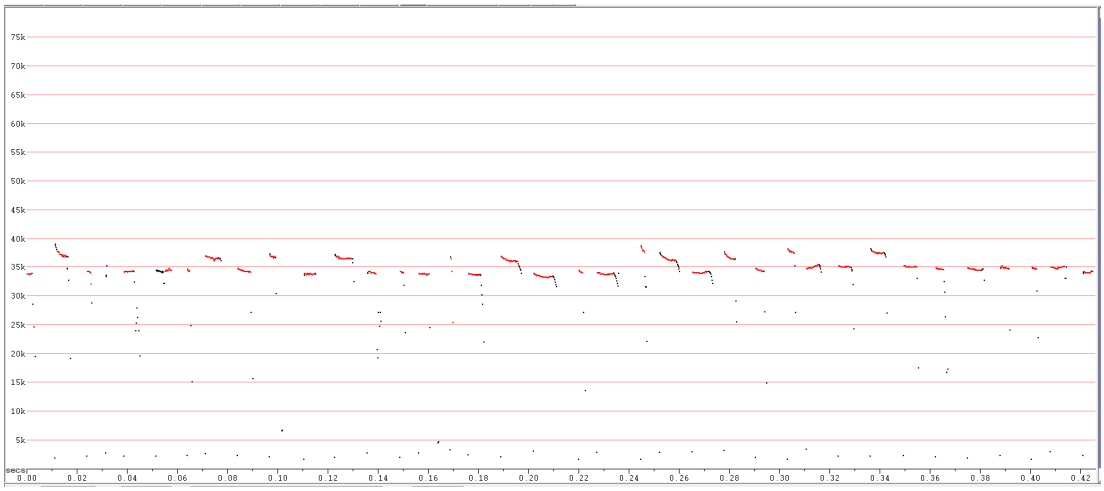
Definitely *Miniopterus orianae (schreibersii) oceanensis*. Curved call with a characteristic frequency 44 – 47.5 kHz. The species can be distinguished from *V. darlingtoni* and *V. regulus* in NSW by having a longer pre-characteristic section, and by uneven consecutive pulses. This species is known or predicted to occur in the area (NPWS Atlas and Atlas of Living Australia Data February 2016).

Definitely Vespadelus pumulis. Curved call with a characteristic frequency between 50.5 – 58 kHz. Where the species calls overlap with *V. troughtoni* an end frequency of more than 54.5 kHz suggests that he call belongs to *V. pumulis*. The end frequency of the calls recorded at Belford were above 54.5 kHz. The end frequency of the above call sequence is approximately 55 kHz.

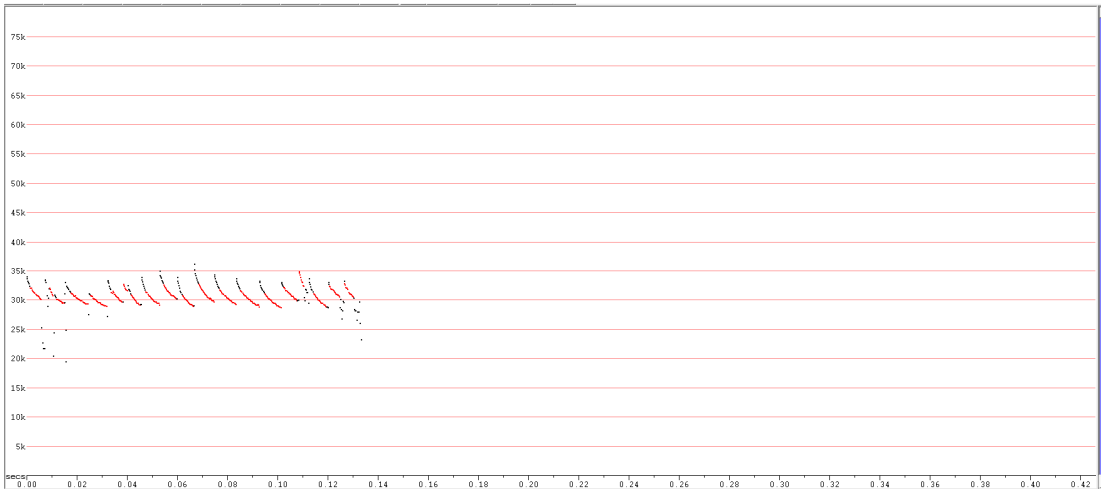
Section 2.

Species composites/groups identified

A species listed here that is not also listed in the species positively identified should be considered as possibly present. Call identification issues for these species are discussed below each call example.

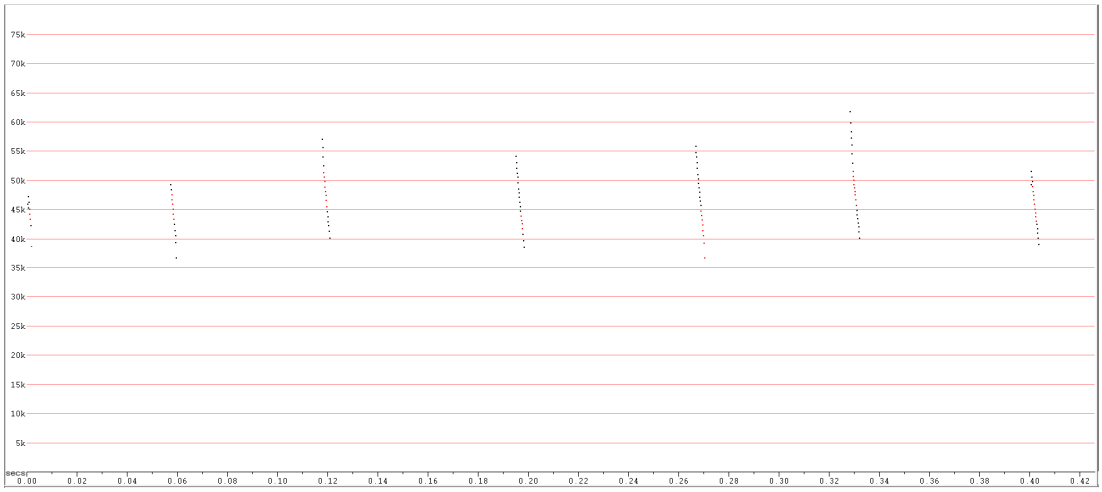


Probably *Mormopterus ridei*/*Mormopterus norfolkensis*. Calls of these species overlap. *M. norfolkensis* may call for several pulses without alternating. The alternation in the above call is not considered clear enough to assign positive species identification.



Probably *Chalinolobus gouldii* /*Mormopterus ridei*. Frequency ranges overlap in the species, *C. gouldii* usually has steep, curved pulses that alternate in frequency compared to flat or shallow-curved pulses with no alternation in *Mormopterus* species. For example the call above could belong to an attack phase of a *Mormopterus* species or a *Chalinolobus gouldii* call were the upper pulses have dropped out as may occur in more open spaces. Calls in this data set were attributable to both species however a large number of calls were either of low quality (brief and noisy) or displayed intermediate characteristics and could not be reliably identified.

Probably *Scotorepens orion*/*Scoteanax rueppellii*/ *Falsistrellus tasmaniensis*. The above call sequence contains pulses with a characteristic frequency of approximately 35 kHz. Attributes sufficient enough to confidently attribute the pulses species level are not present.



Probably *Myotis macropus/Nyctophilus* species. *M. macropus* calls can be differentiated from *Nyctophilus* species by having a pulse interval less than 75ms, an initial slope of greater than 400 OPS and often displaying a single change in slope (kink) in the central part of the pulse. The calls recorded at Belford did not consistently display at least 2 out of 3 characteristics.
Myotis macropus, *Nyctophilus geoffroyii* and *Nyctophilus gouldi* have been recorded in the region (NPWS Atlas and Atlas of Living Australia Data February 2016). This call is uncompressed. Open water in dams and small drainage channels were recorded on site.

Probably *Vespadelus* sp. /*Miniopterus orianae oceanensis*. *M. o. oceanensis* was positively identified in the data set, both V. regulus and V. vulturnus have been recorded in the area. Some calls recorded at Belford were either brief or weak and had poorly-defined pulse structure.

Vespadelus vulturnus/ *Vespadelus troughtoni*/*Vespadelus pumulis*. The calls of these species overlap between 49 KHz. *Vespadelus troughtoni* calls between 50.5 – 53 KHz all three (3) species have been recorded in the area (NPWS Atlas and Atlas of Living Australia Data February 2016).

Probably *Vespadelus pumulis*/ *Miniopterus australis*. The species calls overlap between 54.5 – 58 kHz. With sufficient call structure the species can be separated by pulse shape and duration.

References

Churchill, S. 2008, Australian Bats, Allen and Unwin, Sydney.

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

Reardon T. B., McKenzie N. L., Cooper S. J. B., Appleton B., Carthew S. & Adams M. (2014) A molecular and morphological investigation of species boundaries and phylogenetic relationships in Australian free-tailed bats Mormopterus (Chiroptera : Molossidae). Australian Journal of Zoology 62, 109-36.

Reinhold, L., Law, B., Ford, G. and Pennay, M. 2001, Key to the bat calls of southeast Queensland and north-east New South Wales. Forest Ecosystem Research and Assessment Technical paper 2001-07, Department of Natural Resources and Mines, Queensland.

Disclaimer

Appendix 9

Credit Report

Biodiversity credit report

This report identifies the number and type of biodiversity credits required for a major project.

Date of report: 20/09/2016 Time: 11:02:16AM Calculator version: v4.0

Major Project details

Proposal ID:	0158/2016/3898MP
Proposal name:	Belford to Golden Highway
Proposal address:	New England Highway Belford NSW 2335
Proponent name:	Roads and Maritime Services
Proponent address:	Level 1 59 Darby Street Newcastle NSW 2300
Proponent phone:	02 4924 0630
Assessor name:	Deborah Landenberger
Assessor address:	9 Yacaaba Street Nelson Bay NSW 2315
Assessor phone:	02 4981 1600
Assessor accreditation:	0158

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter	10.40	519.95
Total	10.40	520

Credit profiles

1. Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter, (HU815)

Number of ecosystem credits created	185
IBRA sub-region	Hunter

Offset options - Plant Community types	Offset options - IBRA sub-regions
Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter, (HU815)	Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter, (HU815)

Number of ecosystem credits created	335
IBRA sub-region	Hunter

Offset options - Plant Community types	Offset options - IBRA sub-regions
Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter, (HU815)	Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Summary of species credits required