Travers

bushfire & ecology

Biodiversity Development Assessment Report

Part Lot 1 DP1220196
100 South Creek Road
Cromer
(western portion)

November 2019
(REF: 18EG03BAR)

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The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features are to be confirmed by a registered surveyor.

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Executive Summary

Travers bushfire & ecology has been engaged to undertake a biodiversity assessment for a proposal industrial development within the western portion of Lot 1 DP1220196 at 100 South Creek Road, Cromer. Survey was undertaken in this entire lot which will hereafter be referred to as the 'study area' (refer to Figure 3).

The proposed works for assessment of ecological impacts are within the western side of the study area where existing large industrial buildings already exist. This area subject to the proposed development footprint will hereafter be referred to as the 'subject site' (refer to Figure 1).

Development proposal

The proposal is for a warehouse / industrial complex to include eleven (11) warehouse units with mezzanine offices, a further five (5) office tenancies, a self-storage facility and a café. These will be built in the western portion of Lot 1 DP1220196. The small northern area and the eastern portion of the site are subject to future development applications, therefore any vegetation and habitat features in this area are not assessed as it is anticipated that there will be no impact.

The study area is not situated on bushfire prone land so a Bushfire Assessment Report is not required.

Recorded threatened species & TECs

Ecological survey and assessment has been undertaken in accordance with relevant legislation including the *Environmental Planning and Assessment Act 1979*, the *Biodiversity Conservation Act 2016*, the *Environment Protection and Biodiversity Conservation Act 1999* and the *Fisheries Management Act 1994*.

In respect of matters required to be considered under the *Environmental Planning and Assessment Act 1979* and relating to the species / provisions of the *Biodiversity Conservation Act 2016*, three (3) threatened fauna species including the Powerful Owl (*Ninox strenua*), Grey-headed Flying-fox (*Pteropus poliocephalus*) and Little Bentwing-bat (*Miniopterus australis*), two (2) threatened flora species *Eucalyptus scoparia* and *Syzygium paniculatum* (all planted), and no threatened ecological communities (TECs) were recorded within the study area.

The assessment of significance test in accordance with Section 7.3 of the *BC Act* concluded that the proposed development is not likely to have a significant effect on any threatened species, endangered communities, or their habitat. Therefore a species impact statement is not required for the proposed activity.

In respect of matters required to be considered under the *Environment Protection and Biodiversity Conservation Act 1999*, one (1) threatened fauna species Grey-headed Flying-fox (*Pteropus poliocephalus*), no protected migratory bird species, three (3) threatened flora species *Eucalyptus scoparia, Macadamia integrifolia* and *Syzygium paniculatum* (all planted), and no threatened ecological communities listed under this Act were recorded within the study area.

The proposed development was not considered to have a significant impact on matters of national environmental significance. As such a referral to Department of Environment and Energy is not required.

In respect of matters relative to the *Fisheries Management Act 1994*, no suitable habitat for threatened marine or aquatic species was observed within the study area and there are no matters requiring further consideration under this Act.

Serious and irreversible impacts (SAII)

An impact is to be regarded as serious and irreversible if it is likely to contribute significantly to the risk of a threatened species or ecological community most at risk of extinction. The principles for determining serious and irreversible impacts are set out under Section 6.7.2 of the Biodiversity Conservation Regulation 2017.

The principles prescribed in Section 6.7 of the *BC Regulation (2017)* have been reviewed and it is considered that the above impacts are not serious and irreversible impacts.

Biodiversity Offsets Scheme (BOS) – Threshold Assessment

The proposed development does not exceed the nominated threshold triggers as outlined in Section 2 nor does the site occur within an area mapped as containing biodiversity values by DPIE.

Therefore biodiversity offsets are not required under the Biodiversity Offsets Scheme (BOS).

Conclusion

The direct, indirect and cumulative impacts of the proposal have been carefully considered in Section 6.2 of this report.

Recommendations have been outlined within Section 6.3 to minimise the identified potential ecological impacts, address threatening processes and to create a more positive ecological outcome for threatened species and their associated habitats.

It is concluded that the proposal industrial development within the western portion of Lot 1 DP1220196 at 100 South Creek Road, Cromer, is not likely to cause serious or irreversible impact (state) or significant impact (national) on any threatened species, populations or TECs or their habitats.

No further assessments are considered to be required under the *Environmental Planning and Assessment Act 1979*, the *Environment Protection and Biodiversity Conservation Act 1999* or the *Fisheries Management Act 1994*.

List of abbreviations

APZ	asset protection zone
BAM	Biodiversity Assessment Method
BAR	Biodiversity Assessment Report
BC Act	*Biodiversity Conservation Act (2016)*
BCAR	Biodiversity Certification Assessment Report
BCR	*Biodiversity Conservation Regulation (2017)*
BDAR	Biodiversity Development Assessment Report
BOS	Biodiversity Offset Scheme
BPA	bushfire protection assessment
BSSAR	Biodiversity Stewardship Site Assessment Report
DCP	development control plan
DEC	NSW Department of Environment and Conservation (superseded by DECC from April 2007)
DECC	NSW Department of Environment and Climate Change (superseded by DECCW from October 2009)
DECCW	NSW Department of Environment, Climate Change and Water (superseded by OEH from April 2011)
DEWHA	Commonwealth Department of Environment, Water, Heritage & the Arts (superseded by SEWPAC)
DOEE	Commonwealth Department of Environment & Energy
DPIE	Department of Planning Industry & Environment
EEC	endangered ecological community
EPA	Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act (1979)*
EPBC Act	*Environment Protection and Biodiversity Conservation Act (1999)*
FM Act	*Fisheries Management Act*
LEP	local environmental plan
LGA	local government area
LLS Act	*Local Land Services Act (2013*)
NES	national environmental significance
NPW Act	*National Parks and Wildlife Act (1974)*
NSW DPI	NSW Department of Industry and Investment
OEH	Office of Environment and Heritage
PCT	plant community type
RFS	NSW Rural Fire Service
SAII	Serious And Irreversible Impacts
SEPP	State Environmental Planning Policy
SEWPAC	Commonwealth Dept. of Sustainability, Environment, Water, Population & Communities (superseded by DOEE)
SIS	species impact statement
SULE	safe useful life expectancy
TEC	threatened ecological community
TPZ	tree preservation zone
TSC Act	*Threatened Species Conservation Act (1995) – Superseded by the Biodiversity Conservation Act (2016)*
VMP	vegetation management plan

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Introduction 1

Travers bushfire & ecology has been engaged to undertake a biodiversity development assessment report for a proposal industrial development within the western portion of Lot 1 DP1220196 at 100 South Creek Road, Cromer. Survey was undertaken in this entire lot which will hereafter be referred to as the 'study area' (refer to Figure 3).

The proposed works for assessment of ecological impacts are within the western side of the study area where existing large industrial buildings already exist. This area subject to the proposed development footprint will hereafter be referred to as the 'subject site' (refer to Figure 1).

1.1 Aims of the assessment

The aims of this Biodiversity Development Assessment Report (BDAR) are to:

- Carry out a botanical survey to describe the vegetation communities and their conditions
- Carry out a fauna habitat survey for the detection and assessment of fauna and their potential habitats
- Complete targeted surveys for threatened species, populations and ecological communities
- Prepare a biodiversity impact assessment in accordance with the requirements of the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*), the *Biodiversity Conservation Act 2016* (*BC Act*), the *Biodiversity Conservation Regulation 2017* (*BCR*), the *Fisheries Management Act 1994* (*FM Act*) and Threatened species assessment guidelines, the assessment of significance (DECC 2007)

1.1.1 Terminology

Throughout this report the terms subject site and study area are used. It is important to have a thorough understanding of these terms as they apply to the assessment.

Subject site - the area directly affected by the proposal.

Study area - the subject site and any additional areas which are likely to be affected by the proposal, either directly or indirectly. The study area should extend as far as is necessary to take all potential impacts into account.

Direct impacts - impacts that directly affect the habitat and individuals. They include, but are not limited to, death through predation, trampling, poisoning of the animal/plant itself and the removal of suitable habitat. When applying each factor, consideration must be given to all of the likely direct impacts of the proposed activity or development.

Indirect impacts - when project-related activities affect species, populations or ecological communities in a manner other than direct loss. Indirect impacts can include loss of individuals through starvation, exposure, predation by domestic and/or feral animals, loss of breeding opportunities, loss of shade/shelter, deleterious hydrological changes, increased soil salinity, erosion, inhibition of nitrogen fixation, weed invasion, fertiliser drift, or increased human activity within or directly adjacent to sensitive habitat areas. As with direct impacts, consideration must be given, when applying each factor, to all of the likely indirect impacts of the proposed activity or development.

1.2 Statutory requirements

1.2.1 Biodiversity Conservation Act 2016 (BC Act)

The *BC Act* repeals the *Threatened Species Conservation Act 1995*, the *Nature Conservation Trust Act 2001* and the animal and plant provisions of the *National Parks and Wildlife Act 1974*.

Together with the *Biodiversity Conservation Regulation* (BCR) *2017*, the *BC Act* establishes a new regulatory framework for assessing and offsetting biodiversity impacts on proposed developments and clearing. It establishes a framework to avoid, minimise and offset impacts on biodiversity from development through the Biodiversity Offsets Scheme (BOS). Where development consent is granted, the authority may impose as a condition of consent an obligation to retire a number and type of biodiversity credits determined under the new Biodiversity Assessment Method (BAM).

The BOS includes two (2) elements to the threshold test – an area trigger and a sensitive biodiversity values land map trigger. If clearing exceeds either trigger, the Biodiversity Offset Scheme applies to the proposed clearing.

Development consent cannot be granted for non-State significant development under Part 4 of the *Environmental Planning and Assessment Act 1979* (NSW) if the consent authority is of the opinion it is likely to have serious and irreversible impacts (SAII) on biodiversity values. The determination of SAII is to be made in accordance with principles prescribed section 6.7 of the BCR. The principles have been designed to capture those impacts which are likely to contribute significantly to the risk of extinction of a threatened species or ecological community in New South Wales.

1.2.2 Fisheries Management Act 1994 (FM Act)

The *FM Act* provides a list of threatened aquatic species that require consideration when addressing the potential impacts of a proposed development. Where a proposed activity is located in an area identified as critical habitat, or such that it is likely to significantly affect threatened species, populations, ecological communities, or their habitats, an SIS is required to be prepared.

1.2.3 Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The *EPBC Act* requires that Commonwealth approval be obtained for certain actions. It provides an assessment and approvals system for actions that have a significant impact on matters of *national environmental significance* (NES). These may include:

- World Heritage Properties and National Heritage Places
- Wetlands of International Importance protected by international treaty

- Nationally listed threatened species and ecological communities
- Nationally listed migratory species
- Commonwealth marine environment

Actions are projects, developments, undertakings, activities, and series of activities or alteration of any of these. An action that needs Commonwealth approval is known as a controlled action. A controlled action needs approval where the Commonwealth decides the action would have a significant effect on an NES matter.

Where a proposed activity is located in an area identified to be of NES, or such that it is likely to significantly affect threatened species, ecological communities, migratory species or their habitats, then the matter needs to be referred to the Commonwealth Department of Environment and Energy (DOEE) for assessment. In the case where no listed federal species are located on site then no referral is required. The onus is on the proponent to make the application and not the Council to make any referral.

A threshold criterion apply to specific NES matters which may determine whether a referral is or is not required, such as for the *EPBC Act* listed ecological communities Cumberland Plain Woodland and Shale-Gravel transition Forest. Consultation with DOEE may be required to determine whether a referral is or is not required. If there is any doubt as to the significance of impact or whether a referral is required, a referral is generally recommended to provide a definite decision under the *EPBC Act* thereby removing any further obligations in the case of 'not controlled' actions.

A significant impact is regarded as being:

> *important, notable, or of consequence, having regard to its context or intensity and depends upon the sensitivity, value, and quality of the environment which is impacted and upon the duration, magnitude, and geographical extent of the impacts. A significant impact is likely when it is a real or not a remote chance or possibility.*
>
> *Source: EPBC Policy Statement*

Guidelines on the correct interpretation of the actions and assessment of significance are located on the department's web site http://www.environment.gov.au/epbc/publications.

1.3 Site description

Table 1.1 provides a summary of the planning, cadastral, topographical, and disturbance details of the study area.

Table 1.1 – Site features

Location	100 South Creek Road, Cromer
Area	Approx. 7.47ha study area. Approx. 4.1ha subject site.
Local government area	Northern Beaches
Grid reference MGA-56	341628E 6265476N
Elevation	Approx. 16 - 36m AHD
Topography	Situated on a gentle slope of 3% to the south.
Geology and soils	Geology; - Northern half: Triassic, Narrabeen group sedimentary; Interbedded laminate, shale and quartz, to lithic quartz sandstone, clay pellet sandstone. Southern half: Quaternary alluvium; Silty to peaty quartz sand, silt, and clay; ferruginous and humic cementation in places;

	common shell layers. Soils; - Newport, Warriewood and Ettalong soil landscapes
Catchment and drainage	Catchment – Sydney Metro Overland flow into a drainage line flowing north to south then under South Creek Road. This then flows into an unnamed stream and into Dee Why Lagoon and the Pacific Ocean.
Vegetation	The majority of the building surrounds within the study area contains managed land with lawns, scattered trees, and garden beds planted with mixed native and exotic species. A small area of disturbed remnant forest occurs in the far north east of the study area.
Existing land use	Industrial buildings and offices surrounded by maintained lawns and gardens.
Clearing	The majority of the study area has been previously cleared for indicated land uses.

1.4 Proposed works

The proposal is for a warehouse / industrial complex to include eleven (11) warehouse units with mezzanine offices, a further five (5) office tenancies, a self-storage facility and a café. The ground floor plan is shown on Figure 1.

The study area is not situated on bushfire prone land so a Bushfire Assessment Report is not required.

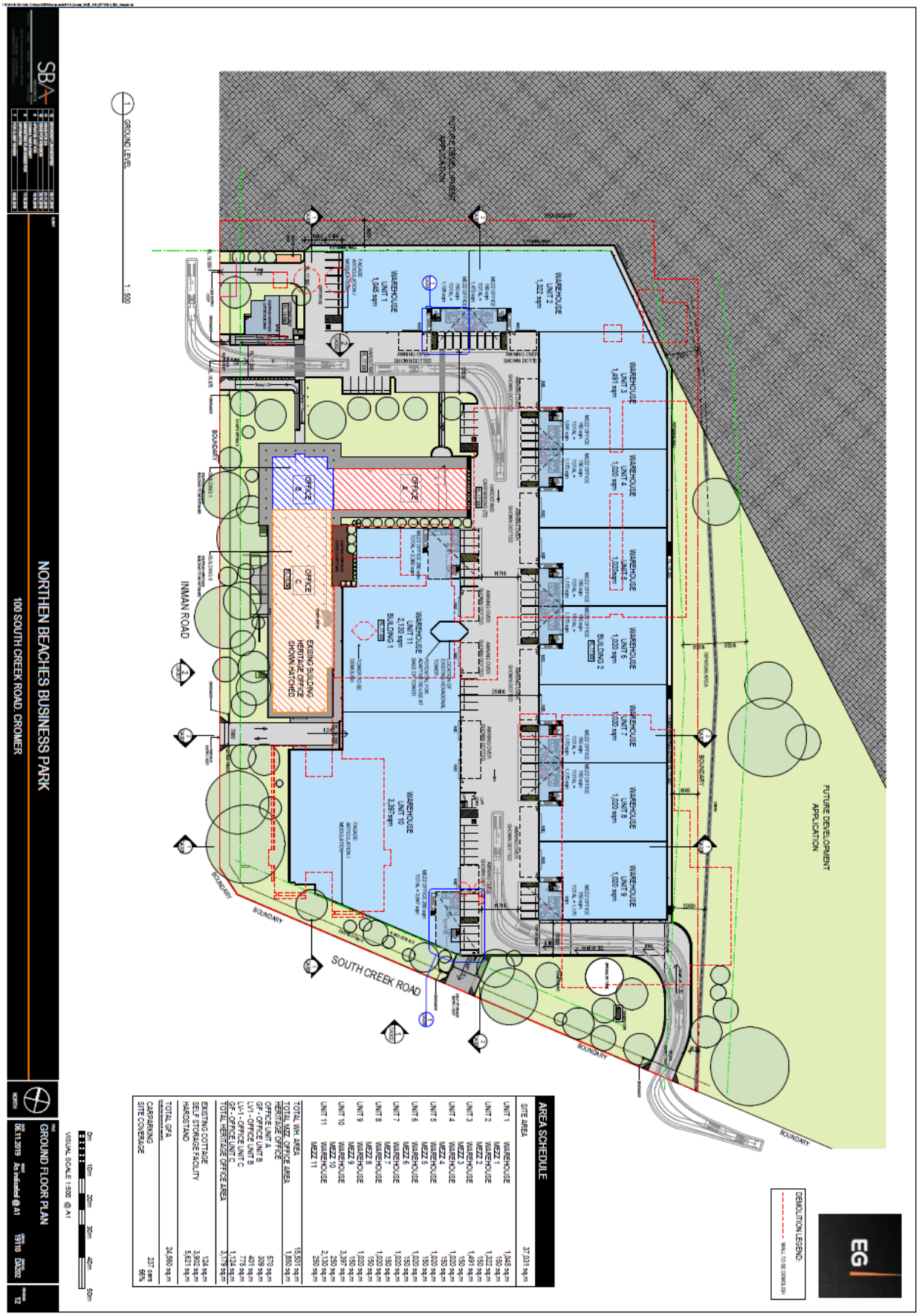


Figure 1 – Proposed development
(Source: SBA Architects, 2019)

Biodiversity Offsets Scheme Thresholds 2

The BOS includes two (2) elements to the threshold test – an area trigger and a sensitive biodiversity values land map trigger. If clearing exceeds either trigger, the BOS applies to the proposed clearing.

2.1 Sensitive Biodiversity Values Land

The study area is not located on lands mapped as sensitive biodiversity values land (refer to Figure 2) – therefore an offset is not required as an outcome of this threshold test. These are typically mapped as orange polygons. The study area is shown in red.

Figure 2 – Sensitive biodiversity values land map
(source: https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BVMap)

2.2 Area clearing threshold

The area threshold varies depending on the minimum lot size (shown in the lot size maps made under the relevant Local Environmental Plan (LEP)), or actual lot size (where there is no minimum lot size provided for the relevant land under the LEP).

The area threshold applies to all proposed native vegetation clearing associated with a development proposal – for example in the case of a subdivision; all future clearing across the lots subject to the subdivision, must be considered. Thresholds outlined under the BOS are outlined in the table below.

Table 2.1 – BOS entry threshold report

NSW GOVERNMENT

Biodiversity Offset Scheme (BOS) Entry Threshold Report

Results Summary

Date of Calculation	10/07/2018 11:40 AM	**BAM Required***
Total Digitised Area	7.54 ha	
Minimum Lot Size Method	LEP	
Minimum Lot Size	0.06 ha	
Area Threshold	0.25 ha	
Area of native vegetation cleared	Unknown #	Unknown #
Impact on biodiversity values land map	no	no

The area threshold varies depending on the minimum lot size (shown in the lot size maps made under the relevant Local Environmental Plan (LEP)), or actual lot size (where there is no minimum lot size provided for the relevant land under the LEP).

Table 2.1 identifies that the site has a minimum lot size of 0.06ha, and the clearing area threshold for which the BOS applies is 0.25ha. Based on the development plans provided (Figure 1), *TBE* concludes that the proposed development will remove less than 0.25ha of native vegetation therefore offsetting under the BOS does not apply.

2.3 Serious and Irreversible Impacts

An impact is to be regarded as serious and irreversible if it is likely to contribute significantly to the risk of a threatened species or ecological community most at risk of extinction. Threatened species and communities that are potential for serious and irreversible impacts are outlined in Appendix 2 of *Guidance to assist a decision-maker to determine a serious and irreversible impact* (OEH 2017). The principles for determining serious and irreversible impacts are set out under Section 6.7.2 of the *Biodiversity Conservation Regulation 2017*.

Candidate species recorded or with potential to occur within the study area include:

Table 2.2 – Candidate SAII species

Scientific Name	*BC Act*	Potential to occur
Eucalyptus scoparia	E1	recorded on site
Eastern Bentwing-bat	V	✓
Little Bentwing-bat	V	✓
Swift Parrot	E	unlikely
Bush Stone-curlew	E	unlikely
Large-eared Pied Bat	V	unlikely

The individuals of *E. scoparia* recorded are considered to be planted as these species have restricted distribution and habitat requirements and would not naturally occur within the site.

The site does not likely support any breeding habitat or likely important roosting/foraging for Eastern Bentwing-bat, Little Bentwing-bat, Swift Parrot or Large-eared Pied Bat. Little Bentwing-bat was recorded from a single pass during the overnight recording. The buildings/structures present may support artificial roosting habitat but this is not expected based on survey results so the species likely uses the study area for foraging only.

The Bush Stone-curlew has been recorded across the road to the south from three records in 2008. The study area does provide suitable foraging and nesting habitat for this species however it was not observed or heard following the single night's target call-playback survey. It is recommended that a second survey session is undertaken to ensure the site has no notable habitat use by this species. Such use is not expected.

Based on the principles for determining SAII these species are unlikely to offer a constraint to development. The proposal is therefore not likely to be constrained by any serious and irreversible impacts.

Survey Methodology 3

3.1 Information collation, technical resources, desktop assessments, specialist identification and licences

A review of the relevant information pertinent to the study area was undertaken.

Client documents reviewed include:

- Development plans prepared by *SBA Architects* (issue 12, 6/11/19)

Standard technical resources utilised:

- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities 2004* (working draft), Department of Environment and Conservation (DEC)
- *Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna – Amphibians* (DECC – April 2009a)
- http://www.environment.nsw.gov.au/threatenedspecies/surveymethodsfauna.htm
- Aerial photographs (Google Earth Pro / Spatial Information Exchange / NearMap)
- Topographical maps (scale 1:25,000)
- LiDAR data for contours (Land and Property Information, est. 2015 estimated)
- *Biodiversity Conservation Act 2016* (*BC Act*)
- *Biodiversity Conservation Regulation 2017* (*BC Regulation*)
- *Fisheries Management Act 1994* (FM Act)
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- NSW Office of Environment and Heritage's BioNet - Atlas of NSW Wildlife, which holds data from a number of custodians. Data obtained July 2018
- EPBC Protected Matters Search Tool - *DOEE* (2018)
- Royal Botanic Gardens flora database (2018)
- BioNet Vegetation Map Collection (previously VIS Catalogue V. 2.1)
- Previous reports and surveys within the site (refer to Section 5.1)
- Australian Virtual Herbarium (accessed July 2018).

Desktop assessment:

To determine the likely and actual occurrence of flora species, fauna species and plant communities on the study area, desktop assessments were undertaken including:

- ***A literature review*** – A review of readily available literature for the area was undertaken to obtain reference material and background information for this survey.

- ***A data search*** – A search of the *Atlas of NSW Wildlife* (OEH 2018) was undertaken to identify records of threatened flora and fauna species located within a 10km radius of the site. Searches were also undertaken on the DOEE – 'protected matters search tool' website to generate a report that will help determine whether matters of national environmental significance or other matters protected by the *EPBC Act* are likely to occur in the area of interest. The search was broadened to a 10km radius like the Atlas search. These two searches combined, enabled the preparation of a list of

threatened flora and fauna species that could potentially occur within the habitats found on the site (Tables A2.1, A2.2 and A2.3).

Accuracy of identification:

Plant Community Types (PCTs) were identified using the OEH online BioNet Vegetation Classification System.

***Licences*:**

Individual staff members of *Travers bushfire & ecology* are licensed under Clause 20 of the *National Parks and Wildlife (Land Management) Regulation 1995* and Sections 120 & 131 of the *National Parks and Wildlife Act 1974* to conduct flora and fauna surveys within service and non-service areas. NPWS Scientific Licence Numbers: SL100848.

Travers bushfire & ecology staff are licensed under an Animal Research Authority issued by the Department of Agriculture. This authority allows *Travers bushfire & ecology* staff to conduct various fauna surveys of native and introduced fauna for the purposes of environmental consulting throughout New South Wales.

3.2 Flora survey methodology

A review of the Atlas of NSW Wildlife (OEH 2018) was undertaken prior to the site inspection to determine threatened species previously recorded within 10km of the study area.

Botanical survey was undertaken on 20 July 2018. This included a random meander in accordance with *Cropper* (1993) to gain a full species list of the plants within the site and to identify vegetation communities. Given the highly managed nature of the site and the small area of disturbed remnant vegetation it was deemed unnecessary to conduct more detailed survey.

Threatened species searches were conducted during the random meander and during stratified surveys. Flora species recorded during the survey are listed in Table 4.1. Figure 3 shows the mapped vegetation communities.

It should also be noted that observed specimens are added to an overall species list (Appendix 2) and do not necessarily occur within all vegetation communities on site, nor have been specified to a particular vegetation community. A number of landscaping species were observed within the study area. These were generally not taken into consideration in preparing the species list, or they are not relevant to the ecological assessment.

Three (3) threatened flora species, *Eucalyptus scoparia, Macadamia integrifolia* and *Syzygium paniculatum,* were observed during surveys. The individuals of these species within the study area are growing outside of their known distributions or habitats and are considered to be planted specimens. No naturally-occurring species of threatened flora were observed.

All observed species are listed in Table 4.1.

3.3 Fauna survey methodology

Site survey effort accounting for techniques deployed, duration, and weather conditions are outlined in Table 3.1 and are depicted on Figure 3.

Current standard fauna survey techniques employed by *Travers bushfire & ecology* in line with relevant survey guidelines as well as current survey knowledge are provided in Appendix 1. Fauna survey techniques that have been tailored to the site are provided in Section 2.6.

3.4 Field survey effort

Tables 3.1 and 3.2 below detail the flora and fauna survey effort undertaken for the study area.

Table 3.1 – Fauna survey effort

Fauna group	Date	Weather conditions	Survey technique(s)	Time effort (24hr)
Diurnal birds	25/07/18	1/8 cloud, no wind, no rain, temp 22°C	Diurnal census x4 & opportunistic	2hrs 10min 1450 - 1700
Nocturnal birds	25/07/18	2/8 cloud, no wind, no rain, 4/4 moon, temp 16-14°C	Spotlighting	2hrs 1700 - 1900
			Call playback (Section 2.5 species)	Commenced @ 1740
Arboreal mammals	25/07/18	2/8 cloud, no wind, no rain, 4/4 moon, temp 16-14°C	Spotlighting	2hrs 1700 - 1900
Terrestrial mammals	25/07/18	2/8 cloud, no wind, no rain, 4/4 moon, temp 16-14°C	Spotlighting	2hrs 1700 - 1900
Bats	25/07/18	2/8 cloud, no wind, no rain, 4/4 moon, temp 16-14°C	Spotlighting	2hrs 1700 - 1900
			Ultrasonic microbat recording (Passive monitoring) x1	2hrs 1700 - 1900
	01/08/18	Mostly fine	Ultrasonic microbat recording (Passive monitoring) x2	O'night from 1700
Reptiles	25/07/18	1/8 cloud, no wind, no rain, temp 22°C	Habitat search, opportunistic	2hrs 10min 1450 - 1700
Amphibians	25/07/18	2/8 cloud, no wind, no rain, 4/4 moon, temp 16-14°C	Spotlighting & call identification	2hrs 1700 - 1900

Table 3.2 – Flora survey effort

Flora survey	Survey technique(s)	Dates
Vegetation communities	Verification and survey of the boundaries of plant communities – field verification and aerial photographic interpretation (2 hours)	20/07/2018
Target searches	Target searches in potential habitats	20/07/2018

3.5 Site specific survey techniques

Diurnal birds

Five (5) diurnal bird census points were undertaken within the study area. A minimum of 15 minutes of survey was undertaken at each census point in an area radiating out to between 30-50m. Bird census points were selected to give an even spread and representation across the site and its communities (see Figure 3). Census points were also commenced in locations where bird activity was apparent, as often different small bird species are found foraging together. Opportunistic diurnal bird survey was conducted between census points and whilst undertaking other diurnal surveys.

Nocturnal birds

Given the suitability of habitat present Powerful Owl (*Ninox strenua*), Barking Owl (*Ninox connivens*), and Bush Stone-curlew (*Burhinus grallarius*) were targeted by call-playback techniques.

Bats

Active recording was undertaken during stag-watching of SHT1 on the adjacent eastern portion of the study area and then throughout the remaining nocturnal survey time on the 25/7/18. Then overnight recording was undertaken at two (2) locations on the 01/08/18.

Habitat trees

Hollow-bearing trees were identified and recorded within the subject site on a *Trimble* handheld GPS unit during tree health surveys by *TBE*. All trees with a DHH>10cm received a tree number and a metal tag was placed on the trunk for field relocation purposes. A summary of only the hollow-bearing tree results is provided in Table 5.3 which summarises the collected data on hollow types, hollow size, tree species, diameter at breast height, canopy spread and overall height.

3.6 Survey limitations

It is important to note that field survey data collected during the survey period is representative of species occurring within the study area for that occasion. Due to effects of fire, breeding cycles, migratory patterns, camouflage, weather conditions, time of day, visibility, predatory and / or feeding patterns, increased species frequency or richness may be observed within the study area outside the nominated survey period. Habitat assessments based on the identification of micro-habitat features for various species of interest, including regionally significant and threatened species, have been used to minimise the implications of this survey limitation.

Flora survey limitations

The species list does not include all household or exotic garden / landscaping species and those species which could not be identified at the time of the survey past genus level. Cryptic species not flowering at the time of the survey may not be observed during survey outside of peak flowering periods. Likewise cryptic orchid species are generally only recognisable when flowering.

It is not expected that there are any limitations to threatened flora species survey which could change the outcomes of significance assessment as survey has been undertaken at a time when most are readily flowering or can be observed.

Fauna survey limitations

Nocturnal survey was undertaken during winter when microbat activity is typically low and outside of the warmer months of October-March suggested in relevant survey guidelines. The ultrasonic recording period was also initially limited only to the first two hours after dark. This was overcome by later placing two (2) detectors overnight on the 1/8/18. Whilst microbat activity is lesser during this winter period, activity still occurs particularly closer to roosting sites. Given the very low activity of microbats during both of the recording periods it is expected that the study area does not likely support microbat roosting habitat.

The single night of survey included diurnal searches, nocturnal call-playback and spotlighting for Bush Stone-curlew. Whilst not expected to occur a second survey night for Bush Stone-curlew is recommended to satisfy the requirements for this species given that close records exist within the adjacent lands to the south in 2008.

Survey Results 4

4.1 Flora results

4.1.1 Flora species

The plants observed within the vegetation communities of the study area are listed in the Table 4.1 below.

Table 4.1 – Flora observations for the study area

Family	Scientific name	Common name
Trees		
Fabaceae	*Acacia leiocalyx*	Curracabah
Myrtaceae	*Agonis flexuosa**	-
Casuarinaceae	*Allocasuarina littoralis*	Black She-oak
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak
Myrtaceae	*Angophora costata*	Smooth-barked Apple
Araucariaceae	*Araucaria bidwillii*	Bunya Pine
Araucariaceae	*Araucaria cunninghamii*	Hoop Pine
Arecaceae	*Archontophoenix cunninghamiana*	Bangalow Palm
Pittosporaceae	*Auranticarpa rhombifolia*	Diamond-leaf Pittosporum
Proteaceae	*Banksia serrata*	Old Man Banksia
Sterculiaceae	*Brachychiton acerifolius*	Illawarra Flame Tree
Casuarinaceae	*Casuarina glauca*	Swamp Oak
Lauraceae	*Cinnamomum camphora**	Camphor Laurel
Verbenaceae	*Citharexylum spinosum**	Fiddlewood
Rutaceae	*Citrus limon** (naturalised)	Lemon Tree
Myrtaceae	*Corymbia citriodora*	Lemon-scented Gum
Myrtaceae	*Corymbia gummifera*	Red Bloodwood
Myrtaceae	*Corymbia maculata*	Spotted Gum
Sapindaceae	*Cupaniopsis anacardioides*	Tuckeroo
Cyatheaceae	*Cyathea cooperi*	Straw Treefern
Eleocarpaceae	*Elaeocarpus reticulatus*	Blueberry Ash
Fabaceae	*Erythrina crista-galli**	Cockspur Coral Tree
Fabaceae	*Erythrina x sykesii**	Coral tree
Myrtaceae	*Eucalyptus botryoides*	Bangalay
Myrtaceae	*Eucalyptus microcorys*	Tallowwood
Myrtaceae	*Eucalyptus piperita*	Sydney Peppermint
Myrtaceae	*Eucalyptus punctata*	Grey Gum
Myrtaceae	*Eucalyptus robusta*	Swamp Mahogany
Myrtaceae	*Eucalyptus saligna*	Sydney Blue Gum
Myrtaceae	*Eucalyptus sclerophylla*	Scribbly Gum

Family	Scientific name	Common name
Myrtaceae	*Eucalyptus scoparia*[TS]	Wallangarra White Gum
Myrtaceae	*Eucalyptus sideroxylon*	Red Ironbark
Moraceae	*Ficus macrophylla*	Moreton Bay Fig
Euphorbiaceae	*Glochidion ferdinandi*	Cheese Tree
Proteaceae	*Grevillea robusta*	Silky Oak
Anacardiaceae	*Harpephyllum caffrum**	-
Malvaceae	*Hibiscus tiliaceus**	Cottonwood Hibiscus
Bignoniaceae	*Jacaranda mimosifolia**	Jacaranda
Malvaceae	*Lagunaria patersonia*	Norfolk Island Hibiscus
Hamamelidaceae	*Liquidambar styraciflua**	Sweetgum
Myrtaceae	*Lophostemon confertus*	Brush Box
Proteaceae	*Macadamia integrifolia*[TS]	Macadamia Nut
Magnoliaceae	*Magnolia grandiflora**	Southern Magnolia
Myrtaceae	*Melaleuca linariifolia*	Snow in Summer
Myrtaceae	*Melaleuca quinquenervia*	Broad-leaved Paperbark
Arecaceae	*Phoenix canariensis**	Canary Island Date Palm
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum
Scitamineae	*Ravenala madagascariensis**	Traveller's Palm
Cunoniaceae	*Schizomeria ovata*	Crab Apple
Proteaceae	*Stenocarpus sinuatus*	Queensland Firewheel Tree
Arecaceae	*Syagrus romanzoffiana**	Cocos Palm
Myrtaceae	*Syncarpia glomulifera*	Turpentine
Myrtaceae	*Syzygium australe*	Brush Cherry
Myrtaceae	*Syzygium paniculatum*[TS]	Magenta Lilly Pilly
Euphorbiaceae	*Triadica sebifera**	Chinese Tallowood
Myrtaceae	*Tristaniopsis laurina*	Water Gum
Proteaceae	*Xylomelum pyriforme*	Woody Pear
Shrubs		
Fabaceae	*Acacia linearifolia*	Narrow-leaved Wattle
Fabaceae	*Acacia longifolia*	
Fabaceae	*Acacia podalyriifolia*	Queensland Silver Wattle
Proteaceae	*Banksia ericifolia*	Heath-leaved Banksia
Proteaceae	*Banksia integrifolia*	Coast Banksia
Proteaceae	*Banksia oblongifolia*	Fern-leaf Banksia
Proteaceae	*Banksia robur*	Swamp Banksia
Proteaceae	*Banksia spinulosa*	Hairpin Banksia
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush
Myrtaceae	*Callistemon viminalis*	Weeping Bottlebrush
Theaceae	*Camellia japonica**	Camellia
Solanaceae	*Cestrum parqui**	Chilean Cestrum
Rutaceae	*Coleonema pulchellum**	Diosma
Fabaceae	*Cytisus scoparius* subsp. *scoparius**	Scotch or English Broom
Verbenaceae	*Duranta repens** (cultivar)	Golden Dewdrop
Proteaceae	*Grevillea* sp. (cultivars)	-
Malvaceae	*Hibiscus* sp. (cultivars)*	Hibiscus
Euphorbiaceae	*Homalanthus populifolius*	Bleeding Heart
Myrtaceae	*Kunzea ambigua*	Tick Bush
Verbenaceae	*Lantana camara**	Lantana

Family	Scientific name	Common name
Myrtaceae	*Leptospermum petersonii**	Lemon Scented Tea-tree
Oleaceae	*Ligustrum sinense**	Small-leaved Privet
Zamiaceae	*Macrozamia communis*	Burrawang
Rutaceae	*Murraya paniculata**	Orange Jessamine
Nandinaceae	*Nandina domestica**	Japanese Sacred Bamboo
Apocynaceae	*Nerium oleander**	Oleander Bush
Ochnaceae	*Ochna serrulata**	Mickey Mouse Plant
Malvaceae	*Pavonia hastata**	Pavonia
Phormiaceae	*Phormium tenax**	New Zealand Flax
Apocynaceae	*Plumeria obtusa** (cultivar)	Frangipani
Podocarpaceae	*Podocarpus macrophyllus**	Yew pine
Euphorbiaceae	*Ricinus communis**	Castor Oil Plant
Rosaceae	*Rosa* sp. (cultivar)*	Rose
Adoxaceae	*Sambuccus racemosa**	Red Elderberry
Fabaceae	*Senna pendula* var. *glabrata**	-
Melastomataceae	*Tibouchina urvilleana**	Purple Glory Bush, Lasiandra
Proteaceae	*Telopea speciosissima*	Waratah
Melastomataceae	*Tibouchina urvilleana**	Purple Glory Bush, Lasiandra
Groundcovers		
Polygonaceae	*Acetosa saggitata**	Turkey Rhubarb
Alliaceae	*Agapanthus* sp.*	Agapanthus
Asteraceae	*Ageratina adenophora**	Crofton Weed
Asparagaceae	*Asparagus aethiopicus**	Asparagus Fern
Asparagaceae	*Asparagus plumosus**	Climbing Asparagus Fern
Asteraceae	*Bidens pilosa**	Cobbler's Pegs
Dicksoniaceae	*Calochlaena dubia*	Rainbow Fern
Brassicaceae	*Cardamine flexuosa**	Wood Bittercress
Apiaceae	*Centella asiatica*	Swamp Pennywort
Carophyllaceae	*Cerastium glomeratum**	Mouse-ear Chickweed
Thelypteridaceae	*Christella dentata*	Binung
Asteraceae	*Conyza bonariensis**	Flax-leaf Fleabane
Asteraceae	*Crassocephalum crepidioides**	Thickheads
Poaceae	*Cynodon dactylon*	Common Couch
Cyperaceae	*Cyperus eragrostis**	Umbrella Sedge
Cyperaceae	*Cyperus involucratus**	-
Phormiaceae	*Dianella caerulea*	Blue Flax-lily
Iridaceae	*Dietes bicolor**	
Asteraceae	*Dimorphotheca pluvialis**	Cape Marigold
Poaceae	*Ehrharta erecta**	Panic Veldtgrass
Poaceae	*Eragrostis curvula**	African Lovegrass
Asteraceae	*Euchiton gymnocephalus*	Cudweed
Euphorbiaceae	*Euphorbia peplus**	Spurge
Fumariaceae	*Fumaria muralis subsp. muralis**	Wall Fumitory
Apiaceae	*Hydrocotyle bonariensis**	Pennywort
Asteraceae	*Hypochaeris radicata**	Flatweed
Poaceae	*Imperata cylindrica*	Blady Grass
Juncaceae	*Juncus usitatus*	Common Rush
Lomandraceae	*Lomandra filiformis*	Wattle Matt-rush

Family	Scientific name	Common name
Lomandraceae	*Lomandra longifolia*	Spiky-headed Mat-rush
Fabaceae (Faboideae)	*Medicago* sp.*	A Medic
Poaceae	*Microlaena stipoides*	Weeping Grass
Malvaceae	*Modiola caroliniana**	Red-flowered Mallow
Davalliaceae	*Nephrolepis cordifolia**	Fish-bone Fern
Alliaceae	*Nothoscordum borbonicum**	Onion Weed
Oxalidaceae	*Oxalis corniculata**	Yellow Wood Sorrel, Creeping Oxalis
Oxalidaceae	*Oxalis debilis**	-
Poaceae	*Paspalum dilatatum**	Paspalum
Poaceae	*Pennisetum (Cenchrus) clandestinum**	Kikuyu, Kikuyu Grass
Euphorbiaceae	*Phyllanthus tenellus**	Hen and Chicken
Plantaginaceae	*Plantago lanceolata**	Ribwort
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower
Asteraceae	*Senecio madagascariensis**	Fireweed
Poaceae	*Setaria palmifolia**	Palm Grass
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne
Solanaceae	*Solanum nigrum**	Black-berry Nightshade
Asteraceae	*Soliva sessilis**	Bindii
Asteraceae	*Sonchus oleraceus**	Common Sow-thistle
Caryophyllaceae	*Stellaria media**	Common Chickweed
Poaceae	*Stenotaphrum secundatum**	Buffalo Grass
Strelitzeaceae	*Strelitzia juncea** (cultivar)	Bird of Paradise
Asteraceae	*Taraxacum officinale**	Dandelion
Commelinaceae	*Tradescantia fluminensis**	Wandering Jew
Fabaceae	*Trifolium* sp.*	Clover
Violaceae	*Viola hederacea*	Ivy-leaved Violet
Agavaceae	*Yucca aloifolia*	Dagger Plant
Vines		
Asclepiadaceae	*Araujia sericifera**	Mothvine
Vitaceae	*Cayratia clematidea*	Native Grape
Fabaceae	*Dipogon lignosus**	Dolichos Pea
Convolvulaceae	*Ipomoea purpurea**	Common Morning Glory
Caprifoliaceae	*Lonicera japonica**	Japanese Honeysuckle
Passifloraceae	*Passiflora caerulea**	Passionfruit
Epiphytes		
Aspleniaceae	*Asplenium australasicum*	Birds Nest Fern
Araceae	*Monstera deliciosa**	Fruit Salad Plant
*** denotes exotic species** **[TS] denotes threatened species**		

4.1.2 Vegetation communities

Two (2) vegetation communities were identified within the study area through ground truthing:

- PCT1250 – Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion
- Planted trees, lawns and garden beds

PCT1250 – Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion

This community occupies a very small area in the far north-east of the study area and represents to only remnant vegetation within the site. It is of poor quality, being disturbed and dominated by exotic *Cinnamomum camphora*, and with low native species diversity.

Canopy – Dominated by exotic *Cinnamomum camphora*. Native overstorey is represented by one *Angophora costata* and one declining *Eucalyptus piperita*. Canopy height ranges from 10m to 17m tall with a projected foliage cover (PFC) of approximately 35%.

Mid-storey – Sparse with occasional *Brachychiton acerifolius, Casuarina glauca* and *Macrozamia communis*. Exotics are present such as *Jacaranda mimosifolia*, *Syagrus romanzoffiana* and young *Cinnamomum camphora*. Most specimens have been planted.

Groundcovers – Common native species include *Lomandra longifolia, Calochlaena dubia* and *Christella dentata* and provide approximately 5% PFC. Exotic species such as *Nephrolepis cordifolia*, *Asparagus aethiopicus, Tradescantia flumensis, Setaria palmifolia* and *Ipomoea indica* are also present.

Photo 1 - Disturbed Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest (PCT1250) in the far north east of the site

Planted trees, lawns and garden beds

This vegetation covers most of the study area and is comprised of mixed native and exotic species. Common tree species include *Corymbia citriodora, Corymbia maculata, Eucalyptus*

robusta, Eucalyptus botryoides, Eucalyptus punctata, Eucalyptus microcorys, Casuarina glauca, Syzygium paniculatum, Grevillea robusta, Melaleuca quinquenervia, Angophora costata, Acacia spp., *Callistemon* spp. and *Cinnamomum camphora.* The understorey is mostly limited to managed lawns and garden beds with planted shrubs. Within the drainage line area more structured plantings using local native species have been used, including *Casuarina glauca, Angophora costata, Banksia integrifolia, Pittosporum undulatum, Gahnia sieberiana, Dianella caerulea, Lomandra longifolia* and *Hypolepis muelleri.*

Photo 2 - Landscaped garden beds of trees and shrubs in the north of the site.

Photo 3 - Planted trees and managed lawn in the south of the site.

Photo 4 - Planted vegetation surrounding the drainage line along the eastern boundary of the site.

4.2 Fauna results

Fauna species observed throughout the duration of fauna surveys are listed in Table 4.2 below.

Table 4.2 – Fauna observations for the study area

Common name	Scientific name	Method observed
Birds		**July 18**
Australian Magpie	*Cracticus tibicen*	O W
Australian Raven	*Corvus coronoides*	O W
Crested Pigeon	*Ocyphaps lophotes*	O W
Eastern Whipbird	*Psophodes olivaceus*	W
Galah	*Eolophus roseicapillus*	O W
Laughing Kookaburra	*Dacelo novaeguineae*	O W
Little Corella	*Cacatua sanguinea*	O W
Masked Lapwing	*Vanellus miles*	O W
Noisy Miner	*Manorina melanocephala*	O W
Pied Currawong	*Strepera graculina*	W
Powerful Owl [TS]	*Ninox strenua*	O
Rainbow Lorikeet	*Trichoglossus haematodus*	O W
Sulphur Crested Cockatoo	*Cacatua galerita*	W
Welcome Swallow	*Hirundo neoxena*	O
Mammals		
Common Brushtail Possum	*Trichosurus vulpecula*	O
Common Ringtail Possum	*Pseudocheirus peregrinus*	O
Grey-headed Flying-fox [TS]	*Pteropus poliocephalus*	W
Little Bentwing-bat	*Miniopterus australis*	U
Little Forest Bat	*Vespadelus vulturnus*	U
Long-nosed Bandicoot	*Perameles nasuta*	F[PR]
Rabbit *	*Oryctolagus cuniculus*	O
Amphibians		
Common Eastern Froglet	*Crinia signifera*	W

Note: * indicates introduced species
[TS] indicates threatened species

All species listed are identified to a high level of certainty unless otherwise noted as:

[PR] indicates species identified to a 'probable' level of certainty – more likely than not
[PO] indicates species identified to a 'possible' level of certainty – low-moderate level of confidence

E - Nest/roost	H - Hair/feathers/skin	P - Scat	W - Heard call
F - Tracks/scratchings	K - Dead	Q - Camera	X - In scat
FB - Burrow	O - Observed	T - Trapped/netted	Y - Bone/teeth/shell
G - Crushed cones	OW - Obs & heard call	U - Anabat/ultrasound	Z - In raptor/owl pellet

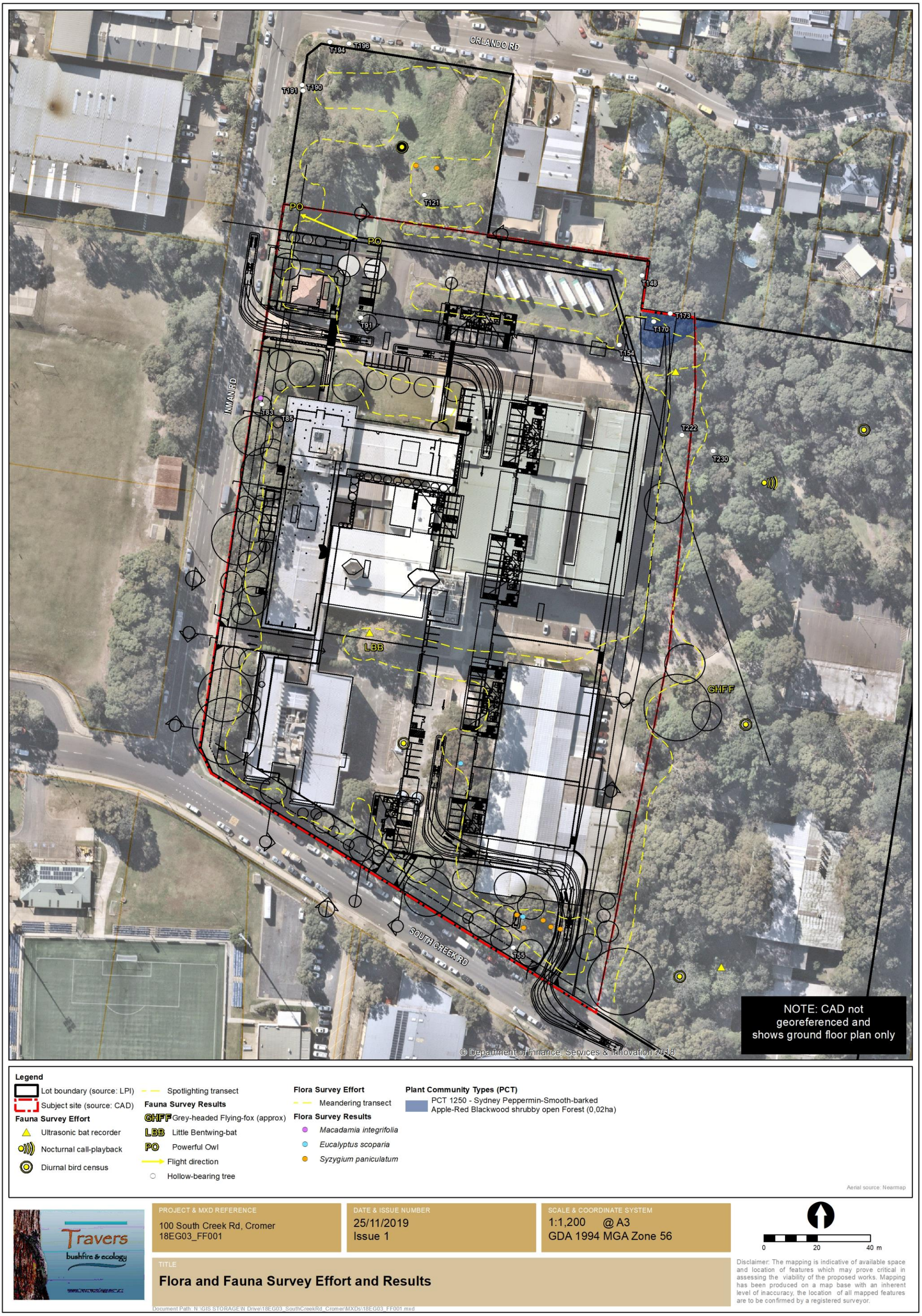


Figure 3 – Flora and fauna survey effort and results

Ecological Assessment 5

5.1 Previous surveys reviewed

The Native Vegetation of the Sydney Metropolitan Area (OEH 2013) identified the vegetation as:

- Coastal Sandstone Gully Forest
- Urban Exotic/ /Native.

A Biodiversity Constraints Assessment by *Eco Logical Australia* (August 2017) identified the following communities on site:

- Peppermint Angophora Forest
- Native Plantings and Weeds
- Mixed Native and Exotic Landscaped Plantings

5.2 Flora

5.2.1 Local / Regional flora matters

The Warringah Local Environment Plant (LEP) 2011 and Development Control Plan (DCP) 2011 do not list any Keystone Species or other important flora species for consideration. The Warringah DCP mapping dos not identify any Native Vegetation, Wildlife Corridor, Threatened or High Conservation Habitat controls for the study area.

5.2.2 State legislative flora matters

(a) Threatened flora species (NSW)

BC Act – A search of the *Atlas of NSW Wildlife* (OEH 2018) indicated a list of species that have been recorded within a 10 km radius of the study area. Those species are considered for suitable habitat and potential to occur in Table A2.1 (Appendix 2).

Based on the habitat assessment within Appendix 2, it is considered that the study area provides no potential habitat for any state listed threatened flora species.

Table 5.1 – State listed threatened flora species with suitable habitat present

Scientific name	*BC Act*	Potential to occur
Eucalyptus scoparia	E1	recorded on site
Syzygium paniculatum	V	recorded on site

Two (2) state listed threatened flora species, *Eucalyptus scoparia* and *Syzygium paniculatum,* were observed during survey(s) undertaken. The individuals of these species are considered to be planted specimens.

Eucalyptus scoparia occurs in Queensland and reaches its southern limit in New South Wales, where it has only recently been discovered. In New South Wales, it is found on well drained granitic hilltops, slopes and outcrops, often as scattered trees in open forest and woodland. There are only three known natural locations within NSW, all near Tenterfield in the far northern New England Tableland Bioregion. The specimen observed within the study area is well outside its natural distribution and was planted on site, as many of this species were as feature or street trees. It is therefore considered that the likelihood of an impacted naturally occurring population of *Eucalyptus scoparia* is unlikely.

Syzygium paniculatum occurs in subtropical and littoral rainforest on sandy soil, from Forster to Jervis Bay. Given that the study area contains no potential habitat for this species, and the highly managed nature of the vegetation within the site, it is considered that the specimens observed within the study area are well outside the natural distribution of the species and was planted on site. It is therefore considered that the likelihood of an impacted naturally occurring population of *Syzygium paniculatum* is unlikely.

A detailed significance of impact assessment has been applied to this/these species within Appendix 3 in accordance with Section 7.3 of the *BC Act*. The significance of impact test for threatened flora species has concluded a not significant impact.

(b) Endangered flora populations (NSW)

No endangered flora populations occur within 10km of the study area.

(c) Threatened ecological communities (NSW)

No threatened ecological communities (TECs) were observed within the study area.

(d) State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017

The *State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017* (Vegetation SEPP) was one of a suite of Land Management and Biodiversity Conservation (LMBC) reforms that commenced in New South Wales on 25 August 2017. The Vegetation SEPP (the SEPP) works together with the *Biodiversity Conservation Act 2016* and the *Local Land Services Amendment Act 2016* to create a framework for the regulation of clearing of native vegetation in NSW.

The SEPP will ensure the biodiversity offset scheme (established under the Land Management and Biodiversity reforms) will apply to all clearing of native vegetation that exceeds the offset thresholds in urban areas and environmental conservation zones that does not require development consent.

Vegetation SEPP applies to the following local government areas:

Bayside, City of Blacktown, Burwood, Camden, City of Campbelltown, Canterbury-Bankstown, Canada Bay, Cumberland, City of Fairfield, Georges River, City of Hawkesbury, Hornsby, Hunter's Hill, Georges River, Inner West, Ku-ring-gai, Lane Cove, City of Liverpool, Mosman, Newcastle, North Sydney, Northern Beaches, City of Parramatta, City of Penrith, City of Randwick, City of Ryde, Strathfield, Sutherland Shire, City of Sydney, The Hills Shire, Waverley, City of Willoughby, Woollahra.

The Vegetation SEPP also applies to land within a variety of zones as set out in the legislation 'Land to which the policy applies'. In the case of a development approval a vegetation clearance authority is not required if consent is given to the proposed works.

As 'development consent' is required for the proposed works the Vegetation SEPP does not apply.

5.2.3 Endangered wetland communities

A number of wetland communities have been listed as TECs under the NSW *BC Act*. We note that 'wetlands' are included in the definition of 'waterfront lands' in accordance with the *Water Management Act 2000* due to their inclusion in the definition of a 'lake' under the same Act. TEC's that are considered to be an endangered protected wetland are as follows:

- Artesian springs ecological community
- Castlereagh Swamp Woodland Community
- Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions
- Coastal Upland Swamp in the Sydney Basin bioregion
- Coolibah–Black Box woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain and Mulga Lands bioregions
- Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions
- Kurri sand swamp woodland in the Sydney Basin Bioregion
- Lagunaria swamp forest on Lord Howe Island
- Maroota Sands swamp forest
- Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion
- Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions
- Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions
- The shorebird community occurring on the relict tidal delta sands at Taren Point
- Upland wetlands of the drainage divide of the New England Tableland Bioregion
- Wingecarribee Swamp

No endangered wetland communities are present within the study area.

In accordance with the NSW DPI - Office of Water - Guidelines for Controlled Activities (2012) a buffer may apply to these communities subject to offset provisions. Where they are mostly cleared, highly fragmented or highly disturbed, consolidation and management in accordance with a Vegetation Management Plan is recommended. The buffers provided are to be considered in the landscape context and in consultation with NSW Natural Resources Access Regulator (NRAR) undertaken to confirm the appropriateness of setbacks.

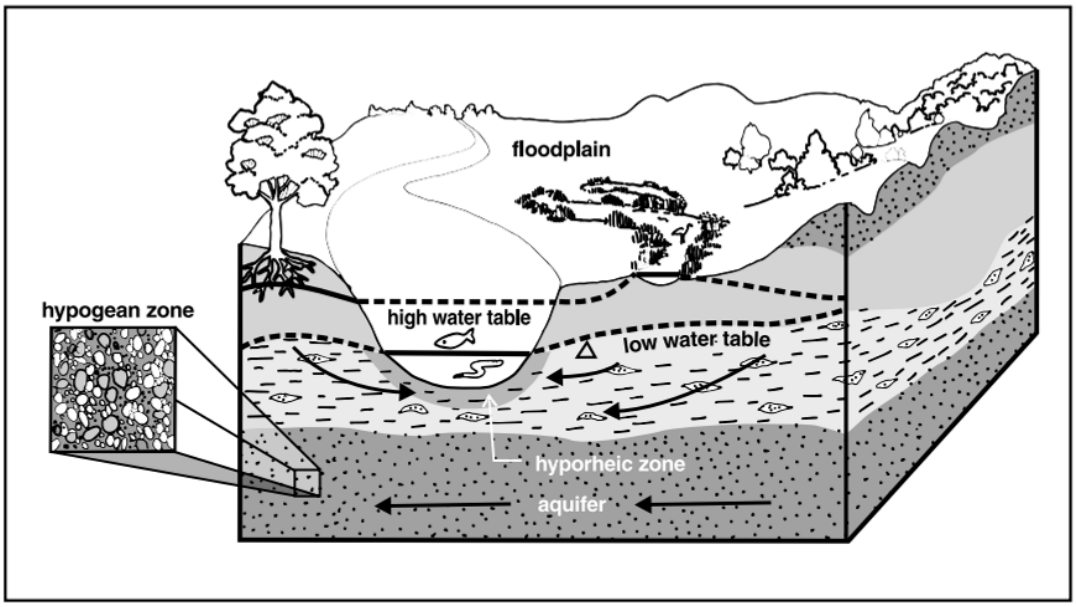
In accordance with the *WM Act*, endangered wetland communities are through the definition of 'lakes' potentially classed as waterfront land. Referral to NSW Natural Resources Access Regulator (NRAR) may be required for determination under the *WM Act* as a controlled activity. As well as protection, a buffer may be applied to these communities as specified by the NRAR.

No endangered wetland communities were present within the subject site and therefore a referral to NRAR is not required.

5.2.4 Groundwater dependent ecosystems

Groundwater dependent ecosystems (GDEs) are communities of plants, animals and other organisms whose extent and life processes are dependent on groundwater. Some examples of ecosystems which depend on groundwater are:

- wetlands;
- red gum forests, vegetation on coastal sand dunes and other terrestrial vegetation;
- ecosystems in streams fed by groundwater;
- limestone cave systems;
- springs; and
- hanging valleys and swamps.



Alluvial groundwater system discharging into a river

Groundwater dependent ecosystems are therefore ecosystems which have their species composition and their natural ecological processes determined by groundwater (NSW State Groundwater Dependent Ecosystems Policy April 2002).

No GDEs are present within the study area.

5.2.5 Matters of national environmental significance - flora

(a) Threatened flora species (national)

A review of the schedules of the *EPBC Act* indicated the potential for a list of threatened flora species to occur within a 10km radius of the site. These species have been considered for habitat presence and potential to occur within Appendix 2.1.

Based on the habitat assessment within Appendix 2, it is considered that the study area provides no potential habitat for any nationally listed species of threatened flora.

Table 5.2 – State listed threatened flora species with suitable habitat present

Common name	*EPBC Act*	Potential to occur
Eucalyptus scoparia	V	recorded on site
Macadamia integrifolia	V	recorded on site
Syzygium paniculatum	V	recorded on site

Three (3) nationally listed threatened flora species, *Eucalyptus scoparia, Macadamia integrifolia* and *Syzygium paniculatum,* were observed during survey(s) undertaken. The individuals of these species are considered to be planted specimens.

Eucalyptus scoparia occurs in Queensland and reaches its southern limit in New South Wales, where it has only recently been discovered. In New South Wales, it is found on well drained granitic hilltops, slopes and outcrops, often as scattered trees in open forest and woodland. There are only three known natural locations within NSW, all near Tenterfield in the far northern New England Tableland Bioregion. The specimen observed within the study area is well outside its natural distribution and was planted on site, as many of this species were as feature or street trees. It is therefore considered that the likelihood of an impacted naturally occurring population of *Eucalyptus scoparia* is unlikely.

Macadamia integrifolia occurs naturally in rainforest in Queensland south to Currumbin Valley in the Gold Coast hinterland. It is not known to occur naturally in NSW, but is cultivated as a nut tree. The specimen observed within the study area is well outside its natural distribution and was planted on site, as many of this species were as feature or street trees. It is therefore considered that the likelihood of an impacted naturally occurring population of *Macadamia integrifolia* is unlikely.

Syzygium paniculatum occurs in subtropical and littoral rainforest on sandy soil, from Forster to Jervis Bay. Given that the study area contains no potential habitat for this species, and the highly managed nature of the vegetation within the site, it is considered that the specimens observed within the study area are well outside the natural distribution of the species and was planted on site. It is therefore considered that the likelihood of an impacted naturally occurring population of *Syzygium paniculatum* is unlikely.

(b) Threatened ecological communities (national)

No threatened ecological communities (TECs) were observed within the study area.

5.3 Fauna

All fauna species recorded during survey are listed in Table 4.2.

5.3.1 Fauna habitat

The fauna habitats present within the site are identified within the following table.

Table 5.3 – Observed fauna habitat

Topography									
Flat	✓	Gentle	✓	Moderate	✓	Steep		Drop-offs	
Vegetation structure									

Closed Forest	Open Forest ✓	Woodland ✓	Heath	Grassland ✓

Disturbance history

Fire	Under-scrubbing ✓	Cut and fill works ✓
Tree clearing ✓	Grazing	

Soil landscape

DEPTH:	Deep ✓	Moderate ✓	Shallow	Skeletal
TYPE:	Clay	Loam ✓	Sand	Organic ✓
VALUE:	Surface foraging ✓	Sub-surface foraging ✓	Denning/burrowing ✓	
WATER RETENTION:	Well Drained ✓	Damp / Moist	Water logged	Swamp / Soak

Rock habitat

CAVES:	Large	Small	Deep	Shallow
CREVICES:	Large	Small	Deep	Shallow
ESCARPMENTS:	Winter / late sunny aspects		Shaded winter / late aspects	
OUTCROPS:	High Surface Area Hides	Med. Surface Area Hides	Low Surface Area Hides	
SCATTERED / ISOLATED:	High Surface Area Hides	Med. Surface Area Hides	Low Surface Area Hides ✓	

Feed resources

FLOWERING TREES:	Eucalypts ✓	Corymbias ✓	Melaleucas ✓	
	Banksias ✓	Acacias ✓		
SEEDING TREES:	Allocasuarinas ✓	Conifers ✓		
WINTER FLOWERING EUCALYPTS:	C. maculata ✓	E. crebra	E. globoidea	E. sideroxylon
	E. squamosa	E. grandis	E. multicaulis	E. scias ✓
	E. robusta	E. tereticornis ✓	E. agglomerata	E. siderophloia
FLOWERING PERIODS:	Autumn	Winter ✓	Spring ✓	Summer ✓
OTHER:	Mistletoe ✓	Figs / Fruit ✓	Sap / Manna	Termites

Foliage protection

UPPER STRATA:	Dense ✓	Moderate ✓	Sparse ✓
MID STRATA:	Dense ✓	Moderate ✓	Sparse ✓
PLANT / SHRUB LAYER:	Dense ✓	Moderate ✓	Sparse ✓
GROUNDCOVERS:	Dense	Moderate ✓	Sparse ✓

Hollows / logs

TREE HOLLOWS:	Large	Medium ✓	Small ✓		
TREE HOLLOW TYPES	Spouts / branch ✓	Trunk ✓	Broken Trunk	Basal Cavities	Stags ✓
GROUND HOLLOWS:	Large	Medium	Small		

Vegetation debris

FALLEN TREES:	Large	Medium	Small
FALLEN BRANCHES:	Large	Medium	Small ✓
LITTER:	Deep ✓	Moderate ✓	Shallow ✓
HUMUS:	Deep ✓	Moderate ✓	Shallow

Drainage catchment

WATER BODIES	Wetland(s)	Soak(s)	Dam(s)	Drainage line(s) ✓	Creek(s)	River(s)
RATE OF FLOW:	Still ✓	Slow ✓	Rapid			
CONSISTENCY:	Permanent	Perennial ✓	Ephemeral ✓			
RUNOFF SOURCE:	Urban / Industrial ✓	Parkland	Grazing	Natural		
RIPARIAN HABITAT:	High quality	Moderate quality	Low quality	Poor quality ✓		

Artificial habitat

STRUCTURES:	Sheds ✓	Infrastructure ✓	Equipment ✓
SUB-SURFACE	Pipe / culvert(s)	Tunnel(s)	Shaft(s)
FOREIGN MATERIALS:	Sheet	Pile / refuse ✓	

5.3.2 Habitat trees

A complete assessment of the location of habitat trees and the size of hollows within was undertaken as part of tree health surveys. Table 5.4 below provides hollow-bearing tree data. Figure 3 provides locations of habitat trees.

The hollows within the subject site itself may be suitable for roosting/breeding habitat use for hollow-dependent threatened species including Little Lorikeet, East-coast Freetail Bat and Large-footed Myotis. However this is not expected based on survey results, the fragmented nature of the vegetation and high human usage of the area.

No large hollows suitable for threatened owls or cockatoos were recorded present.

Table 5.4 – Habitat tree data

Tree No	Common Name	DBH (cm)	Height (m)	Spread (m)	Vigour (%)	Hollows & Other Habitat Features Recorded
T055	Brush Box	75	14	10	60	1x 5-10cm trunk hollow
T083	Smooth-barked Apple	50	16	12	75	1x 5-10cm trunk hollow (3m)
T085	Bottlebrush	18,18	6	4	60	1x 0-5cm trunk (1.5m)
T091	Norfolk Island Hibiscus	20,10	7	5	70	1x 0-5cm trunk (1.5m)
T121	Bangalay	100	20	18	70	1x 0-5cm flaking bark
T148	Water Gum	16	10	4	60	1x 0-5cm trunk (1.5m)
T154	stag	76	3	1	0	5x 0-5cm flaking bark
T170	stag	20,30,20	14	5	0	1x 5-10cm trunk hollow (2m)
T173	Sydney Peppermint	36	15	8	30	1x 5-10cm trunk hollow (5m)
T190	Coral Tree	93	13	12	60	1x 0-5cm branch hollow, 1x 10-15cm trunk base hollow
T191	Coral Tree	18,13	4	3	55	1x 0-5cm branch hollow (2)
T194	Coral Tree	48,35	10	7	60	1x 5-10cm branch hollow
T196	Coral Tree	55,50	15	14	70	1x 15-20cm trunk hollow (possum inside)
T222	stag	75	4	2	0	1x 10-15cm trunk hollow
T230	Sydney Peppermint	55	65	11	3	1x 10-12cm trunk hollow

5.3.3 Local fauna matters

The Northern Beaches Council website does not identify rare or locally significant fauna species of conservation significance.

5.3.4 State legislative fauna matters

(a) Threatened fauna species (NSW)

BC Act – A search of the *Atlas of NSW Wildlife* (OEH, 2018) provided a list of threatened fauna species previously recorded within a 10km radius of the subject site. These species are listed in Table A2.2 (Appendix 2) and are considered for potential habitat within the subject site. Strictly estuarine and oceanic threatened species found within 10km have not been included as no marine / aquatic habitats occur within the subject site.

Based on the habitat assessment within Appendix 2, it is considered that the subject site provides varying levels of potential habitat for the following state listed threatened fauna species:

Table 5.5 – State listed threatened fauna species with suitable habitat present

Common name	*BC Act*	Potential to occur
Powerful Owl	V	recorded
Grey-headed Flying-fox	V	recorded
Little Bentwing-bat	V	recorded
Little Eagle	V	✓
Little Lorikeet	V	✓
Eastern Bentwing-bat	V	✓
Large-footed Myotis	V	✓
Glossy Black-Cockatoo	V	low
Barking Owl	V	low
East-coast Freetail Bat	V	low
Wompoo Fruit-dove	V	unlikely
Superb Fruit-dove	V	unlikely
White-bellied Sea Eagle	V	unlikely
Square-tailed Kite	V	unlikely
Bush Stone-curlew	E	unlikely
Swift Parrot	E	unlikely
Varied Sittella	V	unlikely
Yellow-bellied Sheathtail-bat	V	unlikely
Large-eared Pied Bat	V	unlikely
Greater Broad-nosed Bat	V	unlikely

Note: Full habitat descriptions for these species are provided in Appendix 2.

Three (3) state listed threatened fauna species – Grey-headed Flying-fox (*Pteropus poliocephalus*), Little Bentwing-bat (*Miniopterus australis*) and Powerful Owl (*Ninox strenua*) – were recorded within the study area. A detailed significance of impact assessment has been applied to these species within Appendix 3 in accordance with Section 7.3 of the *BC Act*. The significance of impact test for threatened fauna species recorded and with potential to occur has concluded a not likely significant impact.

FM Act – No habitats suitable for threatened aquatic species were observed within the subject site and as such the provisions of this act do not require any further consideration.

(b) Endangered fauna populations (NSW)

There are three (3) endangered fauna populations known within 10km of the study area. These include the Little Penguin in the Manly Point Area, the Long-nosed Bandicoot at North Head and the Koala in the Pittwater Local Government Area. Whilst the study area did show diggings consistent with bandicoot and likely Long-nosed Bandicoot, the study area does not support habitat within the recognised habitat extent for any of these populations.

(c) SEPP 44 Koala Habitat Protection

SEPP 44 Koala Habitat Protection applies to land within Local Government Areas (LGAs) listed under Schedule 1 of the Policy. In addition, Part 2 of the Policy outlines a three (3) step process to assess the likelihood of the land in question being potential or core koala habitat. Part 2 applies to land which has an area of greater than 1 hectare or has, together with any adjoining land in the same ownership, an area of more than 1 hectare.

The subject site is required to be considered under SEPP 44 as it falls within the Northern Beaches (old Warringah) LGA, which is listed on Schedule 1 of this Policy. In addition, the total area of the subject site is greater than 1 hectare, hence Part 2 – Development Control of Koala Habitats, of the Policy applies.

Potential Koala Habitat (PKH) is defined as land where at least 15% of the total number of trees in the upper or lower strata constitutes any of the tree species listed in Schedule 2 of the policy.

Core Koala Habitat (CKH) is defined as an area of land with a resident population of koalas, evidenced by attributes such as breeding females (i.e. females with young) and recent sightings of and historical records of a population.

A Koala Plan of Management is required to be prepared where council is satisfied that the land is CKH.

Step 1 – Is the land PKH?

Two (2) Koala food tree species – Swamp Mahogany (*Eucalyptus robusta*) and Tallowwood (*Eucalyptus microcorys*), as listed on Schedule 2 of SEPP 44 – were recorded within the study area.

These trees comprised less than 15% of the total number of trees within the Planted Trees community and the Tallowwood trees have all been planted. As such the study area is not considered to comprise 'potential Koala habitat' as defined under SEPP 44 and no further assessment under this policy is required.

5.3.5 National environmental significance - fauna

(a) Threatened fauna species (National)

EPBC Act – A review of the schedules of the *EPBC Act* identified a list of threatened fauna species or species habitat likely to occur within a 10km radius of the subject site. These species have been listed in Table A2.2 (Appendix 2), and those with potential habitat within the subject site are considered in the significance of impact assessment within Appendix 3.

Based on the habitat assessment within Appendix 2, it is considered that the subject site provides varying levels of potential habitat for the following nationally listed threatened fauna species:

One (1) nationally listed threatened fauna species, Grey-headed Flying-fox (*Pteropus poliocephalus*), was recorded foraging within the subject site during surveys undertaken. This is a state listed fauna species and a detailed assessment under state legislation (*EPA Act* 1979) is undertaken within the significance of impact assessment (Appendix 3).

Table 5.6 – Nationally listed threatened fauna species with suitable habitat present

Common name	*BC Act*	*EPBC Act*	Potential to occur
Grey-headed Flying-fox	V	V	recorded
Swift Parrot	E	CE	unlikely
Large-eared Pied Bat	V	V	unlikely

Grey-headed Flying-fox

A single individual Grey-headed Flying-fox was heard foraging within the centre of the study area but was not observed when this area was later approached. Lemon-scented Gum was in heavy flower at this time within the site and the recorded Grey-headed Flying-fox location on Figure 3 is the suspected foraging tree. Foraging of other trees within the study area is expected on a seasonal basis. There is no likelihood of this species utilising the site for roosting and subsequent breeding habitat.

The Significant Impact Criteria for a vulnerable species listed under the *EPBC Act* (Appendix 4) was reviewed to assess the impacts on this species as a result of the proposed development. As the subject site does not contain any likely roosting or subsequent breeding habitat and foraging habitat will remain well represented in the locality, it is concluded that there will not be any significant impact on this species, or other nationally listed threatened fauna species with potential to occur, as a result of the proposal.

(b) Protected migratory species (National)

The EPBC Act Protected Matters Report provides additionally listed terrestrial, wetland and marine migratory species of national significance likely to occur, or with habitat for these species likely to occur, within a 10km radius of the subject site. The habitat potential of migratory species is considered in Table A2.3 (Appendix 2). The habitat potential of threatened migratory species is considered in Table A2.3 Table A2.2 (Appendix 2).

No nationally protected migratory bird species were recorded present during the preliminary survey. The impact assessment for protected migratory bird species with considered potential to occur has concluded a not significant impact.

5.4 Vegetation connectivity

The study area does not contribute to any important connectivity values in the local or regional scale. The vegetation present is isolated from any such contiguous habitat and is highly fragmented within the local urban / industrial landscape. Having said this the vegetation present may combine with adjacent narrow drainages to provide a stepping-stone or temporary refuge habitat for locally occurring threatened fauna species.

Figure 4 – Local connectivity

5.5 Watercourses

An ephemeral drainage line exists along the eastern boundary of the subject site. This drainage line has had its alignment modified and runs north to south through a combination of open channels and underground pipes. It is not identified as a stream using current 1:25,000 topographic maps therefore a controlled activity approval on waterfront land is not required under the *Water Management Act 2000* (*WM Act*). The drainage line is not identified as a development control under the Warringah DCP (2011) Waterways and Riparian Land Mapping, therefore the council Protection of Waterways and Riparian Land Policy does not apply. Whilst this drainage line does not provide constraints to development, it contains small permanent pools that may provide habitat for local fauna species, but unlikely to support any important threatened species habitat.

Photo 5 - Drainage line on the eastern edge of the study area with permanent pool.

Conclusion 6

6.1 Legislative compliance

In respect of matters required to be considered under the *Environmental Planning and Assessment Act 1979* and relating to the species / provisions of the *BC Act*, three (3) threatened fauna species including Powerful Owl (*Ninox strenua*), Little Bentwing-bat (*Miniopterus australis*) and Grey-headed Flying-fox (*Pteropus poliocephalus*), two (2) threatened flora species *Eucalyptus scoparia* and *Syzygium paniculatum* (all planted) and no TECs, were recorded within the study area.

In accordance with Section 7.3 of the *BC Act,* the significance of impact test concluded that the proposed development will not likely have a significant impact on any threatened species, populations or TECs.

In respect of matters required to be considered under the *EPBC Act*, one (1) threatened fauna species Grey-headed Flying-fox (*Pteropus poliocephalus*), no protected migratory bird species, three (3) threatened flora species *Eucalyptus scoparia, Macadamia integrifolia* and *Syzygium paniculatum* (all planted), and no TECs listed under this Act were recorded within the study area.

The proposed development was not considered to have a significant impact on matters of national environmental significance. As such a referral to Department of Environment and Energy is not required.

In respect of matters relative to the *FM Act*, no suitable habitat for threatened marine or aquatic species was observed within the subject site and there are no matters requiring further consideration under this Act.

6.2 Potential ecological impacts

The direct, indirect and cumulative ecological impacts have been considered in respect to recorded biodiversity, threatening processes and extent of impact as a result of the proposed works.

The direct impacts of development within the subject site are considered as:

- Clearing of up to 0.02ha disturbed non-TEC vegetation.
- Removal of seasonal fruit and nectar producing trees for foraging by birds and the recorded Grey-headed Flying-fox.
- Removal of small and medium hollows which may be suitable for threatened fauna.

The potential indirect impacts of the proposal are considered as:

- Reduction of cross-site movements and stepping stone connectivity through the local urban landscape for small passerine birds.

- Increased spill-over from noise, activity, scent and lighting effects into the adjacent remaining habitat.

The potential cumulative impacts (combined results of past, current and future activities) of the proposal are considered as:

- Increased risk of weed invasion and fungal mobilisation or infections
- Cumulative loss of Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest within the locality
- Cumulative loss of native vegetation within the locality
- Edge effects from inappropriate use of any remaining native vegetation areas such as additional clearing, dumping of materials, dumping of food or general waste and building refuse.

6.3 Mitigation and amelioration of impacts

The following recommendations are made to avoid, minimise or ameliorate the above potential ecological impacts.

Flora

- Where possible revegetation using locally occurring native plant species is to be re-established to improve native vegetation cover, and to provide on ground refugia and habitat linkages for fauna.

- Target weed control is to be undertaken within 10m of any works to control the invasion or spread of noxious or invasive environmental weed species.

- Standard *Phytophthora cinnamomi* protocol applies to the cleaning of all plant, equipment, hand tools and work boots prior to delivery onsite to ensure that there is no loose soil or vegetation material caught under or on the equipment and within the tread of vehicle tyres. Any equipment onsite found to contain soil or vegetation material is to be cleaned in a quarantined work area or wash station and treated with anti-fungal herbicides.

- To minimise downslope impacts, erosion control measures are to be in place to reduce temporary erosion and sedimentation risks to adjacent vegetation and any nearby drainage channel.

- To minimise downstream impacts, water quality is to be measured before, during and after development to ensure that ground and surface water quality is maintained in the ephemeral drainage line along the eastern boundary of the subject site.

Fauna

- Protect or retain large canopy trees, particularly native species, on the fringes of the site that provide seasonal foraging habitat for birds and the recorded Grey-headed Flying-fox.

- The felling of hollow-bearing trees is to be conducted under the supervision of a fauna ecologist to ensure appropriate animal welfare procedures are taken, particularly for threatened species. Any hollow that is required to be removed and found to be a quality hollow at the time of removal should be relocated or replaced

with a nest box within any appropriate retained large trees within the study area (as guided by a fauna ecologist).

- If a threatened species is found to be occupying the hollow then the hollow section is to be reattached to a recipient tree within the nearby conservation areas as selected and directed by the fauna ecologist. The welfare and temporary holding of the residing animal(s) is at the discretion of the fauna ecologist. The hollow section should be well secured in the recipient tree in a manner that will not compromise the current or future health of that tree.

- If any fauna species, a nest or roost is located during development works, then works should cease until safe relocation can be advised by a contact fauna ecologist. This most notably includes the emergence of microbats from structures during the demolition process.

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Fauna Survey Methodologies

A1

The fauna survey methods outlined within this Appendix are techniques employed by *Travers bushfire & ecology,* based on industry standards as well as additional methods found to be effective for select fauna groups. The fauna survey techniques deployed for each specific site are outlined within the survey effort table in the main body of this report. The techniques selected will depend upon the site characteristics and extent of available habitat as well as restrictions such as available survey time and weather conditions.

If any additional or target survey techniques for fauna species are undertaken, beyond the methods outlined within this Appendix, the details of these will be described within the main body of this report.

1 Standard survey techniques

1.1 Diurnal birds

Diurnal birds are typically identified visually and / or by calls during diurnal surveys. Habitat searches to identify nests, feathers, eggs, or signs of foraging may be utilised more specifically for identifying threatened diurnal bird species.

Visual observations are made more accurate with the use of binoculars and where necessary or practical, with the use of a spotting scope. Binoculars are carried by the fauna surveyor at all times during nocturnal and diurnal fauna surveys. A birding field guide is always available in the field when required for verifications.

Calls are identified in the field by the fauna surveyor. If an unknown call is heard it is cross-matched to comprehensive bird call reference libraries taken into the field. A call library of birds occupying the NSW coastal areas is also stored into a mobile phone for a quick reference. This phone is carried into the field at all times and may be used for call-playback methods and recording calls for later analysis.

Diurnal bird census points may be undertaken at large sites where the total area may not be effectively covered during the survey period, or as a measure to ensure focused bird only survey.

Song-meters may also be used for remote diurnal bird call surveys in pre-selected diurnal periods (particularly during the dawn chorus) over the deployment period.

1.2 Nocturnal birds

Searches for evidence of Owl roosts, key perches and potential Owl roosting / breeding hollows are made during diurnal site searches. Whitewash, feathers or regurgitated pellets give key information. Pellets are sent for analysis of contents to assist in identification where necessary.

Generally, the presence of nocturnal birds during the nocturnal period is first determined by quiet listening after dusk for calls by individuals emerging from diurnal roosts. Following this,

and provided no calls are heard, call-playback techniques are employed for threatened species that have suitable habitat present.

Threatened nocturnal birds known to provide response to call-playback techniques include Masked Owl (*Tyto novaehollandiae*), Powerful Owl (*Ninox strenua*), Barking Owl (*Ninox connivens*), Sooty Owl (*Tyto tenebricosa*), Grass Owl (*Tyto longimembris*), Black Bittern (*Ixobrychus flavicollis*), Australian Bittern (*Botaurus poiciloptilus*) and Bush Stone-curlew (*Burhinus grallarius*).

Each call is typically played for five minute periods with five minute intervals of quiet listening for a response. This is followed with spotlighting and periods of quiet listening throughout the nocturnal survey.

Separation distances between broadcasting stations during a single night of survey are advised for different species within survey guidelines. These include 1km between Owl calls and 3km between Bush Stone-curlew calls. Subsequent to this, separate broadcasting stations will be deployed on the same night where sites of significant size are surveyed. Separations for bitterns are not advised and these may be broadcast at a number of stations along suitable habitat areas.

Where an owl species has been recorded or is known to occur, call-playback techniques will not be deployed for that species to prevent disturbance of breeding activity. Where a threatened owl is known to occur appropriate additional effort will be undertaken to identify appropriate nesting/roosting trees and identify signs of use as per the methods guided by owl specialist John Young. These techniques vary pending the time of year but all with a focus to identify key breeding and roosting habitat trees and areas.

Stag-watching at appropriate times of year will also be undertaken where suitable large hollows for Owl nesting / roosting show signs of activity or are located within development areas. Full covert or semi-covert Reconyx surveillance cameras may be mounted at suspected hollows to target owl use and behaviour.

Song-meters may also be used to remotely target presence of owls by recording calls in selected nocturnal periods (particularly after dusk and before dawn) in the early breeding period.

1.3 Arboreal mammals

Arboreal mammals may be surveyed using Elliott type A, B and / or C traps, small and / or large hair tubes, surveillance cameras, video endoscope, spotlighting, call-playback techniques, scat searches or searches for other signs of activity.

Baiting and layout for Elliott trapping and hair tubing are typically incorporated into terrestrial trapping and hair tubing effort, unless where target survey is undertaken. Standard baiting and layout is therefore described in Section A1.4 below within terrestrial survey methods. Where gliders are targeted, the standard bait mix may be additionally laced with a nectarivor powder mix used for feeding captive birds. Where Brush-tailed Phascogales are targeted the standard bait mix may be additionally laced with an insectivore powder mix. Where Eastern Pygmy Possum is targeted, the bait mix will be more heavily laced with honey.

Elliott traps for arboreal captures are placed onto tree mounted platforms that are attached to the trunk 2-3m above the ground, at an incline to facilitate drainage during inclement weather. Plastic sleeves are placed around or over traps when there is a possibility of wet weather in the forecast. Arboreal hair tubes are attached to the trunk of trees using rubber bands with the tube entry facing down, preventing water entry.

For all arboreal traps and hair tubes a mixture of honey and water is sprayed onto the trunk up to 8m above the trap and around the trap as a lure. Where Eastern Pygmy Possum is targeted, a high concentrate honey water mix is also sprayed from the base of trunk up and along connective branches.

Arboreal traps and hair tubes are placed in trees selected to bias target species. These are often flowering or sap flow trees for gliders, rough-barked trees for the Brush-tailed Phascogale and Banksias for the Eastern Pygmy possum.

Surveillance cameras may be used to target arboreal mammals in instances where the camera can be placed targeting a location on a tree where baiting is placed. This method may utilise the efforts of tree climbers to permit placement a good height, particularly in instances where scratches indicate regular usage patterns or a hollow is a suspected den.

A videoscope is used for active observations of hollow cavities for the presence of arboreal mammals (and other hollow-dependent fauna). Where a cavity extends beyond the cable distance an angle drill hole is made from the outside so sections can be viewed down to the base. Single photo or video footage may be recorded to assist identification or where only nest bedding material is recorded. This may also be used for later verification of identification.

Where habitat is suitable, the presences of Koala (*Phascolactos cinereus*), Yellow-bellied Glider (*Petaurus australis*) and Squirrel Glider (*Petaurus norfolcensis*) may be targeted by call-playback techniques. Calls are played for five minute periods during nocturnal surveys. This is followed by quiet listening and spotlighting. Arboreal gliders are also identified from characteristic sap feeding scars on select tree species.

1.3.1 Koala survey

Koala survey is undertaken where the site is considered to provide potential habitat under the definitions of SEPP 44 - Koala Habitat Protection, or in the presence of feed trees listed in Appendix 1 of the Recovery Plan for the Koala. Habitat may also be defined according to locally prepared Koala Plans of Management.

SEPP 44 is applied to land within Local Government Areas (LGAs) listed under Schedule 1 of the Policy. Part 2 is applied to land which has an area of greater than 1ha or has, together with any adjoining land in the same ownership, an area of more than 1ha.

To determine Potential Koala Habitat (PKH) under the definitions of SEPP 44 an estimate of the percentage density of each tree species within vegetation communities is determined by averaging the percentage of stems counted. PKH is defined as land where at least 15% of the total number of trees in the upper or lower strata constitutes any of the tree species listed in Schedule 2 of the Policy.

Where Koala habitat is considered to be present, the site will be surveyed on foot, with known Koala food trees being inspected for signs of use. Trees are inspected for characteristic scratch and claw marks on the trunk and scats around the base of each tree. Koalas may also be targeted during nocturnal survey involving call-playback techniques and spotlighting.

For large sites, Koala search quadrats may be employed within portions of communities where feed trees are present at suitable densities. All Koala feed trees within quadrats are searched for signs of activity including characteristic claw ‘pock’ marks on the trunk and faecal pellets around the base. Pellet searches are undertaken according to the tree base search methods described in *Phillips & Callaghan* (2008). Search quadrats are less labour

intensive than the SAT techniques described below but may only be an initial survey effort to determine presence / absence.

Where any Koala activity is recorded the complete Spot Assessment Technique (SAT) described by *Phillips & Callaghan* (2008) may be undertaken as a measure of Koala *activity*. This technique may also be employed in the first instance as an indicator of presence / absence, particularly where a site has potential Koala activity based on previous records.

For any survey technique, the location and density of Koala droppings, if found, are documented.

1.4 Terrestrial mammals

Various traps may be used to survey for the presence of terrestrial mammals. These include Elliott trapping, medium and large cage trapping, small and large hair tubing and pitfall traps. Other survey methods for terrestrial mammals include the use of surveillance cameras, song-meters, spotlighting and activity searches.

Arboreal and terrestrial Elliott traps and hair tubes are placed in grids, or more commonly along trap-lines of 5-10 traps separated by distances of 20-50m, depending on site size and variation of habitat. Trap or hair tube sizes selected at each trap station may alternate or may have an emphasis on certain sizes according to target species.

Selection of terrestrial Elliott trap, cage trap, hair tube or pitfall trap locations has an emphasis on nearby foliage, runways, shelters and signs of activity.

Standard bait mix for all Elliott traps, medium cage traps and hair tubes is a mixture of rolled oats, honey and peanut butter. Standard bait mix may be supplemented with sardines in large hair tubes or cage traps to simultaneously target Spotted-tailed Quoll. Cage traps may also be baited solely with meat, chicken or roadkill to target Spotted-tailed Quoll. Where Potoroos or Bandicoots are targeted, truffle oil may be used to lace the standard bait mix or used on its own.

Surveillance cameras are used in terrestrial mammal surveys particularly for detection of a broad target group or shy species. The surveillance camera is mounted on a tree and directed towards a closed baited trap or canister. Surveillance cameras may also be used to detect use or monitor activity at burrows, hollows, nests, runways, etc.

Song-meters may be used as a supplementary surveying tool to identify mammal calls including Yellow-bellied Glider, Squirrel Glider and Spotted-tailed Quoll.

During diurnal site searches, assessment is made of ‘found’ scats, markings, diggings, runways and scratches located. Any scats or pellets not readily identifiable (particularly predator scats) may be collected and sent to Barbara Triggs for identification of contents, hair or bone fragments.

1.5 Bats

Micro-chiropteran bats are surveyed by echolocation using ultrasonic recording detectors or trapped using harp (Constantine) traps, mist nets or trip lines. Microchiropteran bats are also surveyed by searches of subterranean habitats such as caves, tunnels or shafts where present, or by searching structures such as under bridges and abandoned buildings or wall / ceiling cavities, where entry is possible.

Ultrasonic recording detectors are used in fixed passive monitoring positions. Active monitoring may also be used in conjunction with spotlighting or during stag-watching for greater accuracy of recorded call identification. Active monitoring utilises a handheld sonograph recording microbat calls in real-time. Spotlighting of the microbat is then used to determine size and wing morphology to assist in finer differentiation between species with similar call shape and frequencies.

Harp traps and mist nets are placed along suitable 'flyways' such as along open narrow road / river corridors to maximise the likelihood of captures. Traps may be purpose set to capture bats emerging from roosts by being placed at the entry of tunnels / caves or draped over the edge of bridges. Trip lines are placed over water to trip low flying drinking bats into the water. These bats are collected as they swim to the waters edge.

Harp traps are checked during early nocturnal survey, as well as each morning. Mist nets and trip lines require constant monitoring. Captured bats are identified using field identification guides. Bats are released at the point of capture after dusk or placed under trunk bark / splits of nearby trees.

Mega-chiropteran bat species, such as Grey-headed Flying-fox, are surveyed by targeting flowering / fruiting trees during spotlighting activities and by listening to distinctive vocalisations. Suitable roosting habitat is searched for presence of small or large established camps during diurnal survey periods.

1.6 Amphibians

Amphibians are surveyed by vocal call identification, call-playback, spotlighting along the edge of water-bodies, pitfall trapping, funnel trapping, by driving along sealed roads near waterways, habitat searches and collection of tadpoles.

Calls are identified in the field by the fauna surveyor. For similar calling species, or if an unknown male call is heard, it is cross-matched to frog call reference libraries taken into the field. A call library of frogs occupying the NSW coastal areas is also stored into a mobile phone for a quick reference. This phone is carried into the field at all times and may be used for call-playback methods and recording calls for later analysis.

Threatened frog species that call in chorus may be targeted by use of call-playback techniques where suitable habitat exists, with some species more reliable than others in providing a response. Red-crowned Toadlet may also be targeted by clapping and loud retort along suitable habitat drainages in order to evoke a call response.

Any amphibians found are visually identified and, when required to be examined, are handled with latex gloves and kept moist until release. Any tadpoles requiring capture are collected with a scoop net and placed within a snap-lock clear plastic bag for analysis of colour and morphological features. Where tadpole identification cannot be made in the field tadpoles are placed in a small glass box with laminated grid paper and dorsal and lateral photos are taken. These are supplied to Marion Anstis or Dr Arthur White for identification.

Song-meters may also be used to remotely record frog calls in selected periods (particularly during dusk) close to breeding areas over a preselected recording period.

Amphibian survey yields best results during or following wet periods with seasonal breeding and subsequent male calling varying according each species. Targeted survey is thus undertaken in appropriate seasons.

1.7 Reptiles

Reptiles are surveyed opportunistically during diurnal site visit(s), but also by habitat searches, pitfall trapping, funnel trapping, by driving along roads on humid nights and by camera surveillance at burrows.

Habitat searches for reptiles are undertaken in likely localities such as under logs, rocky slabs on rock surfaces, under sheet debris, under bark exfoliations and leaf litter at the base of trees and along the edge of wetlands. Aspect and land surface thermal properties are considered to determine best search locations particularly along rocky escarpments.

During warmer months spotlighting may assist survey effort particularly during humid conditions.

1.8 Invertebrates

Target survey is undertaken for Cumberland Plain Land Snail (*Meridolum corneovirens*) or Dural Land Snail (*Pommerhelix duralensis*) when in proximity to previous *Bionet* records and particularly where typical host vegetation communities are present. The most appropriate areas of observed habitat are searched. Dense areas of leaf litter with likely moisture retaining properties are scraped using a three pronged rake. Logs, stumps, artificial refuse and rocks are also turned over. In large survey areas, search quadrats are undertaken evenly across highest quality habitat areas to estimate population size.

The top (spiral side), side (showing aperture) and underside (showing umbilicus) of snail specimens found are photographed and sent to Michael Shea or Frank Koehler of the Australian Museum Malacology Unit for confirmation of identification.

2 Habitat trees

Hollow-bearing tree surveys use a *Trimble* handheld GPS unit to log both field reference location as well as tree data. Data such as hollow types, hollow size, tree species, diameter at breast height, canopy spread and overall height are documented. A metal tag with the tree number is placed on the trunk for field relocation purposes. Other habitat features such as nests and significant sized mistletoe for foraging are also noted.

3 Survey effort table descriptors:

Target - Where effort is specifically concentrated towards an individual species. Selected target species will be identified within the survey effort table and where necessary described within the report.

Opportunistic - Where birds are identified by observation, call or indirect methods as the opportunity arises.

Habitat search - Where suitable areas of habitat for selected fauna groups such as frogs, reptiles and invertebrates are specifically searched.

Diurnal bird census point(s) - Bird surveys are undertaken within a specified area surrounding a point (or in a quadrat) for a specified amount of time. Size and time will be specified in the survey effort table. These are more typically undertaken across larger sites where the total area cannot be effectively covered during the survey period. Subsequently census points are selected to adequately represent each of the habitat areas present and particularly areas designated for proposed development. Often census points are commenced at locations where bird activity is noticeably high.

Spotting-scope outlook - A *Nikon* spotting scope with 16~47 zoom at x60 magnification on a mounted tripod is used for distant inspections of diurnal birds. This is undertaken at wetlands for viewing waterfowl and waders but also other difficult to access areas. It may also be used for inspecting activity at nests, hollows and combined with spotlight for a panoramic search in open areas.

Call-playback - This involves broadcasting pre-recorded calls from CD through a 15 watt Toa 'Faunatech' amplifier to evoke a response from a target species known to reply. Species selected for call-playback will be indicated in the survey effort table.

Spotlighting - Is carried out using a hand held Olight LED spotlights with varied light intensity settings. This technique involves walking amongst the woodland areas, forest fringes, along roads, trails and fence lines so that a maximum number of trees can be observed. Intensity is regulated depending on the vegetation structure and distances viewed to enable eyeshine without retina damage to observed animals. Spotlighting around water-bodies and particularly along the shallow fringes is used for finding frogs. Spotlighting is used in combination with binoculars or spotting scope for closer night inspections.

Stag-watching - Involves watching hollows in the dusk period approximately 15 minutes prior to dark until 30 minutes following dark. Placement of the observer on the ground allows for a silhouette of any emerging fauna to be seen against the lighter sky background such that a spotlight is not required, which would likely to disrupt emergence behaviour. Where any movement is observed, a spotlight may then be used for identification purposes.

Search quadrats - Are undertaken within a specified area surrounding a point (or in a quadrat) for a specified amount of time. These are more typically undertaken across larger sites where the total area cannot be effectively covered during the survey period. Subsequently quadrats are selected to adequately represent each of the suitable habitat areas present and particularly areas designated for proposed development. The use of this technique simply as an initial time-effective suitable indicator of presence / absence of Koalas has been discussed with Koala expert, Stephen Phillips.

Koala Spot Assessment Technique (SAT) - Method outlined by *Phillips & Callaghan* (2008) and accepted by the Australian Koala Foundation to determine Koala activity levels. Activity levels are calculated from the proportion of trees showing signs of Koala use as indicated by the presence of scats as well as site location within the state.

Elliott trapping - Using *Elliott* type A (33x10x10cm) and Type B (45x15x15cm), B and / or Type C traps for trapping small sized mammals. Trapping nights' effort will be indicated in the survey effort table. Trapping layout, trap sizes, baiting and trapping period will be outlined within the site specific methodology section.

Medium cage trapping - Using medium sized cage traps (17x17x45cm foldout cages with tread-plate mechanism or 22x25x58cm rigid cage with tread-plate mechanism) for trapping up to cat/bandicoot sized mammals. Trapping layout, target species, baiting and trapping period will be outlined within the site specific methodology section.

Large cage trapping - Using large sized cage traps (25x25x50cm foldout cages with pull lever (meat) mechanism, 28x28x60cm foldout cages with tread-plate mechanism or 30x30x70cm rigid cage with tread-plate mechanism) for trapping up to quoll sized mammals. Trapping layout, target species, baiting and trapping period will be outlined within the site specific methodology section.

Hair tubing - Using small (40mm diameter x 120mm long) and/or large (90mm diameter x 200mm long) PVC pipe sections for collecting mammal hair samples. At one end of each tube is an enclosed chamber where the bait is placed and capped. Small drill holes in the inside face of the chamber allow the smell of the bait to permeate out through the tube without allowing access to the bait. At the other open entry end, double-sided tape is attached around the inner rim so hair samples of animals entering the tube are collected.

Hair samples collected are sent to Barbara Triggs for identification. Trapping layout, tube sizes, baiting and trapping period will be outlined within the site specific methodology section.

EPP denning tubes - Using (80mm diameter x 240mm long) PVC pipe sections to provide a nesting/denning opportunity for Eastern Pygmy Possum. Both ends and covered and sealed with PVC caps. A 60mm diameter cardboard post-pack tube wrapped in bubble wrap for insulation and capped at the base is placed inside the PVC pipe. A 33mm drill hole on the side at one end permits access and velcro tape stuck down the internal cylinder allows the animal to climb down to the base. Cut lines around the outer surface of the tube permit small mammals to climb up the outside. Denning tubes are placed vertically in shrub trees (preferably flowering banksias). If no animals are found residing within the tube after a prolonged survey period (generally 6 weeks) use may then instead also be identified from bedding material present. Pygmy Possums use fine bedding material such as *Isopogon* and *Banksia ericifolia* by comparison to Feather-tail Gliders and Antechinus which use eucalypt leaves.

Pitfall trapping - Is used to survey for small terrestrial mammals, frogs, reptiles and invertebrates. Pitfall trapping involves the use of 15cm diameter and 60cm long PVC stormwater pipe sections placed vertically into pre dug holes. The pipe is placed and set firm with surrounding soil so that the top rim is level with the ground surface. Drift fences made of damp-proof-course 270mm wide are held tight and upright by wooden and steel pegs and run along the length of each trap-line. Drift fences are run over the middle of each pit in the trap line ensuring at least 5m of fencing is run along each side of each pit. Ground fauna passing beyond the pitfall transect are diverted towards the pits along the fence line.

Funnel trapping - Is used to survey mainly for frogs and reptiles. Funnel traps are 18cm x 18cm x 75cm long and constructed of shade cloth with an internal spring and wire frame in a similar design to yabby traps. At each end an inward facing funnel directs fauna through a 4cm hole and into the trap. Herpetofauna search the walls and corners for an exit and discover it difficult to re-find the internal exit hole. As with pitfall traps, funnel traps are used with drift fences that divert fauna towards the trap entry. At least 5m of fencing is run between each funnel trap which may be placed on either side of the fence. Trapping layout, target species, fence lengths and trapping period will be outlined within the site specific methodology section.

Passive microbat monitoring - Involves leaving the Anabat (Mk2 or SD-2) or SM4Bat zero-crossing recorders in a fixed mounted position to record call-sequences of passing bats. Recording locations are determined in order to represent different available foraging structures for various micro-chiropteran bat species. Dams, cleared flyways, high insect activity areas, forest edges and ecotones are particularly targeted. Bat call recordings are analysed using Analook 3.7.23 computer software.

Active microbat monitoring - Is a method of active microbat recording during stag-watching or during nocturnal spotlighting survey. Active monitoring involves walking with an Echo Meter Touch microphone allied to a mobile acoustics spectrogram app on iPhone for viewing call-sequences in real-time. When calls are heard the transducer microphone is actively directed towards the calling animal with the aid of a spotlight, so longer and clearer call sequences may be recorded. When calls of a potential threatened species are observed on the sonograph a view by spotlight of the bat size and wing morphology is attempted for greater identification accuracy.

Active vehicle microbat monitoring - Is a method of active microbat recording deployed when large distances need to be covered in a nocturnal survey period. A Hi-mic extension cable allows the transducer microphone to be placed on a bracket on the roof of a travelling vehicle so calls may be viewed whilst driving. The vehicle travels at no more than 40km/h to prevent wind interference. When calls of a potential threatened species are observed on the dash mounted PDA screen active spotlighting is undertaken.

Harp trapping - Is used to capture microchiropteran bats. Harp traps have an aluminium frame with a two-bank 4.2m^2 area and calico capture bag set along the base area.

Mist netting - Is used to capture microchiropteran bats. The mist net capture area is 2.4m high and 9m wide and supported by two 3.5m poles which are braced with ropes and pegs. Design is a 0.08mm ultrafine nylon monofilament thread arranged in a 14x14mm mesh, with four horizontal capture pockets. These features are specific for the use to capture micro-chiropteran bat species and are provided from the only known supplier in Poland.

Trip lining - Is used to capture microchiropteran bats. Fishing line is strung tight on pegs in a zig-zag pattern across open water-bodies just above the water surface to trip drinking bats into the water.

Surveillance camera - Is used to remotely monitor activity at burrows, hollows, etc. or to survey for species presence at baited stations. A Reconyx Hyperfire HC500, HC550 or HC600 digital weatherproof camera with a passive motion detector and a night-time infrared illuminator is used depending on the target outcome. Full covert or semi-covert cameras will be used to maximise recordings or for behaviour, whilst white-flash cameras will be used for colour identification. The camera is mounted on a tree or tripod and takes three consecutive photo frames on the detection of movement up to 30m away or the detection of a heat/cold source different to the ambient temperature.

Song-meters - are used to remotely record animal calls. SM4 bioacoustics song-meters may be programmed to record during select periods in the day depending on the targeted activity. Song Scope software may be used to create a recogniser file and determine the frequency of calls over the recorded period, which may be effective in determining local breeding activity, numbers and locations.

Videoscope - is used for active observations of hollow cavities for the presence of arboreal mammals and other hollow-dependent fauna. A Dellon industrial endoscope with a 1m cable and rotational camera head and LED light allow real-time inspection down irregular shaped cavities to be viewed on the attached LCD screen. Single photo or video footage may be recorded.

Weather conditions - Survey effort for each fauna group accounting for methods undertaken, duration, and weather conditions are provided in the survey effort table. Weather details are documented for all survey techniques and include:

- air temperature
- cloud cover
- rain (e.g. none, light drizzle, heavy drizzle, heavy rain)
- recent rain events (where relevant)
- wind strength e.g. calm, light (leaves rustle), moderate (moves branches), strong (moves tree crowns)
- wind direction
- moon (where relevant) (e.g. none, 1/4 moon, 1/2 moon, 3/4 moon, full moon)

Threatened & Migratory Species Habitat Assessment

A2

Table A2.1 provides an assessment of potential habitat within the subject site for state and nationally listed threatened flora species recorded within 10km on the Atlas of NSW Wildlife (OEH) or indicated to have potential habitat present within 10km on the *EPBC Act* Protected Matters Tool. Note that OEH have recently changed to DPIE, however the searches were undertaken prior to the change over.

Table A2.1 – Threatened flora habitat assessment

Scientific name DATABASE SOURCE	***BC Act***	***EPBC Act***	**Growth form and habitat requirements**	**Recorded on site (✓)**	**If not recorded on-site**				**Considered in assessment of significance test (✓) Refer to Appendix 3**
					Suitable habitat present (✓)	**Nearby and / or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Acacia bynoeana OEH EPBC	E1	V	Erect or spreading shrub to 0.3m high growing in heath and dry sclerophyll Open Forest on sandy soils. Often associated with disturbed areas such as roadsides. Distribution limits N-Newcastle S-Berrima.	x	x	-	-	-	x
Acacia terminalis subsp. *terminalis* OEH EPBC	E1	E	Erect shrub to 2m tall, flowers from March to July. Occurs in eucalypt woodland or forest, usually in sandy soil on creek banks, hillslopes or in shallow soil in rock crevices and sandstone platforms on cliffs. Typically restricted to the Port Jackson and eastern suburbs of Sydney.	x	x	-	-	-	x

Scientific name DATABASE SOURCE	***BC Act***	***EPBC Act***	**Growth form and habitat requirements**	**Recorded on site (✓)**	**If not recorded on-site**				**Considered in assessment of significance test (✓) Refer to Appendix 3**
					Suitable habitat present (✓)	**Nearby and / or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Allocasuarina portuensis OEH	E1	E	A shrub of 3-5m tall, similar to other Casuarinaceae species. Grows in tall shrubland on sandstone headland at Nielsen Park, Vaucluse.	x	x	-	-	-	x
Asterolasia elegans OEH EPBC	E1	E	Erect shrub 1-3m high growing in moist sclerophyll forests on Hawkesbury sandstone slopes hillsides. Distribution limits Maroota region.	x	x	-	-	-	x
Caladenia tessellata OEH EPBC	E1	V	Terrestrial orchid. Clay-loam or sandy soils. LHCCREMS guidelines suggest the species grows in Map Unit 34 – Coastal Sand Wallum Woodland - Heath. Flowers in September – November. Distribution limits N-Swansea S-south of Eden.	x	x	-	-	-	x
Callistemon linearifolius OEH	V	-	Shrub to 4m high. Dry sclerophyll forest on coast and adjacent ranges. Distribution limits N-Nelson Bay S-Georges River.	x	x	-	-	-	x
Chamaesyce psammogeton OEH	E1	-	Prostrate herb. Coastal dunes. Distribution limits N-Tweed Heads S-Jervis Bay.	x	x	-	-	-	x
Cryptostylis hunteriana EPBC	V	V	Saprophytic orchid. Grows in swamp heath on sandy soils. Distribution limits N-Gibraltar Range S-south of Eden.	x	x	-	-	-	x

Scientific name DATABASE SOURCE	***BC Act***	***EPBC Act***	**Growth form and habitat requirements**	**Recorded on site (✓)**	**If not recorded on-site**				**Considered in assessment of significance test (✓) Refer to Appendix 3**
					Suitable habitat present (✓)	**Nearby and / or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Cynanchum elegans EPBC	E1	E	Climber or twiner to 1m. Grows in rainforest gullies, scrub & scree slopes. Distribution limits N-Gloucester S-Wollongong.	x	x	-	-	-	x
Darwinia biflora OEH	V	V	Erect or spreading shrub to 0.8m high. Grows in heath or understorey of woodland on or near shale-capped ridges underlain by Hawkesbury sandstone. Distribution limits N-Gosford S-Cheltenham.	x	x	-	-	-	x
Diuris bracteata OEH EPBC	E1	Ext.	An orchid that grows in dry sclerophyll woodland. Was thought to be extinct until approximately 10yrs ago. Found in the Sydney Basin Bioregion. Flowers in September.	x	x	-	-	-	x
Epacris purpurascens var. *purpurascens* OEH	V	-	Erect shrub to 1.5m high growing in sclerophyll forest and scrub and near creeks and swamps on Sandstone. Distribution limits N-Gosford S-Blue Mountains.	x	x	-	-	-	x
Eucalyptus camfieldii OEH EPBC	V	V	Stringybark to 10m high. Grows on coastal shrub heath and woodlands on sandy soils derived from alluviums and Hawkesbury sandstone. Distribution limits N-Norah Head S-Royal NP.	x	x	-	-	-	x

Scientific name DATABASE SOURCE	***BC Act***	***EPBC Act***	**Growth form and habitat requirements**	**Recorded on site (✓)**	**If not recorded on-site**				**Considered in assessment of significance test (✓) Refer to Appendix 3**
					Suitable habitat present (✓)	**Nearby and / or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Eucalyptus nicholii OEH	V	-	This species is widely planted as an urban street tree and in gardens but is quite rare in the wild. It is confined to the New England Tablelands of NSW, where it occurs from Nundle to north of Tenterfield, largely on private property.	x	x	-	-	-	x
Eucalyptus scoparia OEH	E1	V	Smooth-barked tree only known from vicinity of Bald Rock.	✓	x	-	-	only if planted	✓
Genoplesium baueri OEH EPBC	E1	E	A terrestrial orchid that grows in sparse sclerophyll forest and moss gardens over sandstone. Flowers Feb – Mar Distribution limits N – Hunter Valley S – Nowra	x	x	-	-	-	x
Grammitis stenophylla OEH	E1	-	A small lithophytic fern with fronds generally <5cm. Occurs in rainforest and wet sclerophyll forest in the coastal divisions of NSW. Usually grown on rocks.	x	x	-	-	-	x
Grevillea caleyi OEH EPBC	E1	E	Shrub mostly 1-3m high. Grows in laterite. Distribution limits Terrey Hills-Belrose area.	x	x	-	-	-	x
Haloragodendron lucasii OEH EPBC	E1	E	Straggling shrub to 1.5m high. Grows in open forest on sheltered slopes near creeks. Distribution limits Ku-ring-gai Plateau and Mt Wilson.	x	x	-	-	-	x

Scientific name DATABASE SOURCE	***BC Act***	***EPBC Act***	**Growth form and habitat requirements**	**Recorded on site (✓)**	**If not recorded on-site**				**Considered in assessment of significance test (✓) Refer to Appendix 3**
					Suitable habitat present (✓)	**Nearby and / or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Hibbertia puberula OEH	E1	-	Shrublets with branches up to 30cm long. Not been seen for 40 years however early records are from Hawkesbury River area in Sydney and the Blue Mountains.	x	x	-	-	-	x
Hibbertia superans OEH	E1	-	Small spreading shrub to 0.3m high. Grows on sandstone, usually in or near SSTF. Distribution limits N-Glenorie S-Kellyville disjunct Mt Boss.	x	x	-	-	-	x
Kunzea rupestris OEH EPBC	V	V	Shrub to 1.5m high. Grows in cracks and fissures on Hawkesbury sandstone rock platforms. Distribution limits N-Maroota S-Glenorie.	x	x	-	-	-	x
Lasiopetalum joyceae OEH	V	V	Erect shrub to 2m high. Grows in heath and open forest on Hawkesbury sandstone. Distribution limits Hornsby Plateau.	x	x	-	-	-	x
Leptospermum deanei OEH EPBC	V	V	Shrub to 5m high. Grows on forested slopes. Distribution limits Near watershed of Lane Cove River.	x	x	-	-	-	x
Melaleuca biconvexa OEH EPBC	V	V	Tall shrub. Grows in wetlands adjoining perennial streams and on the banks of those streams, generally within the geological series known as the Terrigal Formation. Distribution limits N-Port Macquarie S-Jervis Bay.	x	x	-	-	-	x

Scientific name DATABASE SOURCE	***BC Act***	***EPBC Act***	**Growth form and habitat requirements**	**Recorded on site (✓)**	**If not recorded on-site**				**Considered in assessment of significance test (✓) Refer to Appendix 3**
					Suitable habitat present (✓)	**Nearby and / or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Melaleuca deanei OEH EPBC	V	V	Shrub to 3m high. Grows in heath on sandstone. Distribution limits N-Gosford S-Nowra.	x	x	-	-	-	x
Microtis angusii OEH EPBC	E1	E	Terrestrial orchid which is known from one population at Ingleside. Associated with the Duffy's Forest vegetation community. Flowers May-Oct.	x	x	-	-	-	x
Pelargonium sp. *Striatellum* EPBC	E1	E	Herb to 90cm tall which grows in damp places especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance. Varied distribution from SE NSW to QLD.	x	x	-	-	-	x
Persoonia hirsuta OEH EPBC	E1	E	Erect to decumbent shrub. Grows in dry sclerophyll forest and woodland on Hawkesbury sandstone with infrequent fire histories. Distribution limits N-Glen Davis S-Hill Top.	x	x	-	-	-	x
Pimelea curviflora var. *curviflora* OEH EPBC	V	V	Woody herb or sub-shrub to 0.2-1.2m high. Grows on Hawkesbury sandstone near shale outcrops. Distribution Sydney.	x	x	-	-	-	x
Prostanthera densa OEH	V	V	Erect shrub 0.5-2m. Grows in sclerophyll forest and shrubland. Distribution limits N-Nelson Bay S-Beecroft Peninsula.	x	x	-	-	-	x

Scientific name DATABASE SOURCE	***BC Act***	***EPBC Act***	**Growth form and habitat requirements**	**Recorded on site (✓)**	**If not recorded on-site**				**Considered in assessment of significance test (✓) Refer to Appendix 3**
					Suitable habitat present (✓)	**Nearby and / or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Prostanthera junonis OEH	E1	E	Small shrub. Grows in sclerophyll forest and heath in shallow soil on sandstone. Distribution limits Somersby region.	x	x	-	-	-	x
Prostanthera marifolia OEH EPBC	E4A	CE	Erect shrub to 0.3m high. Woodland dominated by Eucalyptus sieberi and Corymbia gummifera. In deeply weathered clay soil with ironstone nodules. Has been recorded previously in the Sydney Harbour region.	x	x	-	-	-	x
Sarcochilus hartmannii OEH EPBC	V	V	An orchid which grows on volcanic rocks, often in shallow soil in sclerophyll forest or exposed sites usually at an elevation above 500m. Distribution – north from the Richmond River in the far north of NSW.	x	x	-	-	-	x
Senecio spathulatus OEH	E1	-	A low growing daisy that prefers primary dunes. Known to occur at Cape Howe and between Kurnell north to Myall Lakes National Park. Also occurs in coastal locations in eastern Victoria.	x	x	-	-	-	x
Syzygium paniculatum OEH EPBC	V	V	Small tree. Subtropical and littoral rainforest on sandy soil. Distribution limits N-Forster S-Jervis Bay.	✓	x	-	-	only if planted	✓
Tetratheca glandulosa OEH	V	-	Spreading shrub to 0.2m high. Sandy or rocky heath or scrub. Distribution limits N-Mangrove Mountain S-Port Jackson.	x	x	-	-	-	✓

Scientific name DATABASE SOURCE	***BC Act***	***EPBC Act***	**Growth form and habitat requirements**	**Recorded on site (✓)**	**If not recorded on-site**				**Considered in assessment of significance test (✓) Refer to Appendix 3**
					Suitable habitat present (✓)	**Nearby and / or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Thesium australe EPBC	V	V	Erect herb to 0.4m high. Root parasite. Themeda grassland or woodland often damp. Distribution limits N-Tweed Heads S-south of Eden.	x	x	-	-	-	x
Triplarina imbricata EPBC	E1	E	A shrub to 2.8m tall, flowers from Nov-Dec. Occurs in heath, often in damp places along creek lines; coast and adjacent ranges. Known from the Tabulum and Nymboida districts in NE NSW.	x	x	-	-	-	x

OEH	- Denotes species listed within 10km of the subject site on the *Atlas of NSW Wildlife*
EPBC	- Denotes species listed within 10km of the subject site in the *EPBC Act* habitat search
TBE	- Denotes additional species considered by *Travers bushfire & ecology* to have potential habitat based on regional knowledge and other records
V	- Denotes vulnerable listed species under the relevant Act
E or E1	- Denotes endangered listed species under the relevant Act
E4A/CE	- Denotes critically endangered listed species under the relevant Act
NOTE:	1. This field is not considered if no suitable habitat is present within the subject site 2. 'records' refer to those provided by the *Atlas of NSW Wildlife* 3. 'nearby' or 'recent' records are species specific accounting for home range, dispersal ability and life cycle

Table A2.2 provides an assessment of potential habitat within the subject site for state and nationally listed threatened fauna species recorded within 10km on the *Atlas of NSW Wildlife* (OEH) or indicated to have potential habitat present within 10km on the *EPBC Act* Protected Matters Tool.

Table A2.2 – Threatened fauna habitat assessment

Common name ***Scientific name*** DATABASE SOURCE	***BC Act***	***EPBC Act***	**Preferred habitat** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on-site**				**Further consideration required (✓)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Giant Burrowing Frog *Heleioporus australiacus* OEH EPBC	V	V	Inhabits open forests and riparian forests along non-perennial streams, digging burrows into sandy creek banks. *Distribution Limit: N-Near Singleton S-South of Eden.*	x	x	-	-	x	x
Stuttering Frog *Mixophyes balbus* EPBC	E	V	Terrestrial inhabitant of rainforest and wet sclerophyll forests. *Distribution Limit: N-near Tenterfield S-South of Bombala*.	x	x	-	-	x	x
Red-crowned Toadlet *Pseudophryne australis* OEH	V	-	Prefers sandstone areas, breeds in grass and debris beside non-perennial creeks or gutters. Individuals can also be found under logs and rocks in non-breeding periods. *Distribution Limit: N-Pokolbin. S-near Wollongong.*	x	x	-	-	x	x
Green and Golden Bell Frog *Litoria aurea* OEH EPBC	E	V	Prefers the edges of permanent water, streams, swamps, creeks, lagoons, farm dams and ornamental ponds. Often found under debris. *Distribution Limit: N-Byron Bay S-South of Eden.*	x	marginal	✓	x	Not likely	x

Common name ***Scientific name*** DATABASE SOURCE	***BC Act***	***EPBC Act***	**Preferred habitat** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on-site**				**Further consideration required (✓)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Littlejohn's Tree Frog *Litoria littlejohnii* EPBC	V	V	Found in wet and dry sclerophyll forest associated with sandstone outcrops at altitudes 280-1,000m on eastern slopes of Great Dividing Range. Prefers flowing rocky streams. *Distribution Limit: N-Hunter River S-Eden.*	x	x	-	-	x	x
Rosenberg's Goanna *Varanus rosenbergi* OEH	V	-	Hawkesbury sandstone outcrop specialist. Inhabits woodlands, dry open forests and heathland sheltering in burrows, hollow logs, rock crevices and outcrops. *Distribution Limit: N-Nr Broke. S-Nowra Located in scattered patches near Sydney, Nowra and Goulburn.*	x	x	-	-	x	x
Wompoo Fruit-dove *Ptilinopus magnificus* OEH	V	-	Inhabits large undisturbed patches of lowland and adjacent highland rainforest and moist eucalypt forests where it feeds on fruit. *Distribution Limit: N-Tweed Heads. S-Sydney.*	x	✓	✓	x	unlikely	✓
Superb Fruit-dove *Ptilinopus superbus* OEH	V	-	Rainforests, adjacent mangroves, eucalypt forests, scrubland with native fruits. *Distribution Limit: N-Border Ranges National Park. S-Bateman's Bay.*	x	✓	x	✓	unlikely	✓

Common name ***Scientific name*** DATABASE SOURCE	***BC Act***	***EPBC Act***	**Preferred habitat** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on-site**				**Further consideration required (✓)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
White-bellied Sea Eagle (*Haliaeetus leucogaster*) OEH	V	-	Occupies coasts, islands, estuaries, inlets, large rivers, inland lakes and reservoirs. *Sedentary; dispersive. N-Tweed Heads. S-South of Eden.*	x	marginal	✓	✓	unlikely	✓
Little Eagle *Hieraaetus morphnoides* OEH	V	-	Utilises plains, foothills, open forests, woodlands and scrublands; river red gums on watercourses and lakes. *Distribution Limit - N-Tweed Heads. S-South of Eden.*	x	✓	✓	✓	✓	✓
Square-tailed Kite *Lophoictinia isura* OEH	V	-	Utilises mostly coastal and sub-coastal open forest, woodland or lightly timbered habitats and inland habitats along watercourses and mallee that are rich in passerine birds. *Distribution Limit: N-Goondiwindi. S-South of Eden.*	x	✓	x	✓	unlikely	✓
Eastern Osprey *Pandion cristatus* OEH	V	-	Utilises waterbodies including coastal waters, inlets, lakes, estuaries and offshore islands with a dead tree for perching and feeding. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	x	x	-	-	x	x
Bush Stone-curlew *Burhinus grallarius* OEH	E	-	Utilises open forests and savannah woodlands, sometimes dune scrub, savannah and mangrove fringes. *Distribution Limit: N-Border Ranges National Park. S-Near Nowra.*	x	✓	✓	x	unlikely	✓

Common name ***Scientific name*** DATABASE SOURCE	***BC Act***	***EPBC Act***	**Preferred habitat** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on-site**				**Further consideration required (✓)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Australian Painted Snipe *Rostratula australis* OEH	E	E	Most numerous within the Murray-Darling basin and inland Australia within marshes and freshwater wetlands with swampy vegetation. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	x	x	-	-	x	x
Curlew Sandpiper *Callidris ferruginea* OEH EPBC	E	CE	Mainly coastal, but many inland feeding along tidal mudflats, salt marsh, salt fields, fresh, brackish or saline wetlands and sewerage ponds. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	x	x	-	-	x	x
Gang-gang Cockatoo *Callocephalon fimbriatum* OEH	V	-	Prefers wetter forests and woodlands from sea level to > 2,000m on the Great Dividing Range, timbered foothills and valleys, timbered watercourses, coastal scrubs, farmlands and suburban gardens. *Distribution Limit: mid north coast of NSW to western Victoria.*	x	x	-	-	x	x
Glossy Black-Cockatoo *Calyptorhynchus lathami* OEH	V	-	Open forests with *Allocasuarina* species and hollows for nesting. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	x	limited	✓	✓	low	✓

Common name ***Scientific name*** DATABASE SOURCE	***BC Act***	***EPBC Act***	**Preferred habitat** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on-site**				**Further consideration required (✓)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Little Lorikeet *Glossopsitta pusilla* OEH	V	-	Inhabits forests, woodlands; large trees in open country; timbered watercourses, shelterbeds, and street trees. *Distribution Limit: N-Tweed Heads. S-South of Eden*.	x	✓	✓	✓	✓	✓
Swift Parrot *Lathamus discolour* OEH EPBC	E	CE	Inhabits eucalypt forests and woodlands with winter flowering eucalypts. *Distribution Limit: N-Border Ranges National Park. S-South of Eden*.	x	✓	✓	x	unlikely	✓
Turquoise Parrot *Neophema pulchella* OEH	V	-	Inhabits coastal scrubland, open forest and timbered grassland, especially ecotones between dry hardwood forests and grasslands. *Distribution Limit: N-Near Tenterfield. S-South of Eden.*	x	x	-	-	x	x
Barking Owl *Ninox connivens* OEH	V	-	Inhabits principally woodlands but also open forests and partially cleared land and utilises hollows for nesting. *Distribution Limits: N-Border Ranges National Park. S-Eden.*	x	limited	✓	✓	low	✓
Powerful Owl *Ninox strenua* OEH	V	-	Forests containing mature trees for shelter or breeding and densely vegetated gullies for roosting. *Distribution Limits: N-Border Ranges National Park. S-Eden.*	✓	-	-	-	-	✓

Common name ***Scientific name*** DATABASE SOURCE	***BC Act***	***EPBC Act***	**Preferred habitat** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on-site**				**Further consideration required (✓)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Masked Owl *Tyto novaehollandiae* OEH	V	-	Open forest and woodlands with cleared areas for hunting and hollow trees or dense vegetation for roosting. *Distribution Limit: N-Border Ranges National Park. S-Eden.*	x	x	-	-	x	x
Sooty Owl *Tyto tenebricosa* OEH	V	-	Tall, dense, wet forests containing trees with very large hollows. *Distribution Limit: N-Border Ranges National Park. S-South of Eden.*	x	x	-	-	x	x
Eastern Bristlebird *Dasyornis brachypterus* EPBC	E	E	Coastal woodlands, dense scrubs and heathlands, especially where low heathland borders taller woodland or dense tall tea-tree. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	x	x	-	-	x	x
Regent Honeyeater *Xanthomyza Phrygia* OEH EPBC	E4A	CE	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. *Distribution Limit: N-Urbanville. S-Eden.*	x	marginal	x	x	Not likely	x
Painted Honeyeater *Grantiella picta* EPBC	V	V	A nomadic bird occurring in low densities within open forest, woodland and scrubland feeding on mistletoe fruits. Inhabits primarily Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. *Distribution Limit: N-Boggabilla. S-Albury with greatest occurrences on the inland slopes of the Great Dividing Range.*	x	x	-	-	x	x

Common name ***Scientific name*** DATABASE SOURCE	***BC Act***	***EPBC Act***	**Preferred habitat** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on-site**				**Further consideration required (✓)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Black-chinned Honeyeater *Melithreptus gularis gularis* OEH	V	-	Found in woodlands containing box-ironbark associations and River Red Gums, also drier coastal woodlands of the Cumberland Plain and Hunter Richmond and Clarence. *Distribution Limit: N-Cape York Pen. Qld. S-Victor H. Mt Lofty Ra & Flinders Ra. SA.*	x	x	-	-	x	x
Varied Sittella *Daphoenositta chrysoptera* OEH	V	-	Open eucalypt woodlands / forests (except heavier rainforests); mallee, inland acacia, coastal tea-tree scrubs; golf courses, shelterbelts, orchards, parks, scrubby gardens. *Distribution Limit: N-Border Ranges National Park. S-South of Eden*.	x	limited	x	✓	unlikely	✓
Dusky Woodswallow *Artamus cyanopterus cyanopterus* OEH	V	-	Found in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. It has also been recorded in shrublands and heathlands and various modified habitats, including regenerating forests; very occasionally in moist forests or rainforests. Prefers habitat with an open understorey. Often observed in farmland tree patches or roadside remnants. *Widespread in eastern, southern and southwestern Australia.*	x	x	-	-	x	x

Common name ***Scientific name*** DATABASE SOURCE	***BC Act***	***EPBC Act***	**Preferred habitat** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on-site**				**Further consideration required (✓)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Scarlet Robin *Petroica boodang* OEH	V	-	Found in foothill forests, woodlands, watercourses; in autumn-winter, more open habitats: river red gum woodlands, golf courses, parks, orchards, gardens. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	x	marginal	x	x	Not likely	x
Diamond Firetail *Stagonopleura guttata* OEH	V	-	Found in Eucalypt woodlands, forests and mallee where there is grassy understorey west of the Great Div. also drier coastal woodlands of the Cumberland Plain and Hunter Richmond and Clarence River Valleys. *Distribution Limit: N-Rockhampton Q. S-Eyre Pen Kangaroo Is. SA.*	x	x	-	-	x	x
Spotted-tailed Quoll *Dasyurus maculatus* OEH EPBC	V	E	Dry and moist open forests containing rock caves, hollow logs or trees. *Distribution Limit: N-Mt Warning National Park. S-South of Eden.*	x	x	-	-	x	x
Southern Brown Bandicoot *Isoodon obesulus* OEH EPBC	E	E	Utilises a range of habitats containing thick ground cover - open forest, woodland, heath, cleared land, urbanised areas and regenerating bushland. *Distribution Limit: N-Kempsey. S-South of Eden.*	x	x	-	-	x	x

Common name ***Scientific name*** DATABASE SOURCE	***BC Act***	***EPBC Act***	**Preferred habitat** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on-site**				**Further consideration required (✓)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Koala *Phascolarctos cinereus* OEH EPBC	V	V	Inhabits both wet and dry eucalypt forest on high nutrient soils containing preferred feed trees. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	x	x	-	-	x	x
Eastern Pygmy Possum *Cercatetus nanus* OEH	V	-	Found in a variety of habitats from rainforest through open forest to heath. Feeds on insects but also gathers pollen from banksias, eucalypts and bottlebrushes. Nests in banksias and myrtaceous shrubs. *Distribution Limit: N-Tweed Heads. S-Eden.*	x	x	-	-	x	x
Squirrel Glider *Petaurus norfolcensis* OEH	V	-	Mixed aged stands of eucalypt forest & woodlands including gum barked & high nectar producing species & hollow bearing trees. *Distribution Limit: N-Tweed Heads. S-Albury.*	x	marginal	x	x	Not likely	x
Greater Glider *Petauroides volans* EPBC	-	V	Favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species. Population density is optimal at elevation levels at 845 m above sea level. Prefer overstorey basal areas in old-growth tree stands. Highest abundance typically in taller, montane, moist eucalypt forests, with relatively old trees and abundant hollows *Distribution Limit: N-Border Ranges National Park. S- South of Eden.*	x	x	-	-	x	x

Common name ***Scientific name*** DATABASE SOURCE	***BC Act***	***EPBC Act***	**Preferred habitat** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on-site**				**Further consideration required (✓)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Brush-tailed Rock-wallaby *Petrogale penicillata* EPBC	E	V	Found in rocky gorges with a vegetation of rainforest or open forests to isolated rocky outcrops in semi-arid woodland country. *Distribution Limit: N-North of Tenterfield. S-Bombala.*	x	x	-	-	x	x
Grey-headed Flying-fox *Pteropus poliocephalus* OEH EPBC	V	V	Found in a variety of habitats including rainforest, mangroves, paperbark swamp, wet and dry open forest and cultivated areas. Forms camps commonly found in gullies and in vegetation with a dense canopy. *Distribution Limit: N-Tweed Heads. S-Eden.*	✓	-	-	-	-	✓
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris* OEH	V	-	Rainforests, sclerophyll forests and woodlands. *Distribution Limit: N-North of Walgett. S-Sydney.*	x	Sub-optimal	x	x	unlikely	✓
East-coast Freetail Bat *Micronomus norfolkensis* OEH	V	-	Inhabits open forests and woodlands foraging above the canopy and along the edge of forests. Roosts in tree hollows, under bark and buildings. *Distribution Limit: N-Woodenbong. S-Pambula.*	x	✓	x	x	low	✓

Common name ***Scientific name*** DATABASE SOURCE	***BC Act***	***EPBC Act***	**Preferred habitat** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on-site**				**Further consideration required (✓)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Large-eared Pied Bat *Chalinolobus dwyeri* OEH EPBC	V	V	Warm-temperate to subtropical dry sclerophyll forest and woodland. Roosts in caves, tunnels and tree hollows in colonies of up to 30 animals. *Distribution Limit: N-Border Ranges National Park. S-Wollongong.*	x	✓	x	✓	unlikely	✓
Eastern Falsistrelle *Falsistrellus tasmaniensis* OEH	V	-	Recorded roosting in caves, old buildings and tree hollows. *Distribution Limit: N-Border Ranges National Park. S-Pambula.*	x	✓	x	x	Not likely	x
Little Bentwing-bat *Miniopterus australis* OEH	V	-	Roosts in caves, old buildings and structures in the higher rainfall forests along the south coast of Australia. *Distribution Limit: N-Border Ranges National Park. S-Sydney.*	x	✓	✓	✓	✓	✓
Eastern Bentwing-bat *Miniopterus orianae oceanensis* OEH	V	-	Prefers areas where there are caves, old mines, old buildings, stormwater drains and well-timbered areas. *Distribution Limit: N-Border Ranges National Park. S-South of Eden.*	x	✓	✓	✓	✓	✓

Common name ***Scientific name*** DATABASE SOURCE	***BC Act***	***EPBC Act***	**Preferred habitat** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on-site**				**Further consideration required (✓)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Large-footed Myotis *Myotis macropus* OEH	V	-	Roosts in caves, mines, tunnels, buildings, tree hollows and under bridges. Forages over open water. *Distribution limits: N-Border Ranges National Park. S-South of Eden.*	x	✓	✓	✓	✓	✓
Greater Broad-nosed Bat *Scoteanax rueppellii* OEH	V	-	Inhabits areas containing moist river and creek systems, especially tree lined creeks. *Distribution Limit: N-Border Ranges National Park. S-Pambula.*	x	✓	x	✓	unlikely	✓
New Holland Mouse *Pseudomys novaehollandiae* EPBC	-	V	Occurs in heathlands, woodlands, open forest and paperbark swamps and on sandy, loamy or rocky soils. Coastal populations have a marked preference for sandy substrates, a heathy understorey of leguminous shrubs less than 1m high and sparse ground litter. Recolonise of regenerating burnt areas. *Distribution Limit: N-Border Ranges National Park. S-South of Eden.*	x	x	-	-	x	x

Common name *Scientific name* DATABASE SOURCE	*BC Act*	*EPBC Act*	Preferred habitat *Distribution limit*	Recorded on site (✓)	If not recorded on-site				Further consideration required (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Macquarie Perch *Macquaria australasica* EPBC	V (FM Act 1994)	E	Occurs in south east Australia at moderate to high altitudes in rivers and reservoirs. Historical records show the species was widespread and abundant in the upper reaches of the Lachlan, Murrumbidgee and Murray Rivers and their tributaries. Allen (1989) states that introduced populations are present in Nepean River and water supply dams in the Sydney area. Occurs in lakes and flowing streams, usually in deep holes.	x	x	-	-	x	x
Australian Greyling *Prototroctes maraena* EPBC	Part 2, Section 19 – Protected Fish (FM Act 1994)	V	Clear, moderate to fast flowing water in the upper reaches of rivers (sometimes to altitudes above 1,000m). Typically found in gravel bottom pools. Often forming aggregations below barriers to upstream movement (e.g. weirs, waterfalls).	x	x	-	-	x	x

OEH	-	Denotes species listed within 10km of the subject site on the *Atlas of NSW Wildlife*
EPBC	-	Denotes species listed within 10km of the subject site in the *EPBC Act* habitat search
V	-	Denotes vulnerable listed species under the relevant Act
E	-	Denotes endangered listed species under the relevant Act
E4A/CE	-	Denotes critically endangered listed species under the relevant Act
NOTE:	1.	This field is not considered if no suitable habitat is present within the subject site
	2.	'records' refer to those provided by the *Atlas of NSW Wildlife*
	3.	'nearby' or 'recent' records are species specific accounting for home range, dispersal ability and life cycle

Table A2.3 provides an assessment of potential habitat within the subject site for nationally *protected* migratory fauna species recorded within 10km on the *EPBC Act* Protected Matters Tool. Nationally *threatened* migratory species are considered in Table A2.2.

Table A2.3 – Migratory fauna habitat assessment

Common name ***Scientific name***	**Preferred habitat** ***Migratory breeding***	**Suitable habitat present (✓)**	**Recorded on site (✓)**	**Comments**
Oriental Cuckoo (*Cuculus optatus*)	It mainly inhabits forests, occurring in coniferous, deciduous and mixed forest. It feeds mainly on insects and their larvae, foraging for them in trees and bushes as well as on the ground.	×	-	
White-throated Needletail (*Hirundapus caudacutus*)	Airspace over forests, woodlands, farmlands, plains, lakes, coasts, towns; companies forage often along favoured hilltops and timbered ranges. *Breeds Siberia, Himalayas, east to Japan. Summer migrant to eastern Australia.*	✓	×	
Black-faced Monarch (*Monarcha melanopsis*)	Rainforests, eucalypt woodlands; coastal scrubs; damp gullies in rainforest, eucalypt forest; more open woodland when migrating. *Summer breeding migrant to coastal south east Australia, otherwise uncommon*.	×	-	
Spectacled Monarch (*Monarcha trivirgatus*)	Understorey of mountain / lowland rainforest, thickly wooded gullies, waterside vegetation, mostly well below canopy. *Summer breeding migrant to south-east Qld and north-east NSW down to Port Stephens from Sept/Oct to May. Uncommon in southern part of range.*	×	-	
Satin Flycatcher (*Myiagra cyanoleuca*)	Heavily vegetated gullies in forests, taller woodlands, usually above shrub-layer; during migration, coastal forests, woodlands, mangroves, trees in open country, gardens. *Breeds mostly south east Australia and Tasmania over warmer months, winters in north east Qld.*	×	-	
Rufous Fantail (*Rhipidura rufifrons*)	Undergrowth of rainforests / wetter eucalypt forests / gullies; monsoon forests, paperbarks, sub-inland and coastal scrubs; mangroves, watercourses; parks, gardens. On migration, farms, streets buildings. *Breeding migrant to south east Australia over warmer months. Altitudinal migrant in north east NSW in mountain forests during warmer months.*	×	-	
Yellow Wagtail (*Motacilla flava*)	The yellow wagtail typically forages in damp grassland and on relatively bare open ground at edges of rivers, lakes and wetlands, but also feeds in dry grassland and in fields of cereal crops.	×	-	

Significance of Impact Test

A3

Section 7.3 of the *BC Act* requires a determination as to whether a development or activity is likely to significantly affect threatened species or ecological communities, or their habitats. Henceforth this is referred to as the 'Significance of Impact Test'.

For the purposes of this part, development or an activity is likely to significantly affect threatened species if:

(a) it is likely to significantly affect threatened species or ecological communities, or their habitats, according to the test in Section 7.3, or
(b) the development exceeds the biodiversity offsets scheme threshold if the biodiversity offsets scheme applies to the impacts of the development on biodiversity values, or
(c) it is carried out in a declared area of outstanding biodiversity value.

Section 7.3 of the *BC Act* provides the terms of the test for determining whether proposed development or activity likely to significantly affect threatened species or ecological communities, or their habitats.

The following significance of impact test relies on the biodiversity assessment provided in this report and should be read making reference to the relevant discussion on each threatened species or their habitats, endangered population and ecological community.

Flora investigations and fauna habitat assessments of the study area have resulted in the identification of suitable habitat for the following threatened species and populations with varying potential to occur. Species recorded or with a considered potential to occur have been noted. The potential for any direct or indirect impacts on these species has also been considered and noted.

Threatened flora

Scientific name	*BC Act*	Potential to occur	Potential impact
Eucalyptus scoparia	E1	recorded on site (planted)	No impact
Syzygium paniculatum	V	recorded on site (planted)	No impact

Threatened ecological communities

None present

Threatened fauna

Common name	*BC Act*	Potential to occur	Potential impact
Powerful Owl	V	recorded	Direct – on potential roosting and foraging habitat
Grey-headed Flying-fox	V	recorded	Direct – on recorded foraging habitat
Little Bentwing-bat	V	recorded	Direct – on unlikely roosting habitat
Little Eagle	V	✓	None anticipated
Little Lorikeet	V	✓	Direct – on potential roosting, breeding and foraging habitat
Eastern Bentwing-bat	V	✓	Direct – on unlikely roosting habitat
Large-footed Myotis	V	✓	Direct – on unlikely roosting habitat
Glossy Black-Cockatoo	V	low	None anticipated
Barking Owl	V	low	None anticipated
East-coast Freetail Bat	V	low	None anticipated
Wompoo Fruit-dove	V	unlikely	None anticipated
Superb Fruit-dove	V	unlikely	None anticipated
White-bellied Sea Eagle	V	unlikely	None anticipated
Square-tailed Kite	V	unlikely	None anticipated
Bush Stone-curlew	E	unlikely	None anticipated
Swift Parrot	E	unlikely	None anticipated
Varied Sittella	V	unlikely	None anticipated
Yellow-bellied Sheathtail-bat	V	unlikely	None anticipated
Large-eared Pied Bat	V	unlikely	None anticipated
Greater Broad-nosed Bat	V	unlikely	None anticipated

Endangered populations

- None for flora
- None for fauna

BC ACT 2016 - SECTION 7.3 – SIGNIFICANCE OF IMPACT TEST

Test for determining whether proposed development or activity likely to significantly affect threatened species or ecological communities, or their habitats. The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:

a) In the case of a threatened species, whether the proposed development or activity 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,

The direct and indirect impacts of the proposal are considered within Section 5.2.

With consideration to the relative direct and indirect impacts on all threatened species with varying potential to occur, it is considered that the proposal is unlikely to disrupt the life cycle for any of these listed species such that a viable local population would be placed at risk of extinction. Species recorded present during survey, previously recorded nearby or with high potential to occur and requiring further discussion given potential impacts are further discussed in detail below.

Summary of threatened species recorded

Eucalyptus scoparia
This species occurs in Queensland and reaches its southern limit in New South Wales, where it has only recently been discovered. In New South Wales, it is found on well drained granitic hilltops, slopes and outcrops, often as scattered trees in open forest and woodland. There are only three known natural locations within NSW, all near Tenterfield in the far northern New England Tableland Bioregion. The specimen observed within the study area is well outside its natural distribution and was planted on site, as many of this species were as feature or street trees. It is therefore considered that the likelihood of an impacted naturally occurring population of *Eucalyptus scoparia* is unlikely.

Syzygium paniculatum
This species occurs in subtropical and littoral rainforest on sandy soil, from Forster to Jervis Bay. Given that the study area contains no potential habitat for this species, and the highly managed nature of the vegetation within the site, it is considered that the specimens observed within the study area are well outside the natural distribution of the species and was planted on site. It is therefore considered that the likelihood of an impacted naturally occurring population of *Syzygium paniculatum* is unlikely.

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

Grey-Headed Flying-foxes are canopy feeding frugivores and nectarivores, inhabiting a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas. This species roosts in camps, which may contain tens of thousands of individuals.

A single individual Grey-headed Flying-fox was heard foraging within the centre of the study area but was not observed when this area was later approached. Lemon-scented Gum was in heavy flower at this time within the site and the recorded location on Figure 3 is the suspected foraging tree. Foraging of other trees within the study area is expected on a seasonal basis. There is no likelihood of this species utilising the site for roosting and subsequent breeding habitat. Foraging habitat is otherwise well represented in the surrounding locality such that removal of habitat will not significantly impact on a local population. It is recommended that foraging habitat is replaced by locally native flowering eucalypts within landscaping areas.

Powerful Owl *(Ninox strenua)*

The Powerful Owl inhabits mature rainforest and wet and dry eucalypt forest. Optimal habitat includes a tall shrub layer and abundant hollows supporting high densities of arboreal mammals. Roosting is generally within dense foliage of mid-canopy trees in sheltered gullies. Large trees with hollows at least 45cm in diameter and 100cm deep are required for nesting. Mated pairs of Powerful Owl roost together or separately, maintaining several roost sites throughout their territory, which are used in rotation (Lindsey 1992), shifting with the availability of prey. A pair is generally faithful to a traditional nesting hollow. Powerful Owls form pairs for life, and are strongly territorial. Estimates of the home range of this species vary greatly, but territories are thought to range from 800 to 1500 hectares (Kavanagh 1997).

A Powerful Owl was observed perching on the corner of the tennis court fence during spotlighting of the study area. This was approximately 30 minutes after call-playback was undertaken. Based on this and the selected roosting location the individual had no doubt flowing into the study area as a response to the call-playback. The individual did not however respond by call.

The natural patch of vegetation in the north-eastern corner of the study area provides good roosting habitat for this species. A diurnal inspection of this area found no evidence of roosting activity during the current breeding period. Preferred prey species Common Ringtail Possum and Grey-headed Flying-fox were also recorded and therefore the study area also provides suitable foraging habitat.

Given that the study does not support any likely breeding habitat and the site is not being utilised for roosting during the breeding period, it is considered that the proposal is unlikely to significantly impact on any important habitat for the local breeding pair.

Little Bentwing-bat *(Miniopterus australis)*

The Little Bentwing-bat forages below the canopy within open forests and woodlands, feeding on small insects (Dwyer 1995b). This species roosts in caves, tunnels, tree hollows and occasionally old buildings (Dwyer 1995b). Caves are an important resource for this species, particularly for breeding where maternity caves must have suitable temperature, humidity and physical dimensions to permit breeding (Dwyer 1995b). One record exists of this species utilising a tree hollow however hollows are not currently considered as preferred habitat for this species (pers. com. Brad Law).

The Little Bentwing-bat was recorded only from a single recorded pass during overnight ultrasonic recording in the central courtyard. This species was also not recorded at the other recorder locations. The study area may provide suitable roosting habitat within the existing structures but no more so than any other structures in the locality and this is also not expected based on the survey results. Furthermore, such structure roosting would not be utilised for important breeding habitat. It is expected that the study area would support only foraging habitat for this species, which is otherwise well represented in the locality. Therefore the Little Bentwing-bat will not likely be significantly impacted by the proposal.

b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

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

No TECs occur within the subject site.

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,

No TECs occur within the subject site.

c) In relation to the habitat of threatened species or ecological community:

It is considered that the habitat attributes of the subject site provide known or potential habitat for Powerful Owl, Grey-headed Flying-fox, Little Bentwing-bat, Little Eagle, Little Lorikeet, Eastern Bentwing-bat, Large-footed Myotis, Glossy Black-Cockatoo, Barking Owl, East-coast Freetail Bat, Wompoo Fruit-dove, Superb Fruit-dove, White-bellied Sea Eagle, Square-tailed Kite, Bush Stone-curlew, Swift Parrot, Varied Sittella, Yellow-bellied Sheathtail-bat, Large-eared Pied Bat and Greater Broad-nosed Bat.

i. The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

The subject site has an area of 4.1ha, which comprises approximately 0.02ha of natural vegetation. Hollows within the managed landscape also provide potential habitat. Otherwise the remaining structures provide low potential artificial habitat. The structures and some trees containing small hollows will be removed. The native vegetation patch will likely remain mostly undisturbed.

ii. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

The study area does not contribute to any important connectivity values in the local or regional scale. The vegetation present is isolated from any such contiguous habitat and is already highly fragmented within the local urban / industrial landscape. Having said this the vegetation present may combine with adjacent narrow drainages to provide a stepping-stone or temporary refuge habitat for locally occurring threatened fauna species.

Therefore, it is considered that known habitat for a threatened species, population or ecological community within the local area and region is unlikely to become isolated or fragmented as a result of the proposal.

iii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

In respect to threatened fauna species recorded or with potential to occur the proposed area of impact is not likely of high quality, of any breeding importance or central to the home range requirements of any species such that behaviour or ecology of these species will be significantly altered in any way.

The proposed development is unlikely to impact on the site's existing natural habitats and the recorded hollows that will be removed are unlikely of threatened fauna species value.

Therefore the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population and ecological communities in the locality is considered to be minimal.

d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The subject site is not within any declared area of outstanding biodiversity value. Therefore the proposal will not have any adverse effects on any declared area of outstanding biodiversity value (either directly or indirectly).

e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

A key threatening process is defined as a process that threatens, or could threaten, the survival or evolutionary development of species, populations or ecological communities.

The current list of key threatening processes, and whether the proposed activity is recognised as a threatening process, is shown below.

Listed key threatening process (as described in the final determination of the Scientific Committee to list the threatening process)	Is the development or activity proposed of a class of development or activity that is recognised as a threatening process?		
	Likely	**Possible**	**Unlikely**
Aggressive exclusion of birds by Noisy Miners (*Manorina melanocephala*)			✓
Alteration of habitat following subsidence due to longwall mining			✓
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands			✓
Anthropogenic Climate Change			✓
Bushrock removal			✓
Clearing of native vegetation	✓		
Competition and habitat degradation by feral goats			✓
Competition and grazing by the feral European Rabbit (*Oryctolagus cuniculus*)		✓	
Competition from feral honeybees			✓
Death or injury to marine species following capture in shark control programs on ocean beaches			✓
Entanglement in, or ingestion of anthropogenic debris in marine and estuarine environments			✓
Forest Eucalypt dieback associated with over-abundant psyllids and bell miners			✓
High frequency fire resulting in the disruption of life-cycle processes in plants and animals and loss of vegetation structure and composition			✓
Herbivory and environmental degradation caused by feral deer			✓
Importation of red imported fire ants into NSW			✓
Infection by *Psittacine circoviral* (beak and feather) disease affecting endangered psittacine species and populations			✓
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis			✓
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae		✓	
Infection of native plants by *Phytophthora cinnamomi*		✓	
Introduction of the large earth bumblebee (*Bombus terrestris*)			✓
Invasion and establishment of exotic vines and scramblers		✓	
Invasion and establishment of Scotch Broom (*Cytisus scoparius*)		✓	
Invasion and establishment of the Cane Toad (*Bufo marinus*)			✓
Invasion, establishment and spread of *Lantana camara*		✓	
Invasion of native plant communities by bitou bush & boneseed *Chrysanthemoides monilifera*			✓
Invasion of native plant communities by exotic perennial grasses		✓	

Listed key threatening process (as described in the final determination of the Scientific Committee to list the threatening process)	Is the development or activity proposed of a class of development or activity that is recognised as a threatening process?		
	Likely	**Possible**	**Unlikely**
Invasion of native plant communities by African Olive (*Olea europaea* subsp. *cuspidata*)			✓
Invasion of the Yellow Crazy Ant (*Anoplolepis gracilipes*)			✓
Loss of Hollow-bearing trees	✓		
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants		✓	
Loss and/or degradation of sites used for hill-topping by butterflies			✓
Predation and hybridisation by feral dogs (*Canis lupus familiaris*)			✓
Predation by the European Red Fox (*Vulpes vulpes*)			✓
Predation by the Feral Cat (*Felis catus*)			✓
Predation by Gambusia holbrooki Girard, 1859 (plague minnow or mosquito fish)			✓
Predation by the Ship Rat (*Rattus rattus*) on Lord Howe Island			✓
Predation, habitat degradation, competition & disease transmission from Feral pigs (*Sus scofa*)			✓
Removal of dead wood and dead trees		✓	

The above key threatening processes have been considered in reference to the proposal. It was considered that the proposal may contribute to a small degree to a number these processes as described below. It was not considered that the proposal will have a large or significant impact on any of the following key threatening processes. Some mitigation measures have been listed under each process to minimise or reduce such impacts upon those processes.

Summary of "likely" or "possible" Key Threatening Processes

This section identifies what mitigation measures can be implemented to address threatening processes.

Clearing of native vegetation

The proposal is of a class of development recognised as a threatening process. It is generally recommended that all sites should aim to achieve a maintain or improve outcome on the quality and quantity of native vegetation cover through protection and restoration measures. The vegetation management process is to be undertaken in accordance with the conditions of consent and any required vegetation and tree management plans for the proposed development. Offsetting the loss of native vegetation including trees is to be considered as part of the proposed works. The removal of native vegetation on the subject site is not likely to significantly affect the biodiversity of the local area due to the extent of better quality natural vegetation within the local area and the small area of vegetation to be removed.

Invasion and establishment of exotic vines and scramblers

The subject site currently contains exotic vine and scrambler species such as *Ipomoea indica* (Morning Glory), *Araujia sericifera* (Mothvine) and *Tradescantia fluminensis* (Wandering Jew). The proposed development will provide an opportunity to remove, control and possibly eradicate these species within the subject site. This will result in a beneficial outcome by reducing the likelihood of this Key Threatening Process (KTP) from impacting on the site.

Competition and grazing by the feral European rabbit

It is expected that the proposed development will increase or decrease the potential for rabbit invasion. Rabbit management and control such as through exclusion fencing, destruction of warrens and target "Pindone" baiting is recommended as a standard protocol.

Infection of native plants by Phytophthora cinnamomi

The proposal may temporarily increase the risk of fungal infection on site as it may be spread via vehicular movement and relocation of soil and vegetation. Consequently standard *Phytophthora cinnamomi* protocol applies to the cleaning of all plant, equipment, hand tools and work boots prior to delivery onsite to ensure that there is no loose soil or vegetation material caught under or on the equipment and within the tread of vehicle tyres or tracks. Any equipment found to contain soil or vegetation material from offsite is to be cleaned in a quarantined work area or wash station and treated with anti-fungal pesticides prior to commencing work.

Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae

'Myrtle Rust' may be spread via machinery, animals and humans as well as by environmental factors such as wind. The presence of machinery and construction works is likely to slightly increase the potential for spread of this key threatening process. Similar protocols as to *Phytophthora cinnamomi* should be applied.

Invasion and establishment of Scotch Broom (Cytisus scoparius)

The site currently contains this species, however it is expected that the proposed development will provide an opportunity to remove, control and manage this species throughout the whole of the site by the application of a bushland management plan or weed control program.

Invasion, establishment and spread of Lantana camara

The site currently contains this species, however it is expected that the proposed development will provide an opportunity to remove, control and manage this species throughout the whole of the site by the application of a bushland management plan or weed control program.

Invasion of native plant communities by exotic perennial grasses

The proposal is of a class of development recognised as a threatening process due to possible incursions of grasses such as *Ehrharta erecta* (Panic Veldtgrass), *Paspalum urvillei* (Vasey Grass), *Pennisetum clandestinum* (Kikuyu) and *Stenotaphrum secundatum* (Buffalo Grass). However the vegetation within the subject site is of a degraded nature and the proposed development is not expected to significantly increase the prevalence of exotic

perennial grasses. It is expected that the proposed development will decrease the number of exotic grass species and will provide an opportunity to manage the area with regard to weed invasion.

Loss of hollow-bearing trees

Hollow-bearing tree surveys identified one medium (10-30cm) and otherwise small (0-10cm) sized hollows within the subject site. The proposal will require the removal of some of these hollow-bearing trees and as such is of a class of development recognised as a threatening process. These hollows are not expected to provide threatened fauna species habitat value. The replacement of hollows within the retained bushland areas of the study area is recommended to supplement the loss of tree hollows.

Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants

The proposal is of a class of development recognised as a threatening process due to possible incursions of escaped garden plants. However the vegetation within the subject site is of a degraded nature and the proposed development is not expected to significantly increase the prevalence of escaped garden plants. It is recommended that future landscaping work use naturally-occurring, local plant species to minimise the chance of invasion by escaped garden plants.

National - Significant Impact Criteria

A4

Under the EPBC Act an action will require approval from the Australian Government Environment Minister if the action has, will have, or is likely to have, a significant impact on a matter of national environmental significance. The following significant impact criteria were sourced from the EPBC Act Policy Statement 1.1 (May 2006):

CRITICALLY ENDANGERED AND ENDANGERED SPECIES

Significant impact criteria

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

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

>> What is a population of a species?

A 'population of a species' is defined under the EPBC Act as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:
- a geographically distinct regional population, or collection of local populations; or
- a population, or collection of local populations, that occurs within a particular bioregion.

>> What is habitat critical to the survival of a species or ecological community?

'Habitat critical to the survival of a species or ecological community' refers to areas that are necessary:
- For activities such as foraging, breeding, roosting, or dispersal;
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- To maintain genetic diversity and long term evolutionary development; or
- For the reintroduction of populations or recovery of the species or ecological community.

Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act.

VULNERABLE SPECIES

Significant impact criteria

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

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

>> What is an important population of a species?

An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- Key source populations either for breeding or dispersal;
- Populations that are necessary for maintaining genetic diversity; and/or
- Populations that are near the limit of the species range.

CRITICALLY ENDANGERED AND ENDANGERED ECOLOGICAL COMMUNITIES

Significant impact criteria

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

- Reduce the extent of an ecological community;
- Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines;
- Adversely affect habitat critical to the survival of an ecological community;
- Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns;
- Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting;
- Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:
  - assisting invasive species, that are harmful to the listed ecological community, to become established; or
  - 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; or
- Interfere with the recovery of an ecological community.

MIGRATORY SPECIES

Significant impact criteria

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

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

>> What is important habitat for a migratory species?

An area of 'important habitat' for a migratory species is:

a) Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or
b) Habitat that is of critical importance to the species at particular life-cycle stages; and/or
c) Habitat utilised by a migratory species which is at the limit of the species range; and/or
d) Habitat within an area where the species is declining.

>> What is an ecologically significant proportion?

Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore, what is an 'ecologically significant proportion' of the population varies with the species (each circumstance will need to be evaluated). Some factors that should be considered include the species' population status, genetic distinctiveness and species specific behavioural patterns (for example, site fidelity and dispersal rates).

>> What is the population of a migratory species?

'Population', in relation to migratory species, means the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries including Australia.