FLORA and FAUNA

survey and assessment

Proposed rezoning and development,
Lot 4A, 5A, 6A and 7A DP 17157, Part of Lot 1 in DP 325720 and Part of Lot 1 in DP 325784,
Gurney Crescent, Seaforth, NSW

May 2019

Lesnok ENVIRONMENTAL

Cover photographs:

Left: Character of the disturbed scrub that occurs within the subject site.
Right: Character of the cleared/slashed grassed area that dominates the proposed Lots.
Photo taken looking west.

Report produced at the request of:

APP Corporation Pty. Limited

on behalf of the

NSW Ministry of Health

by

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			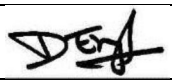	
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			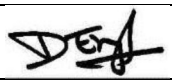	
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			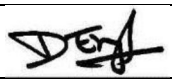	

This report is prepared in accordance with both the 6th Edition of the Commonwealth of Australia (2002) Style Manual.

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Glossary

Abbreviation	Definition
^{0}C	Degrees Celsius
AOBV	Areas Of Outstanding Biodiversity Value
APZ	Asset Protection Zone
ASL	Above Sea Level
BAM	Biodiversity Assessment Method
BC Act	NSW *Biodiversity Conservation Act 2016*
BDAR	Biodiversity Development Assessment Report
BOS	Biodiversity Offsets Scheme
CBD	Central Business District
DE	Commonwealth Department of the Environment (now known as the Commonwealth Department of the Environment and Energy)
DEC	NSW Department of Environment and Conservation (now known as the NSW Office of Environment and Heritage)
DECC	NSW Department of Environment and Climate Change (now known as the NSW Office of Environment and Heritage)
DEE	Commonwealth Department of the Environment and Energy
DP	Deposited Plan
DP&E	Department of Planning and Environment
DPI	NSW Department of Primary Industries
EEC	Endangered Ecological Community
EPA Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
GPS	Global Positioning System[1]
ha	hectares
KTP	Key Threatening Process
LEP	Local Environment Plan
Lesryk	Lesryk Environmental Pty Ltd
LGA	Local Government Area
LLS	Local Land Services
mm/cm/m/m^2/km	Millimetres, centimetres, metres, square metres, kilometres
MNES	Matter of National Environmental Significance
NP	National Park
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
PMST	Protected Matters Search Tool
RoTAP	Rare of Threatened Australian Plant
SEPP	State Environmental Planning Policy
VMP	Vegetation Management Plan
WoNS	Weeds of National Significance

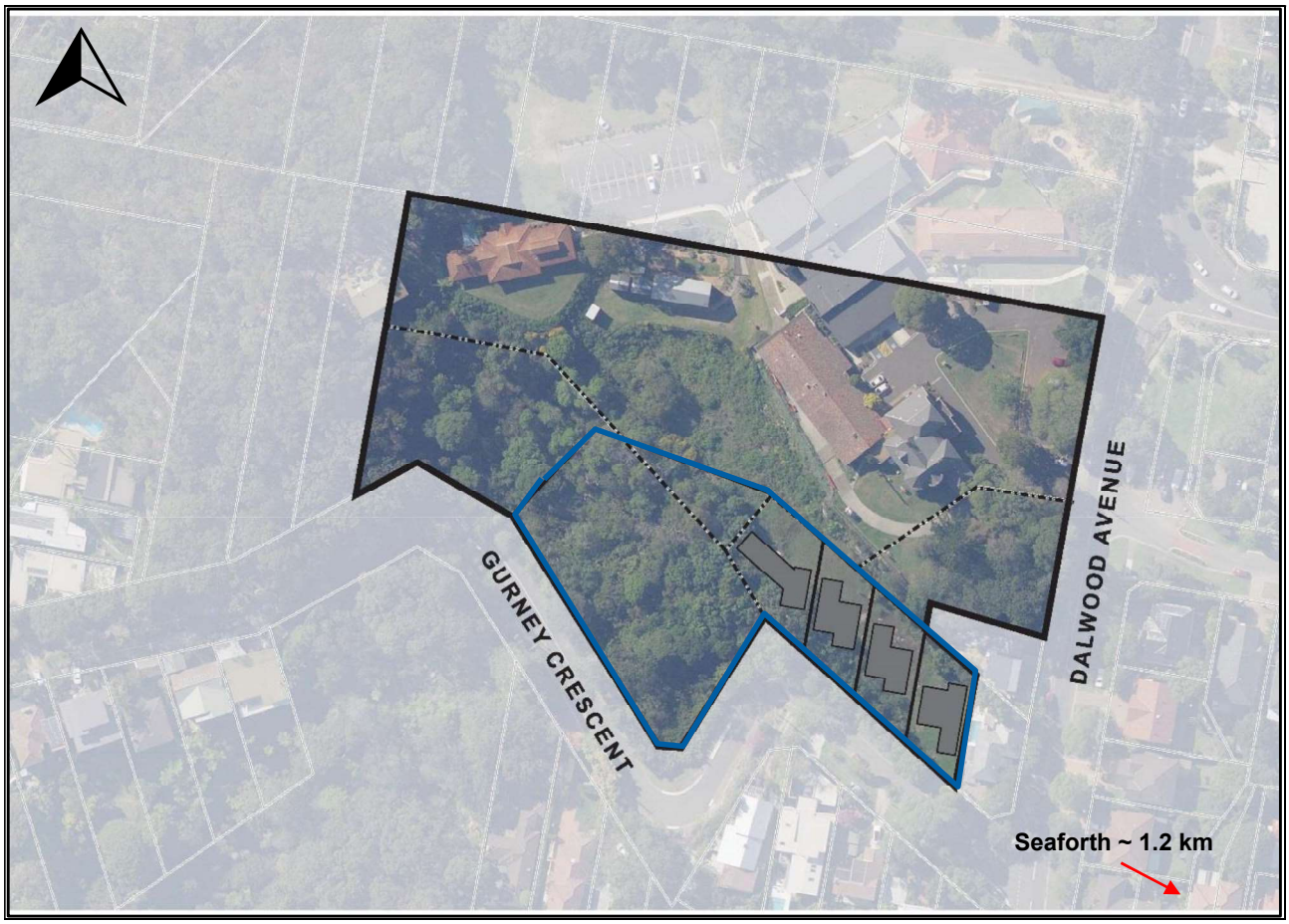
[1] Coordinate system used: WGS84 ± 5 m to 10 m.

For the purpose of this investigation:

Areas of outstanding biodiversity	An area of outstanding biodiversity value is: o an area important at a State, national or global scale, and o an area that makes a significant contribution to the persistence of at least one of the following: i. multiple species or at least one threatened species or ecological community ii. irreplaceable biological distinctiveness iii. ecological processes or ecological integrity iv. outstanding ecological value for education or scientific research. o The declaration of an area may relate, but is not limited, to protecting threatened species or ecological communities, connectivity, climate refuges and migratory species (BC Act).
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: o key source populations either for breeding or dispersal o populations that are necessary for maintaining genetic diversity, and/or o populations that are near the limit of the species range (DE 2013).
Local population (in regards to a threatened species)	Comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area (DECC 2007).
Invasive species	Is an introduced species, including an introduced (translocated) native species, which out-competes native species for space and resources, or which is a predator of native species. Introducing an invasive species into an area may result in that species becoming established. An invasive species may harm listed threatened species or ecological communities by direct competition, modification of habitat or predation.
Proposal	Is considered to include 'all activities likely to be undertaken within the subject site to achieve the objective of the proposed development' (DECC 2007).
Subject site	Means the area directly affected by the proposal. The subject site includes the footprint of the proposal and any ancillary works, facilities, accesses or hazard reduction zones that support the construction or operation of the development or activity (OEH 2018).
Study area	Means the subject site and any additional areas which are likely to be affected by the proposal, either directly or indirectly (OEH 2018).
Study region	Is considered to 'include the lands that surround the subject site for a distance of 10 km' (DECC 2007).
Direct impacts	Are those that directly affect the habitat of species and ecological communities and of individuals using the study area. They include, but are not limited to, death through predation, trampling, poisoning of the animal/plant itself and the removal of suitable habitat (OEH 2018).
Indirect impacts	Occur when project-related activities affect species or ecological communities in a manner other than direct loss within the subject site. Indirect impacts may sterilise or reduce the habitability of adjacent or connected habitats. 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, reduction in viability of adjacent habitat due to edge effects, deleterious hydrological changes, increased soil salinity, erosion, inhibition of nitrogen fixation, weed invasion, noise, light spill, fertiliser drift, or increased human activity within or directly adjacent to sensitive habitat areas (OEH 2018).

1. Introduction

At the request of APP Corporation Pty. Ltd, on behalf of the NSW Ministry of Health, a flora and fauna investigation has been carried out across Lots 4A, 5A, 6A and 7A DP 17157, Part of Lot 1 in DP 325720 and Part of Lot 1 in DP 325784 Gurney Crescent, Seaforth, NSW (Figure 1). These lots are located in the southern portion of the 3.7 ha Dalwood Home Site, this being owned and managed by the Northern Sydney Local Health District. The Dalwood Home site contains a range of historic and contemporary buildings utilised for child and family health services and related community purposes.



Not to scale: Source: APP Corporation Pty Ltd

Figure 1. Subject site [delineated by blue lines] and study area.

The investigation has been conducted in order to accompany a Planning Proposal to Northern Beaches Council in support of an amendment to Manly LEP 2013. The proposed amendment includes rezoning of the land from part SP2 Infrastructure (Health Services Facilities) and part E2 Environmental Conservation to part R2 Low Density Residential and part E4 Environmental Living. The rezoning will enable the establishment of four (4) new detached dwellings on each of the lots (indicative footprint of each dwelling shown on Figure 1).

This proposal does not trigger the BOS as it does not cover an area mapped on the Biodiversity Values map, and the amount of native vegetation likely to be cleared in association with this proposal would not exceed the threshold above which the BAM and offsets scheme apply (i.e. potential for 0.5 ha over 1 to < 40 ha). Therefore, the preparation of a BDAR does not need to be undertaken as part of the proposal.

The assessment of possible impacts associated with the proposal is based on a field investigation of the subject site, a literature review of previous studies undertaken in both the region and this portion of the Northern Beaches Council LGA, the consultation of standard databases and a consideration of the objectives of the EPBC Act, EPA Act, BC Act and any relevant SEPP.

2. Legislative requirements

A number of Commonwealth, State and local Acts, policies and documents are relevant to the proposal and its possible impact on the ecology of both the subject site and locality. The most relevant of these are listed in Table 1.

3. Environmental setting

Locality:	Seaforth, approximately 9 km north of the Sydney CBD (Figure 1)
Property size:	3.7 ha
Study area:	~1 ha
LGA:	Northern Beach Council
Zoning (subject site):	Part SP2 – Infrastructure (Health Services Facilities) and part E2 – Environmental Conservation
ASL:	Natural elevations vary between 75 m and 100 m ASL
Soil Landscape:	Lambert Erosional and Hawkesbury Colluvial Landscapes.

The Dalwood Home Site is located on a plateau above Middle Harbour, approximately 4 km west of the Sydney suburb of Manly. Garrigal NP is located approximately 890 m north of the subject site, the remainder of the area comprised of the low-density residential locality of Seaforth.

The area proposed for rezoning is located in the southern section of the Dalwood Home Site (i.e. Lot 4A, 5A, 6A and 7A DP 17157, Part of Lot 1 in DP 325720 and Part of Lot 1 in DP 325784). These lots are bordered by Gurney Crescent to the south, low-density residential buildings to the east and the various buildings associated with Dalwood Home to the north. The northern half of the subject site, being of higher elevation and generally flat, contains buildings that are currently in use, whilst the southern and eastern portions consist of wooded areas on steep gradients and an escarpment. It is noted that the wooded area associated with Gurney Crescent is overgrown and is impacted by weed invasion.

For reference, a photographic record of the site has been provided (Appendix 1).

The annual average rainfall in the region is about 1323 mm with the greatest falls being experienced between February and June (Bureau of Meteorology 2019). Average temperatures range from a winter low of approximately 8^{o}C to a summer high of around 25.9^{o}C (Bureau of Meteorology 2019).

The subject site's topography is dominated by a ridge top with a flat to gentle slope and steep inclines, with rock outcropping and scarps in the south and west. Natural elevations within the subject site range from 75 m ASL in the south to 100 m ASL in the north-eastern portion of the area investigated.

The subject site is located primarily within an urban catchment. No permanent water bodies are present within the study area and no defined ephemeral drainage lines or eroded gullies occur. Given the topography of the site, in times of heavy rainfall there is expected to be the downslope movement of surface runoff. This runoff is expected to flow west and south of the escarpment area. Any water that drains from the site would enter the network of stormwater drains that occur in association with the adjacent residential streets. This runoff eventually flows into Middle Harbour which is located 350 m west of the subject site.

The soils of the subject site have been mapped by Chapman and Murphy (1989) as being comprised of the Lambert Erosional and Hawkesbury Colluvial Landscapes. Both these Landscape groups are derived from the underlying Hawkesbury Sandstone geology (Chapman and Murphy 1989). These soils predominantly consist of Lithosols and Siliceous Sands found in conjunction with rock outcrops, as well as Earthy Sands, Yellow Earths and Yellow Podzolic Soils often occurring on benches, fractures and joints (Chapman and Murphy 1989). Where shale lenses occur, these are characterised by both Yellow and Red Podzolic Soils, while drainage lines are composed of Siliceous Sands and Yellow Earths (Chapman and Murphy 1989).

Table 1. Summary of legislative and policy requirements

Level	Relevant Legislation/Policy	Relevance to study area
Commonwealth	*Environment Protection and Biodiversity Conservation Act 1999*	Under this Act an action will require approval from the Minister if the action has, will have, or is likely to have, a significant impact on a MNES. MNES include listed threatened species and ecological communities, migratory species and wetlands of international importance protected under international agreements. Where applicable, the assessment criteria relevant to this Act must be drawn upon to determine whether there would be a significant effect on these species and hence whether referral to the Federal Environment and Energy Minister is required.
State	NSW *Environmental Planning and Assessment Act 1979*	Part 4 of this Act requires that a determination be made as to whether a proposed action is likely to significantly affect threatened species or ecological communities, or their habitats listed on Schedule 1 and 2 of the BC Act. Where found, the assessment criteria under Section 7.3 of the BC Act (the 'Assessment of Significance') will be drawn upon to determine whether there would be a significant effect on these species and hence whether a BDAR is required.
	NSW *Biodiversity Conservation Act 2016*	The purpose of this Act is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development. This Act also defines those species listed as protected in NSW.
	NSW *Biosecurity Act 2015*	Part 3, Clause 22 of this Act states 'any person who deals with biosecurity matter or a carrier and who knows, or ought reasonably to know, the biosecurity risk posed or likely to be posed by the biosecurity matter, carrier or dealing has a biosecurity duty to ensure that, so far as is reasonably practicable, the biosecurity risk is prevented, eliminated or minimised'. This includes pest animal and plants species as defined under Clause 15 of the Act and anything declared by the regulations to be a pest for the purposes of this Act.
	NSW *State Environmental Planning Policy (Coastal Management) 2018*[2]	Clause 10,11 and 13 of this SEPP require consideration of whether a proposal is likely to have an adverse impact on the following (respectively): • certain land within coastal wetlands and littoral rainforests area • land in proximity to coastal wetlands or littoral rainforest • land that is within the coastal environment area.

[2] *State Environmental Planning Policy (Coastal Management) 2018* updates and consolidates into one integrated policy SEPP 14 (Coastal Wetlands), SEPP 26 (Littoral Rainforests) and SEPP 71 (Coastal Protection), including clause 5.5. of the Standard Instrument – Principal Local Environmental Plan.

Level	Relevant Legislation/Policy	Relevance to study area
State cont.	*Many Local Environmental Plan 2013*	This plan aims to make local environmental planning provisions for land in Manly in accordance with the relevant standard environmental planning instrument under Section 33A of the EPA Act. Particular aims of this plan that are relevant to the proposal are: a) to conserve and enhance terrestrial, aquatic and riparian habitats, biodiversity, wildlife habitat corridors, remnant indigenous vegetation, geodiversity and natural watercourses, b) to promote energy conservation, water cycle management (incorporating water conservation, water reuse, catchment management, stormwater pollution control and flood risk management) and water sensitive urban design, and c) to protect, enhance and manage environmentally sensitive land with special aesthetic, ecological, scientific, cultural or conservation values for the benefit of present and future generations, and d) to protect existing landforms and natural drainage systems and minimise the risk to the community in areas subject to environmental hazards, particularly flooding, bush fires, acid sulfate soils, sea level rise, tsunami and landslip, and e) to provide a framework that facilitates and encourages measures to assist the adaptation of the local environment to mitigate the impacts of climate change, and f) to give priority to retaining bushland for its own intrinsic value and as a recreational, educational and scientific resource.

Soils of the Hawkesbury Sandstone are characterised by being stony, of low fertility and are highly permeable. They also have a high hazard of soil erosion and mass movement, such as rock fall (Chapman and Murphy 1989).

Conservation reserves and other protected areas that occur in the vicinity of the subject site include Sydney Harbour NP (this covering an area of 393 ha), Garrigal NP (2203 ha) and a number of smaller Council managed reserves, including Gurney Crescent Reserve (located immediately south of Gurney Crescent [Figure 2]), Rignold Street Foreshore Reserve (~410 m north-west of the subject site), Pickering Point Reserve (~390 m south-west) and Seaforth and Balgowlah Ovals (~1.2 km north).

Within the Northern Beaches LGA there is 268.1 ha of NP and 88.12 ha of Crown land (Manly City Council 2004). Whilst this is the case, approximately 90% of the bushland in Manly is degraded to some extent due to human activities (Manly City Council 2004).

With reference to the Connected Corridors for Biodiversity mapping, this being part of an initiative to assist Councils to increase habitat connectivity across highly urbanised areas, it is noted that portions of the subject site have been identified as Supporting Habitat and, to a lesser extent, Priority Habitat (Figure 2) (LLS 2019).

Not to scale: Source: LLS (2019)

Figure 2. Biodiversity Corridor mapping. Subject site delineated by red polygon.

The Priority Habitat provides a north-south linkage between Gurney Crescent Reserve and Garrigal NP (Figure 2), movement along this by ground traversing, flying and arboreal animals being possible. The Supporting Habitat, in-conjunction with adjacent Supporting Areas, would meet the dispersal needs of highly tolerant ground traversing species (particularly those that can negotiate urban infrastructure and residential dwellings) as well as flying animals.

Through reference to the listings provided under the EPBC Act, it is noted that no gazetted areas of critical habitat for any flora species, populations or communities occur within, or in the vicinity of, the study area. Similarly, none of the AOBV listed under Part 3 of the Biodiversity Conservation Regulation 2017 occur within, or in the vicinity of, the study area.

4. Literature review and field guides

Prior to undertaking any fieldwork, previous studies conducted in the region and known databases were consulted to identify the diversity of ecological communities, flora and fauna species known for, or potentially occurring in, the study region. The identification of those known or potentially occurring native species and communities within this portion of the Northern Beaches LGA, particularly those listed under the Schedules to the EPBC and BC Acts, thereby permits the tailoring of the field survey strategies to the detection of these plants and animals, their vegetation associations and necessary habitat requirements. By identifying likely species, particularly any threatened plants and animals, either the most appropriate species-specific survey techniques may be selected [should their associated vegetation communities/habitat requirements be present] or a precautionary principle adopted.

The undertaking of a literature search also ensures that the results from surveys conducted during different climatic, seasonal and date periods are considered and drawn upon as required. This approach therefore increases the probability of considering the presence of, and possible impacts on, all known and likely native species, particularly any plants and animals that are of regional, State and/or national conservation concern. This approach also avoids issues inherent with a one off 'snap shot' study.

The studies, reports and databases referred to include:

- the DEE PMST (DEE 2019a)
- the OEH BioNet database [Atlas of NSW Wildlife] (OEH 2019a)
- the OEH Threatened Species website (OEH 2019b)
- DPI WeedWise Database (DPI 2019)
- a flora and fauna assessment, Dalwood Opportunities and Constraints Analysis (Lesryk Environmental Pty Ltd 2012)
- a flora and fauna assessment, Dalwood Site (Lesryk Environmental Pty Ltd 2014)
- Atlas of Living Australia (2019)
- Northern Beaches LEP (Many LEP 2013) (NSW Government 2019a).

Other reports and documents referred to are provided within the bibliography section of this report.

When accessing the DEE and OEH databases, the search area specified was a 10 km buffer around the study area. The data searches were carried out on 19/03/2019.

All these databases and reports were reviewed and drawn upon where relevant. While reviewing these documents, particular attention was paid to identifying relevant ecological matters listed under the Schedules of the EPBC and/or BC Acts, plants, animals and ecological communities that have been recorded in the region and which may occur within, or in the vicinity of, the study area.

Field guides and standard texts used include:

- Harden (1992, 1993, 2000 and 2002), Fairley and Moore (2010) and Robinson (2003) (used for the identification of plants)
- Cogger (2014) (reptiles and frogs)
- Anstis (2017) (frogs)
- Churchill (2008) (flying mammals)
- Simpson and Day (2010) (birds)
- Van Dyck and Strahan (2008) (non-flying mammals)
- Triggs (1996) (identification of scats, tracks and markings).

The naming of those species recorded or known for the region follows the nomenclature presented in these texts, or within the EPBC and BC Acts.

It is noted that the current accepted scientific names for some of the threatened fauna species previously recorded in this locality are not consistent with the names used/provided under either the EPBC or BC Acts. In these instances, nomenclature used within this report follows the current approved scientific conventions.

Where applicable, any EECs are classified and named according to the NSW Scientific Committee's Final and Preliminary Determinations (various dates).

The conservation significance of those ecological communities, plants and animals recorded is made with reference to:

- the RoTAP publication (Briggs and Leigh 1996)
- the EPBC and BC Acts
- vegetation mapping of the study region (OEH 2013, Tozer *et al* 2010)
- OEH's BioNet Vegetation Classification database (OEH 2019c).

4.1. Biodiversity Offsets Scheme Threshold

The *Biodiversity Conservation Regulation 2017* sets out threshold levels for when the BOS would be triggered. The threshold has two elements:

- whether the amount of native vegetation being cleared exceeds a threshold area set out under Section 7.2 of the Regulation
- whether the impacts occur on an area mapped on the Biodiversity Values map published by the Minister for the Environment.

If clearing and other impacts exceeds either trigger, the BOS applies to the proposed development including biodiversity impacts prescribed by clause 6.1 of the Biodiversity Regulation 2017.

In relation to the Dalwood Home Site:

- the amount of native vegetation likely to be cleared in association with this proposal would not exceed the threshold above which the BAM and offsets scheme apply (i.e. potential for 0.5 ha over 1 to < 40 ha)
- the Dalwood Home Site has not been identified on the Biodiversity Vales Map and Threshold Tool (BVMTT) (NSW Government 2019b) as land of high biodiversity value that is particularly sensitive to impacts from development and clearing.

The proposal for rezoning of a portion of the southern section of the site would not trigger the requirement for assessment in accordance with Part 6 (the BOS) of the BC Act. Hence, the application of the BAM (as per Division 2, Part 6 of the BC Act) is not required. Therefore, the preparation of a BDAR does not need to be undertaken as part of the proposal.

5. Results of the literature review

5.1. Threatened flora species

A review of the DEE and OEH databases (DEE 2019a, OEH 2019a) identified 35 threatened plants listed under the EPBC Act and/or the Schedules of the BC Act that have been previously recorded, or are considered to have habitat, in the study region (Appendix 2). Based on the consultation of standard texts and vegetation mapping, there is the possibility that the study area may provide potential habitat for some of these species. Therefore, during the course of the field investigation, efforts were made to target these plants, populations or occurrences of their necessary vegetation associations.

5.2. Threatened Ecological Communities

There are 10 EEC's listed as occurring within the study region, a number of which could potentially occur across the study area. These communities are:

- Blue Gum High Forest in the Sydney Basin Bioregion
- Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions
- Coastal Upland Swamp in the Sydney Basin Bioregion
- Eastern Suburbs Banksia Scrub in the Sydney Basin Bioregion
- Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions
- Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions
- Shale Sandstone Transition Forest in the Sydney Basin Bioregion
- Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions
- Sydney Turpentine-Ironbark Forest
- Western Sydney Dry Rainforest in the Sydney Basin Bioregion

This assessment addresses the potential for occurrence of these communities across the site.

5.3. Vegetation mapping

At a regional scale, the vegetation of south-east NSW (Tozer *et al.* 2010) synthesised mapping and classification from a number of previous studies. This mapping does not indicate any native vegetation occurring within the subject site, presumably as the area of vegetation present is smaller than the threshold for that mapping.

At a local scale, Eco Logical Australia (2011) ground-truthed and assessed the natural assets which are located within several prioritised areas of the Manly LGA. They prepared an assessment report that assessed the presence and boundaries of:

- EECs
- natural assets
- potential vegetative corridors.

Their report provided an analysis of types of species (flora and fauna) and habitats present, and included an assessment of actual degradation and potential threats to natural remnant vegetation for proposed land use zones where environmental protection would be the priority.

Their report found that the vegetation that occurs in the vicinity of Gurney Crescent, this including the communities present on the subject site, contained an excellent diversity of plants which is dominated by a canopy of *Eucalyptus piperita*, *Corymbia gummifera* and *Angophora costata* (Eco Logical Australia 2011). This vegetation was noted to have a narrow weed band (Eco Logical Australia 2011). Eco Logical mapped this area as having high habitat value and recovery potential (Figure 3). On the plateau in the north-west of the site they found senescent/dying tall *Acacia binervia* along with *Eucalyptus racemosa, E.piperita, Angophora costata, Banksia serrata* and *Elaeocarpus reticulatus* mid-storey and a very diverse species assemblage. Areas in the south of the site where weeds had invaded were considered to have a low recovery potential, though they are contiguous with bushland of exceptional ecological value.

Biodiversity mapping under the Manly LEP 2013 indicates that a portion of the proposed new Lot 7A contains an area identified as 'Biodiversity' (Figure 4).

Figure 3. Mapping of the Gurney Crescent bushland (extract from Eco Logical Australia [2011]).

Lesryk (2012) mapped the Dalwood Hospital Site and recorded three vegetation communities including Red Bloodwood – Coast Myall – Scribbly Gum Woodland across a small area on the plateau in the north-west of the Dalwood Hospital Site, Sydney Peppermint – Smooth-barked Apple Open Forest across the sheltered slopes in the west and south-west of the broader site, and Heath/Scrub across the lower areas extending to the proposed rezoning sites (Figure 5).

Lesryk (2012) described this area as disturbed and not supporting an intact native vegetation community but instead supporting a weedy heath/scrub composed of native and introduced species. Common taller plants to 6 m are the native Cheese Tree (*Glochidion ferdinandi*) and Sweet Pittosporum and the weeds Large-leaf Privet (*Ligustrum lucidum*) and African Olive (*Olea europaea* subsp. *cuspidata*). Lantana (*Lantana camara*) and Crofton Weed (*Agertaina adenophora*) are common shrubs and Morning Glory (*Ipomoea indica*) occurs as a groundcover and scrambler. Fishbone Fern (*Nephrolpeis cordifolia*) and Kikuyu (*Pennisetum clandestinum*) are also common groundcover species. There is a flat poorly drained area in the south-east of the site that appears to be the result of previous site disturbance (this resulting int eh removal of a large amount of sandstone material). Here there is patchy growth of the introduced Whiskey Grass (*Andropogon virginicus*), Couch (*Cynodon dactylon*) and Japanese Honeysuckle (*Lonicera japoinica*) on slightly higher ground with Common Rush (*Juncus usitatus*) and Umbrella Sedge (*Cyperus eragrostis*) in damper areas.

Not to scale. Source: NSW Government 2019a

Key

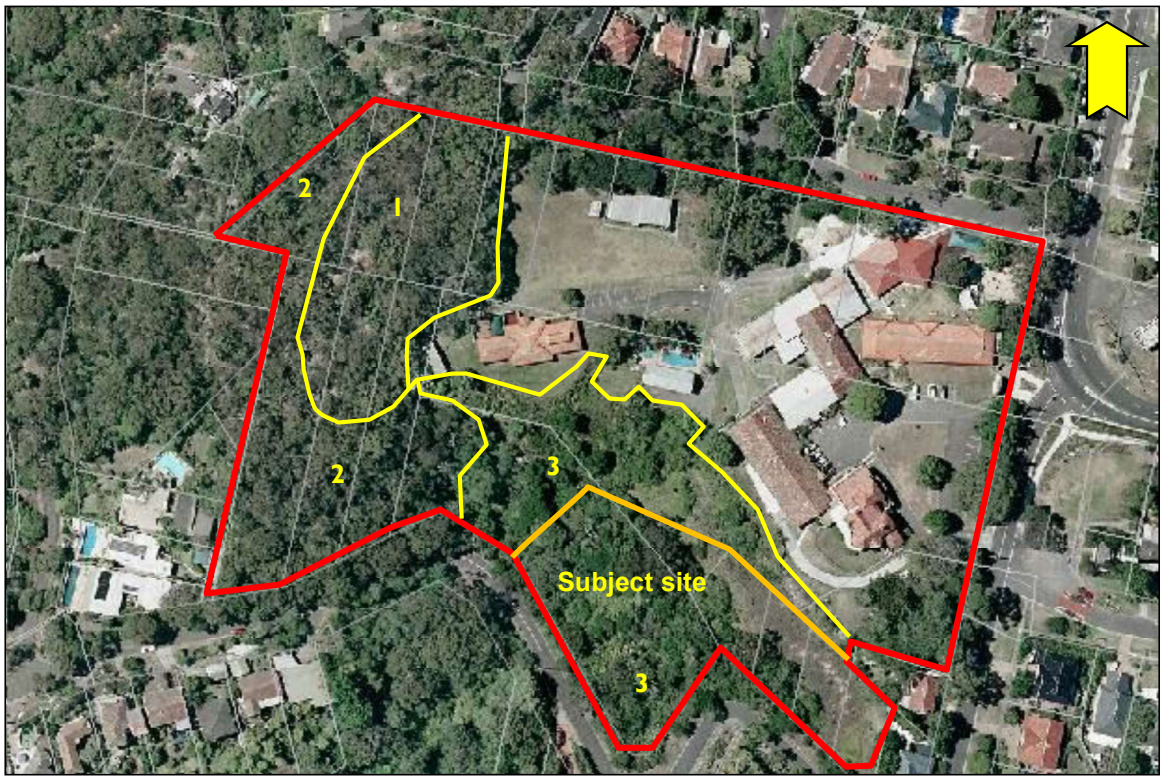
Biodiversity

Figure 4. Biodiversity mapping of the study region. Subject site delineated by red polygon.

None of the vegetation communities mapped within the study area by Lesryk 2012 were considered to be a part of an endangered or threatened vegetation community listed, or currently being considered for listing, on the Schedules to either the EPBC or BC Acts.

5.4. Threatened fauna species

Fauna species previously recorded in the vicinity of the subject site are identified in Appendix 4. Of these, and with a review of the DEE database (DEE 2019a), 45 threatened fauna species listed under the Schedules of the EPBC and/or BC Acts that have been previously recorded, or are considered to have habitat, in the study region (Appendix 2).



Not to scale. Source: Lesryk (2012).

Key
1 = *Red Bloodwood – Coast Myall – Scribbly Gum Woodland*
2 = *Sydney Peppermint – Smooth-barked Apple Open Forest*
3 = *Weedy Heath/Scrub*.

Figure 5. The vegetation present within the study area.

6. Field survey methods

Field investigations of the subject site were carried out between 21 March and 13 May 2019, with the exact dates being presented in Table 2. Table 2 also identifies the researcher present on site, survey method employed and weather conditions experienced at the time of the investigation.

Table 2. Survey details

Date (2019)	Researcher	Survey method employed	Weather conditions experienced
21 March	Deryk Engel (B.Env.Sc.HONS)	Bird surveys Identification indirect evidence Habitat determination	25°C, 30% cloud cover and light winds
2 April	Alison Hunt (B..Sc.HONS, PhD)	Botanical survey	warm (23°C) and overcast with intermittent light rain
30 April	Deryk Engel	Bird surveys Establishment of infrared cameras Establishment of hairtube traps Identification indirect evidence	24°C, 50% cloud cover and moderate breezes
14 May	Deryk Engel	Bird surveys Collection of equipment Identification indirect evidence	20°C, 0% cloud cover and slight breezes

It is noted that, during the late April – early May survey period, 14.6 mm of rain was recorded within the study locality (a total of 72 mm was recorded during the entire survey period).

The purpose of the field investigation was to identify those vegetation communities, fauna habitats, plants and animals present within, and in close proximity to, the subject site that are of State and/or national conservation significance as listed under the Schedules to the EPBC and/or BC Acts.

While conducting the habitat assessments, efforts were made to identify features such as known vegetation associations, geological features, feed trees, mature trees with hollows, connectivity of fauna corridors, aquatic environments and other habitat features important to the life cycle requirements of those threatened plants and animals previously recorded in the study region (as listed in Appendix 2).

The survey methods employed during the field investigation were:

- the identification of those plants present within the subject site, including both direct and indirect impacts
- the identification of the structure of those vegetation communities and fauna habitats present
- the direct observation of those fauna species present within, or adjacent to, the subject site
- diurnal call identifications of fauna species, with all calls being identified in the field
- infrared camera photography
- hairtube trapping
- the identification of any indirect evidence such as tracks, scats, scratchings and diggings that would suggest the presence of a particular fauna species
- ground debris, leaf litter and tree bark searches for sheltering reptiles and amphibians.

Where required, a more detailed description on one or more of the survey methods employed is provided below.

The survey methods employed and level of effort required were generally based on the descriptions provided in the following:

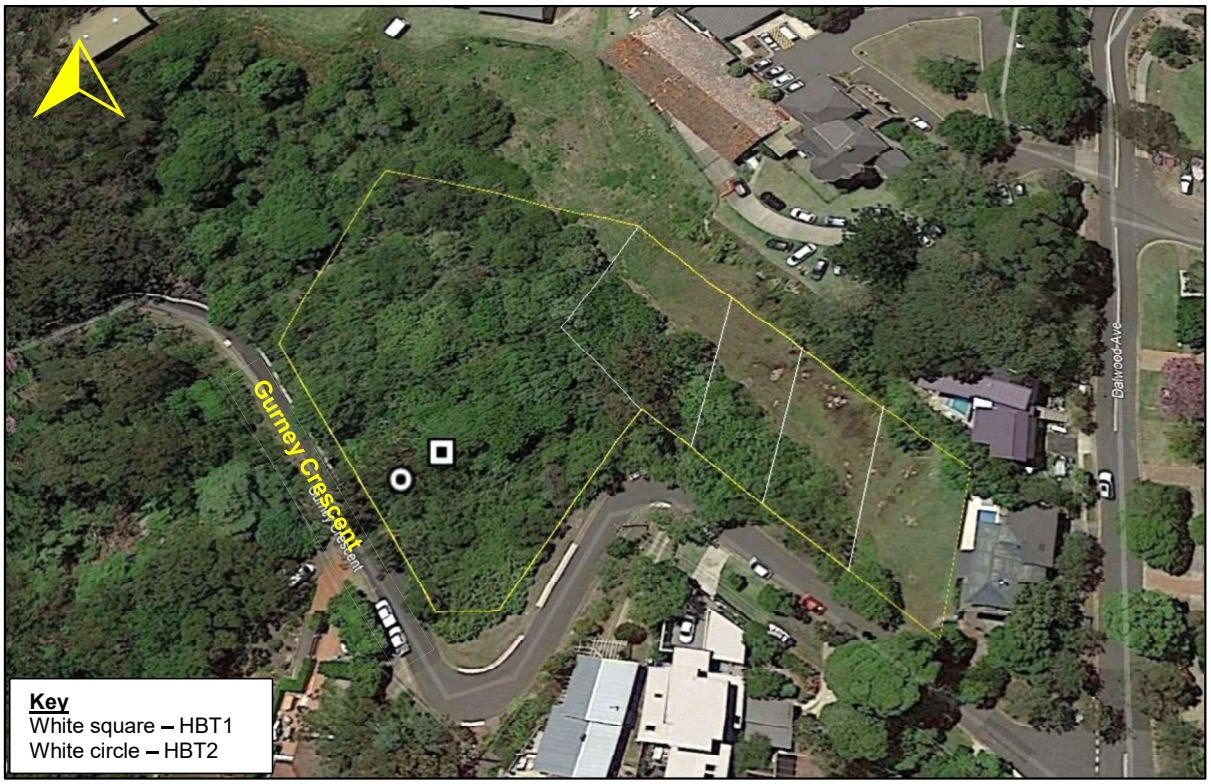
- the OEH survey guidelines for threatened plants (OEH 2016)
- the DEC 2004 publication
- the DEE survey guidelines for Australia's threatened animals (DEE various dates).

Based on the observations made during the diurnal investigation, and in consultation with the BioNet database (OEH 2019a), it was not considered that the undertaking of any nocturnal survey work was required. Within the area of likely disturbance, no drainage lines, caves or other habitats important to nocturnal species, particularly those that are of State or national conservation concern, are present.

Hollow-bearing trees that could be occupied by State listed hollow-dependent microchiropteran (insectivorous bats) are present within the subject site (Figure 6). Whilst this is the case, these plants occur beyond the limits of any of the residential lots proposed to be established and would therefore not require removal or disturbance. Recommendations for the retention of these plants have been provided (Section 10).

6.1. Botanical survey

In association with aerial photography and the plans provided, botanical surveys were conducted within the subject site. When surveying this area the 'Random Meander Method' (Cropper 1993) was employed. This method involves conducting foot traverses through those sites that require investigation, during which time notes are made on the structure and floristic composition of the native vegetation present.



Not to scale. Source: Google Earth (2019)

Figure 6. Location of hollow-bearing trees. Indicative limits of subject site delineated by yellow line.

The 'Random Meander Method' is consistent with the stratified random sampling design as specified in section 5.1 (Stratification, sampling and replication) of the publication titled, *Threatened biodiversity survey and assessment: Guidelines for development and activities (working draft)* (DEC 2004). This method is also mentioned under sections 5.2.1 (Sampling techniques) and 5.2.7 (Targeting threatened plants) of the DEC 2004 publication. The Random Meander Method is suitable for covering large areas and for locating any rare species (and their associated vegetation communities/habitat types) that may occur within a particular site.

The 'Random Meander Method' is employed until no new species have been recorded for at least 30 minutes.

Numerous plant samples were collected (as per approval granted in accordance with OEH Scientific license SL100761) for later identification using standard texts.

Based on the results of the literature review and the habitat requirements of those flora species identified as potentially occurring (see Appendix 2), in consultation with aerial photography and those plans provided, targeted investigations were also carried out where areas of suitable habitat were observed or likely to be present.

6.2. Infrared camera photography

Three Reconyx™ infrared cameras were employed during the course of the field investigation; these being established on 30 April and collected 14 days later. For reference, the locations of the cameras are identified on Figure 7; the GPS coordinates of these being:

- Camera 1 – Easting [E]337055; Northing [N]6259392
- Camera 2 – E337014; N6259414
- Camera 3 – E337007; N6259390.

The cameras employ a passive infrared system, this requiring an animal to 'break' an invisible 'beam'. The cameras were set to operate diurnally and nocturnally, each being set to a sensitivity level of high and a photo interval of 3/ten seconds.

The cameras were secured to a tree at a height of around 0.5 m above ground level, and were angled downwards.

To entice animals into the field of view of the cameras, a lure scented with truffle oil was used. This was placed at a distance of about 1 m in front of the camera and secured to the ground by a large steel peg. This distance was selected as it is within the unit's motion detector coverage range. The lure is constructed from 250 mm long PVC piping, into which has been drilled a number of holes. Foam is placed into the piping and into this the truffle oil is poured.

Based on a review of the unit's date stamp, it was possible to determine that all cameras were operating at the time of their collection.

By the completion of the site investigation, 56 camera nights had been accumulated.

6.3. Hairtube traps

Hairtube trapping, using 15 Faunatech™ hair-tube traps, was carried out within the subject site from 30 April to 14 May (Figure 7). All of the hairtube traps employed were placed on the ground, at intervals of around 20 m between each trap; the GPS coordinates and location of these provided in Table 3.

Table 3. Hairtube trap GPS locations within the study area

Hairtube	Easting	Northing
HT1	337079	6259398
HT2	337069	6259417
HT3	337073	6259381
HT4	337067	6259393
HT5	337063	6259403
HT6	337047	6259404
HT7	337050	6259388
HT8	337049	6259383
HT9	337035	6259391
HT10	337024	6259390
HT11	337033	6259409
HT12	337023	6259419
HT13	337014	6259425
HT14	337012	6259414
HT15	337016	6259400

The hair-tube traps were all baited with the universal mixture (i.e. standard rolled oats, peanut butter and honey mix) (DE 2011a).

KEY

Symbol	Survey Method
●	Infrared camera
●	Hairtube traps
- - - - - - - - - - - -	Subject site

Not to scale. Source: Google Earth 2019

Figure 7. Fauna survey locations.

Any hairs collected from the hair-tube traps were sent to Ms Georgeanna Story of 'ScatsAbout' (Majors Creek, NSW) for analysis.

Any unidentifiable or carnivore scats that contained hair material were also collected and sent to Ms Story for analysis/determination.

By the completion of the site investigation, 210 trap nights had been accumulated.

6.4. Survey effort

By the completion of the field investigation, about nine person hours of active searches had been accumulated. Given the physical condition and size of the area investigated (particularly those portions that are proposed to be developed), this length of time is considered more than adequate when endeavouring to determine the diversity of native species and vegetation communities present, their associated habitats and assemblages, and the conservation status of each of these.

6.5. Limitations

Access to all parts of the subject site was possible, thereby ensuring that all portions of the site were sampled. In addition, no adverse weather conditions were encountered during the investigation.

Not all animals and plants can be fully accounted for within any given study area. The presence of threatened species is not static; it changes over time, often in response to longer term natural forces that can, at any time, be dramatically influenced by human-made disturbances.

While targeted species-specific nocturnal surveys were not a component of this study (e.g. spotlighting, echolocation detection and so forth), given the cleared nature of the site investigated, the identification of the structure of those fauna habitats present and the retention of those hollow-bearing trees observed, it is not considered that the scientific rigour of the field inspection was compromised.

In order to overcome any limitations:

a) database searches were conducted for threatened species, populations and ecological communities known to occur within the region
b) the precautionary principle was adopted where necessary (i.e. suitable habitat for those threatened species known to occur, or that have been previously recorded within the surrounding locality, identified).

This report is based upon data acquired from the current investigation; however, it should be recognised that the data gathered is indicative of the environmental conditions of the site at the time the field work was conducted.

7. Flora results

7.1. Flora species recorded

By the completion of the field survey a number of native and exotic plant species had been recorded (Appendix 3). It is noted that Appendix 3 is not intended to be a comprehensive list of all the species present within the subject site, and only represents those plants that were recorded while undertaking searches for:

- those native species and ecological communities of State and/or national conservation concern that are known, or expected to occur, in the locality
- weeds of significance that would require treatment.

In regards to those plants recorded, it is noted that none are:

- listed, or currently being considered for listing, on the Schedules to the EPBC or BC Acts
- identified as a RoTAP.

As no threatened plants are considered to be adversely impacted by the proposal, the conducting of assessments referring to the EPBC Act's Significant Impact Guidelines and/or Section 7.3 of the BC Act is not required.

7.1.1. Weeds

Under the *Biosecurity Act 2015* 'all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.'

Of those introduced plant species recorded six are listed as Priority Weeds for the Greater Sydney region (DPI 2019), and three are listed under both Schedule 3 of the NSW Biosecurity Regulation 2017, and as WoNS (DPI 2019) (Table 4).

Table 4. Priority weeds recorded within subject site

Weed	**Status**
African Olive (*Olea europaea* subsp. *Cuspidata)*	Priority Weed
Blackberry (*Rubus fruiticosus* species aggregate)	Priority Weed, Schedule 3, WoNS
Green Cestrum (*Cestrum parqui*)	Priority Weed
Ground Asparagus (*Asparagus aethiopicus*)	Priority Weed, Schedule 3, WoNS
Lantana (*Lantana camara*)	Priority Weed, Schedule 3, WoNS
Pampas Grass (*Cortaderia selloana*)	Priority Weed

Schedule 3 weeds 'must not be imported into the State or sold'.

7.2. Vegetation communities

The subject site supports two vegetation associations:

- Cleared/slashed grassed area.
- Disturbed Scrub.

A brief description of each community has been provided below, whilst their approximate limits within the subject site are identified in Figure 8.

It is recommended that the following descriptions be read in conjunction with reference to the photographic record provided (Appendix 1).

Not to scale: Source: Google Earth (2019)

Figure 8. Vegetation communities recorded in the subject site.

7.2.1. Cleared/slashed grassed area

This relatively flat section borders the developed area of the Dalwood Hospital site which lies to the north, and residences to the east. The rock wall which forms the boundary with the Dalwood Hospital site appears to have been formed through the removal of sandstone (quarrying?) from this area. This area is now maintained through slashing, presumably to provide fire protection for the hospital and residences to the east. Vegetation consists mostly of introduced grasses (e.g. Whiskey Grass and Couch) with Japanese Honeysuckle on slightly higher ground and Common Rush and Umbrella Sedge in damper areas.

Occurrence	This community occupies areas proposed for the four dwelling lots. It is dominated by weeds and appears to be regularly slashed.
Area within subject site	1460 m^2
Groundcover High density 0.5 m	Dominant species present Couch (*Cynodon dactylon*) Whiskey Grass (*Andropogon virginicus*) (introduced)
Leaf litter and ground debris	No
Vegetation formation (Keith 2004)	N/A
OEH (2013)	N/A
PCT (OEH 2019c)	N/A
EEC?	No

7.2.2. Disturbed Scrub

This relatively steep, densely weed infested (primarily by Fishpole Bamboo [*Phyllostachys aurea*]) portion of the subject site is about 0.49 ha in area. It grades steeply (about 20 m slope) down from the cleared/slashed grassed area to Gurney Crescent. It is likely that long term disturbances associated with the adjacent quarrying, the construction and operation of Dalwood Hospital, the adjacent residences and the construction of Gurney Crescent have impacted this area through changes in drainage, physical disturbance and the spread of weeds. It is now composed mostly of invasive weed species, some of which are recognised Priority Weeds for the Greater Sydney region, Schedule 3 weeds of the NSW Biosecurity Regulation 2017 and WoNS. Scattered throughout this dense weed infestation is the occasional native species (e.g. two emergent Smooth-barked Apple, Cheese Tree and Black She-oak [*Allocasuarina littoralis*]) along the margins.

Occurrence	This community occurs in the area proposed for the APZ (New Lot 7A).
Area within subject site	4900 m^2
	Notable species present
Canopy Low density	Smooth-barked Apple (*Angophora costata*) *x 2* Black She-oak (*Allocasuarina littoralis*) Sweet Pittosporum (*Pittosporum undulatum*) Cheese Tree (*Glochidion ferdinandi*)
Shrubs / Mid-storey High density	Sweet Pittosporum (*Pittosporum undulatum*) (introduced) Large-leaf Privet (*Ligustrum lucidum*) (introduced) Lantana (*Lantana camara*) (introduced) Cassia (*Senna pendula* var. *glabrata*) (introduced) Fishpole Bamboo (*Phyllostachys aurea*) (introduced)
Leaf litter and ground debris	Minor
Vegetation formation (Keith 2004)	N/A
OEH (2013)	N/A
PCT (OEH 2019c)	N/A
EEC?	No

7.3. Fauna species recorded

The fauna species recorded by the authors within the Dalwood Home site during the current or previous investigations, along with their detection method(s), are listed in Table 5.

Of those species detected, one, the White-bellied Sea-eagle (*Haliaeetus leucogaster*), is listed as Vulnerable under the BC Act. During the 2012 investigation of the Dalwood Home site, this species was observed flying over the subject site (Lesryk 2012). During that investigation, no characteristic Sea-eagle nests were observed, and no individuals of this animal were seen foraging or roosting within the study area (Lesryk 2012).

The White-bellied Sea-eagle was not recorded during the current investigation. No raptor nests were observed within the subject site and the study area is not considered habitat for this species. The White-bellied Sea-eagle would not be reliant upon the resources present within, or adjacent to, the subject site and the proposed subdivision would not significantly affect this threatened species or its habitats. With reference to the assessment criteria provided under Section 7.3 of the BC Act (Section 8.2), the preparation of a BDAR is not required.

Table 5. Fauna species recorded within both the subject site and Dalwood Home site, and their detection method.

Key
V - species listed as Vulnerable under the BC Act.
* - introduced species.
1 – current investigation
2 – Lesryk 2012 [previous investigation of study area]
3 – Lesryk 2014 [previous investigation of study area]

Common Name	Scientific Name	Method of Detection	Recorded
MAMMALS			
Short-beaked Echidna	*Tachyglossus aculeatus*	Infrared camera	1
Long-nosed Bandicoot	*Perameles nasuta*	Infrared camera/hair analysis Characteristic diggings observed	1 2
Common Ringtail Possum	*Pseudocheirus peregrinus*	Infrared camera/hair analysis Observed	1 2
Common Brushtail Possum	*Trichosurus vulpecula*	Infrared camera	1
Swamp Wallaby	*Wallabia bicolor*	Infrared camera/hair analysis Observed	1 2
* Rabbit	*Oryctolagus cuniculus*	Characteristic scats observed	1,2,3
* Cat (domestic – collars evident)	*Felis catus*	Infrared camera	1
* Fox	*Vulpes vulpes*	Infrared camera	1
* Black Rat (based on tail being longer than body)	*Rattus rattus*	Infrared camera	1
BIRDS			
Australian Brush Turkey	*Alectura lathami*	Infrared camera, Observed	1
Masked Lapwing	*Vanellus miles*	Observed	2,3
V White-bellied Sea-eagle	*Haliaeetus leucogaster*	Observed	2
* Rock Dove	*Columba livia*	Observed	1
* Spotted Dove	*Streptopelia chinensis*	Heard	2,3
Sulphur-crested Cockatoo	*Cacatua galerita*	Heard	1,2
Musk Lorikeet	*Glossopsitta concinna*	Heard	1,2
Rainbow Lorikeet	*Trichoglossus haematodus*	Heard	1,3
Laughing Kookaburra	*Dacelo naxaeguineae*	Heard	1,2
Superb Fairy-wren	*Malurus cyaneus*	Observed	1,2
White-browed Scrubwren	*Sericornis frontalis*	Infrared camera, Observed	1
Spotted Pardalote	*Pardalotus punctatus*	Heard	1,2,3
Brown Thornbill	*Acanthiza pusilla*	Observed	2,3
Red Wattlebird	*Anthochaera carunculata*	Heard	1,2,3
Noisy Miner	*Manorina melanocephala*	Heard	1,2,3
Lewin's Honeyeater	*Meliphaga lewinii*	Observed	1
Eastern Spinebill	*Acanthorhynchus tenuirostris*	Observed	1
Eastern Whipbird	*Psophodes olivaceus*	Infrared camera, Heard	1,2,3
Golden Whistler	*Pachycephala pectoralis*	Observed	2
Grey Fantail	*Rhipidura fuliginosa*	Heard	2
Willie Wagtail	*Rhipidura leucophrys*	Observed	2
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	Observed	3
Grey Butcherbird	*Cracticus torquatus*	Heard	1,2
Australian Magpie	*Gymnorhina tibicen*	Heard	1,2
Pied Currawong	*Strepera graculina*	Heard	1,3
Australian Raven	*Corvus coronoides*	Heard	1,2
Magpie-lark	*Grallina cyanoleuca*	Heard	1
Silvereye	*Zosterops lateralis*	Observed	1
Welcome Swallow	*Hirundo neoxena*	Observed	1,2,3
* Red-whiskered Bulbul	*Pycnonotus jocosus*	Heard	1,2
* Common Starling	*Sturnus vulgaris*	Observed	1
REPTILES			
Broad-tailed Gecko	*Phyllurus platurus*	Observed	1
Dark-flecked Garden Sun-skink	*Lampropholis delicata*	Observed	1
AMPHIBIANS			
Common Eastern Froglet	*Crinia signifera*	Heard	1,2

During the course of the current investigation:

- Images obtained through use of the three infrared cameras that were employed over the course of fourteen days indicated the presence of the Short-beaked Echidna, Common Ringtail Possum, Common Brushtail Possum, Swamp Wallaby, Australian Brush Turkey, White-browed Scrubwren, Eastern Whipbird and introduced Cat, Fox and Black Rat.
    - The Short-beaked Echidna was the only small to medium sized ground traversing native mammal photographed.
    - Images obtained of those Cats that accessed the subject site indicated the presence of at least two different individuals (based on coat colour), each of which had a collar.
- Hairs were present within four of the hairtube traps placed out on site. Analysis of these indicated the presence of the Long-nosed Bandicoot, Common Ringtail Possum and Swamp Wallaby.
- No characteristic [conical] bandicoot diggings or scats were observed within the subject site.
- No dreys or other nests were noted.

The native species recorded during the current study are protected, as defined by the BC Act, but considered to be common to abundant throughout both the nearby network of State and local government reserves and surrounding urban areas. Within the surrounding region, these species have been recorded in association with a range of woodland and forest habitats, as well as urban environments. The species recorded would not be solely reliant upon those habitats present within, or in close proximity to, the subject site, such that the removal or further disturbance of these would threaten the 'local' occurrence of these animals. The species recorded are all expected to utilise and occupy the APZ/E4 Zoned portions of the subject site, and both the study area and surrounding locality post-development.

None of the native animals recorded during the current or previous ecological investigations are listed, or currently being considered for listing, under the Schedules to the EPBC Act.

7.4. Habitat types available for native fauna species

Two habitat types available to native fauna were recorded within the study area, these being:

- exotic grassland (corresponds to Section 7.2.1. of this report)
- shrubland (corresponds to Section 7.2.2. of this report).

For reference, descriptions of each of these are provided. It is recommended that these descriptions be read in conjunction with reference to the photographic record provided (Appendix 1).

7.4.1. Exotic grassland

This habitat type is present on the bench that appears to have been formed by previous land use practices (quarrying). This habitat type supports a rank grassland that is dominated by exotic species that are up to 0.5 m in height (depending on the environment's maintenance regime). Remnant small trees and shrubs are present at the base of the cliff line, these being to a maximum height of 3 m. No caves or suitable sheltering ledges occur in association with the 'cliff'/quarry face. Due to ground water seepage, portions of this habitat type are damp underfoot.

7.4.2. Shrubland

The shrubland is present downslope of the levelled bench and supports plants that are up to 4 m in height. Where not affected by a high-density infestation of bamboo (i.e. primarily within the eastern portion of the subject site) the native shrubs are of a medium to high density. The ground cover is sparse and composed primarily of weeds. Leaf litter and ground debris is common, as is the occasional rock outcrop. Associated with these are some ledges and overhangs. Investigations of these with a hand torch did not reveal the presence of any sheltering mammals. Similarly, no evidence to suggest utilisation (e.g. scats/guano) was observed.

Several emergent native trees and tall shrubs are present within this habitat type, these being to 10 m in height. Two of the Smooth-barked Apples present were noted to be hollow-bearing; the locations of these plants are identified on Figure 6, whilst their GPS coordinates are:

- HBT1 – E337021; N6259381 (hollow diameter 20 cm)
- HBT2 – E337014; N6259377 (hollow diameter 10 cm).

Neither hollow-bearing tree will require removal.

Adjacent to Gurney Crescent, any plants that over-hang the roadway have been trimmed and maintained.

Dumped landfill, this including some construction debris, is present within the northern limits of this habitat type.

No ephemeral or permanent drainage lines occur within the area investigated.

Treatment of the bamboo infestation combined with the implementation of revegetation work, would provide resources for native species (i.e. foraging opportunities) that are currently unavailable.

7.4.3. Corridor linkages

Due to the presence of the quarry cliff face, connectivity in a north to north-easterly direction for ground traversing species is limited. Species tolerant of negotiating urban infrastructure and residential areas would be able to traverse the area in an easterly direction. Development of the subject site would not present any additional barriers to the easterly movement of native species. Flying species would be able to traverse the subject site post-development. As with the surrounding/nearby residential areas that are mapped as 'Supporting Habitat' (Figure 2), development of the subject site will not compromise the objectives of the Connected Corridors for Biodiversity initiative.

Movement along the Priority Habitat corridor that occurs to the west of the subject site would not be altered by the scope of work proposed. No barriers to the movement patterns of any species that currently traverse that corridor linkage would be erected. The development of the subject site will not isolate or fragment any habitat areas, nor will it have an adverse cumulative impact when associated with the surrounding residential areas and network of urban roads.

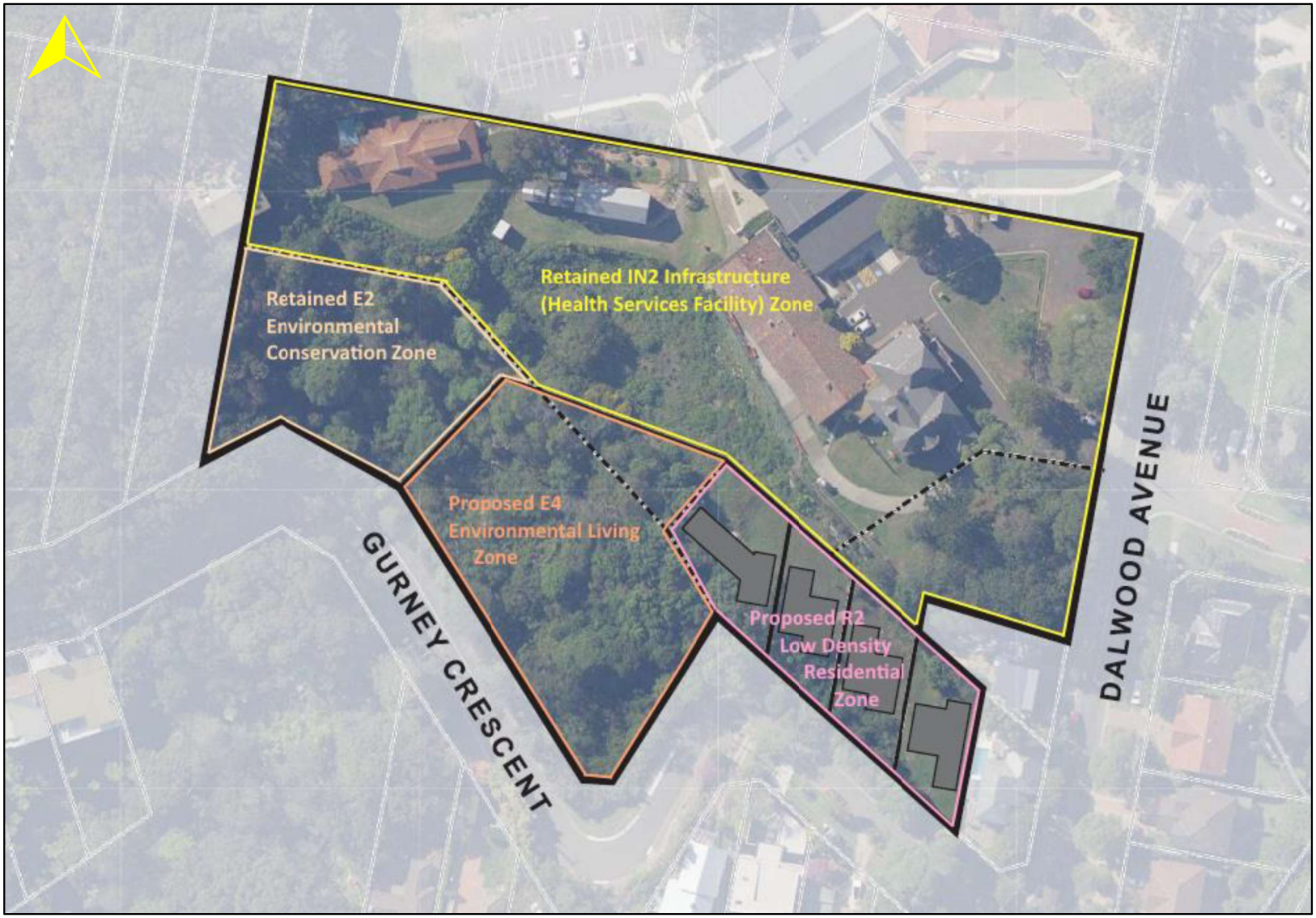
The proposed E4 zoned land (this incorporating the required APZ) and retained E2 lands are present along the eastern edge of a Priority Habitat corridor (Figure 2, Figure 9). These portions of the subject site are to be retained, with weed management and some light vegetation removal occurring. The presence of these portions of the subject site will provide vegetation that permits the movement of native species. Treatment of the bamboo infestation and regeneration with endemic native species would also provide foraging opportunities not current available within these portions of the subject site.

8. Legislative considerations

8.1. Commonwealth - *Environment Protection and Biodiversity Conservation Act 1999*

By the completion of the field investigation no ecological communities, flora or fauna species, or their populations, listed under this Act were recorded within, or in close proximity to, the subject site. Similarly, none are expected to rely upon the habitats to be disturbed for any of their necessary lifecycle requirements.

As such, it is not considered necessary that any assessments referring to the EPBC Act's Significant Impact Guidelines are required.



Not to scale: Source: APP Corporation Pty Ltd

Figure 9. Location of retained E2 and proposed E4 lands.

The proposed development would not have a significant impact on any ecological communities, flora or fauna species of national conservation significance. Therefore, it is considered that the proposed action does not require referral to the Federal Minister for the Environment and Energy for further consideration or approval.

8.2. State - *Biodiversity Conservation Act 2016*

By the completion of the field investigation no ecological communities, flora or fauna species, or their populations, listed under this Act were recorded within, or in close proximity to, the subject site. Similarly, none, including the White-bellied Sea-eagle which was previously observed flying above the subject site, were considered likely to occur within, or be reliant upon, the habitats present.

Considering the assessment criteria provided under Section 7.3 of the BC Act:

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

As their necessary (documented) habitats are not present, no threatened species were recorded and none are expected to be reliant upon, or occur as a resident population within, the subject site. There would be no impact upon local populations of threatened species.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

No endangered populations are known or likely to use the site.

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

(i) *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction,*
(ii) or 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,

Vegetation at the subject site is not a component of any EEC.

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

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,
(ii) and whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,
(iii) and the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

No threatened species were recorded and, based on the identification of those habitats and vegetation communities present, none are considered likely to occur. The establishment of the lots for rezoning will require the removal of 1460 m^2 of cleared/slashed grassland and the likely under scrubbing of densely weed infested vegetation across the proposed new Lot 7A, to establish the APZ is unlikely to fragment or isolate any areas of habitat. The proposal is not considered to impact on any vegetation considered important to the long-term survival of any of the threatened species, population or ecological community(ies) known to be present in the surrounding locality.

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

The site is not listed on the critical habitat register.

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

No recovery plans or threat abatement plans are relevant to the site.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Clearing of native vegetation is identified as a KTP under Schedule 4 of the BC Act.

That stated, the proposed removal/under scrubbing of 4900 m^2 of vegetation as part of the proposed new lots and establishment of the APZ would not be likely to:

(a) adversely affect a threatened species or ecological communities, or
(b) cause a species or ecological community(ies) that are not threatened to become threatened.

The proposed development would not be likely to have a significant effect on any threatened species, population, ecological communities, or their habitats listed under the BC Act; as such, the preparation of a BDAR that further considers the impacts of the proposal on State significant matters is not required.

8.3. State – *State Environmental Planning Policy No.44 – Koala Habitat Protection*

Northern Beaches Council is an amalgamation of Manly, Pittwater and Warringah Councils, this occurring in May 2016. Of these three councils, Pittwater and Warringah are identified under Schedule 1 - LGAs of SEPP 44. This Policy seeks to encourage the proper conservation and management of areas that provide habitat for Koalas (*Phascolarctos cinereus*).

Within the study area, two eucalypt species were recorded (Appendix 3), neither of which is listed under Schedule 2 of SEPP 44 as a Koala Feed Tree. As such, the subject site would not be considered Potential or Core Koala habitat as defined in the Policy. A Koala Plan of Management need not accompany the development application.

8.4. State – *State Environmental Planning Policy (Coastal Management) 2018*

With reference to the Coastal Environment Area Map (DP&E 2018), the subject site is not mapped as Coastal Wetlands or Littoral Rainforest.

9. Conclusion

A flora and fauna investigation has been carried out out across Lots 4A, 5A, 6A and 7A DP 17157, Part of Lot 1 in DP 325720 and Part of Lot 1 in DP 325784 Gurney Crescent, Seaforth, NSW. By the completion of the investigation, no ecological communities, flora or fauna species, or their populations, listed, or currently being considered for listing, under the EPBC or BC Acts were recorded. Similarly, none are expected to rely upon the habitats proposed to be disturbed for any of their necessary or significant lifecycle requirements.

As the proposal will not have a significant impact on any MNES or State conservation matters, referral to the Federal Minister for the Environment and Energy for further consideration or approval would not be necessary. Similarly, the preparation of a BDAR that further assesses and considers the scope of work proposed is not required.

The subject site is not considered to constitute Potential or Core Koala habitat. As such, the development application need not be accompanied by a Koala Plan of Management.

No wetlands or littoral rainforest are present within the study area; as such, the proposal is not considered to have an adverse impact on those features/items listed under Clauses 10(1) and 11(1) of SEPP (Coastal Management) 2018.

With adherence to those recommendations provided in this report, no ecological constraints to the proposal proceeding as planned were identified, or considered likely to occur.

The adoption of those mitigation measures provided would ensure that the proposal is undertaken in an ecologically sustainable manner.

10. Recommendations

Based on the principles of Ecologically Sustainable Development, as identified in Schedule 2 of the Environmental Planning and Assessment Regulation, the following recommendations are provided:

- No hollow-bearing trees should be removed from the proposed APZ area.

- Clearing of native vegetation should be limited to the minimum needed to meet the objectives of the development layout.

- The number of mature trees requiring removal should be limited to the minimum needed to meet the objectives of both the project's development layout and APZ requirements for outer protection areas under Planning for Bushfire Protection.

- A VMP should be developed that includes the removal and treatment of the bamboo infestation.
    - a component of the VMP should be the establishment of endemic native species
    - a maintenance schedule which includes the ongoing removal of exotic plants and replacement of any native species that die or exhibit disease should also form a component of the VMP
    - the VMP should be prepared and implemented by a qualified bush regeneration firm
    - the VMP should be prepared in consultation with an engaged project ecologist to ensure the life cycle needs of those native species present or potentially occurring are considered.

- Areas downslope of the proposed development should be regularly monitored (bi-yearly) during, and for a period of two years after, the establishment of the dwellings to determine if any exotic plants have spread into the adjacent woodland.
    - In these instances, weed management measures should be implemented.

- Limits of clearing should be provided to the construction contractor and identified on maps/plans and on site through the erection of temporary fencing, bunting or similar.

- An ecologist or suitably qualified wildlife contractor should be present on site during the clearing works to collect and relocate any native species (primarily ground-dwelling animals) that are exposed.

- Any animals injured during the clearing work should be collected and taken to a local veterinarian or wildlife carer.

11. Bibliography

Actinotus Environmental Consultants 2001, *Flora and fauna survey for proposed development at Lot Number 101 in DP 1016284 Melwood Avenue Killarney Heights, NSW 2087.* Report prepared for B Torpey Associates Pty. Ltd. by Actinotus Environmental Consultants, Frenches Forest, NSW.

Anstis, M 2017, *Tadpoles and frogs of Australia*. Second edition. New Holland Publishers, Sydney.

Atlas of Living Australia 2019, *database search*, viewed March 2019, <https://biocache.ala.org.au/explore/your-area#-34.7674|150.5632|12|Animals>

Briggs, J and Leigh, J 1996, *Rare or Threatened Australian Plants,* CSIRO Publishing, Collingwood, Victoria

Bureau of Meteorology 2019, *Bureau of Meteorology Climate Averages*, viewed April 2019, <http://www.bom.gov.au/climate/averages>

Chapman, G.A. and Murphy, C.L. 1989, *Soils Landscapes of the Sydney 1:100 000 sheet*. Soil Conservations Service of NSW, Sydney

Churchill, S 2008, *Australian bats - 2nd Edition*, Allen and Unwin, Crows Nest, NSW

Cogger, H 2014, *Reptiles and amphibians of Australia*. CSIRO Publishing, Collingwood, Victoria

Commonwealth of Australia 2002, *Style Manual 6th Edition*, John Wiley and Sons Australia Ltd, Richmond, Victoria

Cropper, S 1993, *Management of Endangered Plants*, CSIRO, Melbourne, Victoria

Department of the Environment 2010a, *Survey guidelines for Australia's threatened frogs: Guidelines for detecting frogs listed as threatened under the EPBC Act*. Commonwealth of Australia Barton, ACT

- 2010b, *Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the EPBC Act*. Commonwealth of Australia Barton, ACT

- 2010c, *Survey guidelines for Australia's threatened bats: Guidelines for detecting bats listed as threatened under the EPBC Act*. Commonwealth of Australia Barton, ACT

- 2011a, *Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the EPBC Act*. Commonwealth of Australia Barton, ACT

- 2011b, *Survey guidelines for Australia's threatened reptiles: Guidelines for detecting reptiles listed as threatened under the EPBC Act*. Commonwealth of Australia Barton, ACT

- 2013, *Matters of National Environmental Significance: Significant Impact Guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999*, viewed April 2019 <http://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf>

Department of Environment and Climate Change 2007, *Threatened species assessment guidelines: The assessment of significance*, Department of Environment and Climate Change, Hurstville, NSW

- 2009, *Threatened species survey and assessment guidelines - field survey methods for fauna: amphibians*, Department of Environment and Climate Change, Sydney, NSW

Department of Environment and Conservation 2004 [Working draft], *Threatened Species Survey and Assessment: Guidelines for developments and activities*, New South Wales Department of Environment and Conservation, Hurstville, NSW

Department of the Environment and Energy 2019a, *Protected Matters Search Tool*, viewed March 2019, <http://www.environment.gov.au/epbc/db/index.html>

- 2019b, *Species profile and threats database*, viewed April 2019, <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>

- 2019c, *Weeds of national significance*, viewed April 2019, <http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html>

Department of Planning and Environment 2019, *Coastal Management - interactive map for State Environmental Planning Policy (Coastal Management) 2018*, viewed April 2019, <http://webmap.environment.nsw.gov.au/PlanningHtml5Viewer/?viewer=SEPP_CoastalManagement>

Department of Primary Industries 2019, *NSW WeedWise: Priority weeds for the Greater Sydney,* viewed April 2019, <https://weeds.dpi.nsw.gov.au/WeedBiosecurities?AreaId=102>

Eco Logical Australia 2011, *Manly natural assets survey to inform the Draft Manly LEP 2011*. Prepared for Manly Council by Eco Logical Australia Pty Ltd, Sutherland, NSW.

ERM 2001, *Community Title Subdivision, Lots 1, 2 and 3 DP 1012951 & Lot 9 DP 200638, Rignold Street, Seaforth - Flora and Fauna Assessment.* Report prepared for proponent by Environmental Resources Management Australia Pty Ltd.

Fairley, A and Moore, P 2010, *Native Plants of the Sydney Region*, Jacana Books, Allen & Unwin, Crows Nest, NSW

Frith, HJ (Ed) 2007, *Complete book of Australian birds*, Readers Digest, Surry Hills, NSW

Google Earth 2019, *Google Earth mapping*, viewed April 2019

Harden, G (Ed) 1992-2002, *Flora of New South Wales Vol 1,2,3 and 4,* NSW University Press, Kensington, NSW

Higgins, PJ (Ed) 1999, *Handbook of Australian, New Zealand and Antarctic Birds Vol. 4*. Oxford University Press, Melbourne

Keith, D 2004, *Ocean Shores to Desert Dunes; the native vegetation of New South Wales and the ACT*, NSW National Parks & Wildlife Service, Sydney, NSW

Lesryk Environmental Pty Ltd 2001a, *Flora and fauna assessment of Precinct A, Seaforth.* Report prepared for the Department of Urban Affairs and Planning and the RTA by Lesryk Environmental Pty Ltd, Bundeena, NSW.

- 2001b, *Flora and fauna assessment of Precinct C, Seaforth.* Report prepared for the Department of Urban Affairs and Planning and the RTA by Lesryk Environmental Pty Ltd, Bundeena, NSW.

- 2001c, *Flora and fauna assessment of Precinct D, Seaforth.* Report prepared for the Department of Urban Affairs and Planning and the RTA by Lesryk Environmental Pty Ltd, Bundeena, NSW.

- 2012, *Flora and fauna opportunities and constraints analysis, Dalwood Children's Services, Dalwood Avenue, Seaforth, NSW*. Report prepared for Hassell Pty Ltd at the request of NSW Health by Lesryk Environmental Pty Ltd, Bundeena, NSW

- 2014, *Flora and fauna survey, Dalwood Children's Services, Dalwood Avenue, Seaforth, NSW*. Report prepared for Johnstaff at the request of NSW Health Infrastructure by Lesryk Environmental Pty Ltd, Bundeena, NSW

Local Land Services 2019, *Greater Sydney LLS - Biodiversity Corridor Mapping*, viewed April 2019, <https://www.arcgis.com/apps/webappviewer/index.html?id=3afa804b96ac4d69a74e9b1ed9780328>

Manly City Council 2004, *State of the Environment Report 2003-2004*, Manly City Council, Manly, NSW

- 2011, *State of the Environment Report 2010-2011*, Manly City Council, Manly, NSW

NSW Government 2019a, *Manly Local Environmental Plan 2013*, viewed April 2019, <https://www.legislation.nsw.gov.au/#/view/EPI/2013/140>

- 2019b, *Biodiversity Values Map and Threshold Tool*, viewed April 2019, <https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BOSETMap>

Office of Environment and Heritage 2013, *The Native Vegetation of the Sydney Metropolitan Area, Volume 2, Vegetation Community Profiles. Version 3.0*. NSW Office of Environment and Heritage, Sydney

- 2016, *NSW Guide to Surveying Threatened Plants*, Office of Environment and Heritage, Sydney South, NSW, viewed April 2019, <http://www.environment.nsw.gov.au/resources/threatenedspecies/160129-threatened-plants-survey-guide.pdf>

- 2018, *Threatened Species Test of Significance Guidelines*, Office of Environment and Heritage, Sydney NSW

- 2019a, *BioNet (Atlas of NSW Wildlife) Database*, data downloaded March 2019, <https://www.environment.nsw.gov.au/atlaspublicapp/UI_Modules/ATLAS_/AtlasSearch.aspx

- 2019b, *Threatened biodiversity profile search*, viewed April 2019, <https://www.environment.nsw.gov.au/threatenedspeciesapp/>

- 2019c, *BioNet Vegetation Classification*, viewed April 2019, <https://www.environment.nsw.gov.au/NSWVCA20PRapp/LoginPR.aspx?ReturnUrl=%2fNSWVCA20PRapp%2fdefault.aspx>

Robinson, L 2003, *Field guide to the native plants of Sydney*, Second edition, Kangaroo Press, Sydney, NSW

Simpson, K and Day, N 2010, *Field guide to the birds of Australia*, 8th Edition, Penguin Books Australia, Victoria

Tozer, MG, Turner, K, Simpson, C, Keith, DA, Tindall, D, Pennay, C, Simpson, C, MacKenzie, B, and Beukers, P 2010, *Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands*, *Cunninghamia* 11 (3): 359-406

Triggs, B 1996, *Tracks, scats and other traces: a field guide to Australian mammals*, Oxford University Press, Melbourne, Victoria

Van Dyck, S and Strahan, R 2008, *The Mammals of Australia* (3rd edition), Reed New Holland, Sydney, NSW

Appendix 1. Photographic record of the area investigated

Plate 1. Character of the Cleared/slashed grassed area. Photograph taken looking north across subject site

Plate 2. Character of the Cleared/slashed grassed area. Photograph taken looking north-west across subject site

Plate 3. Character of the disturbed scrub.

Plate 4. Character of the disturbed scrub.

Plate 5. Character of the disturbed scrub.

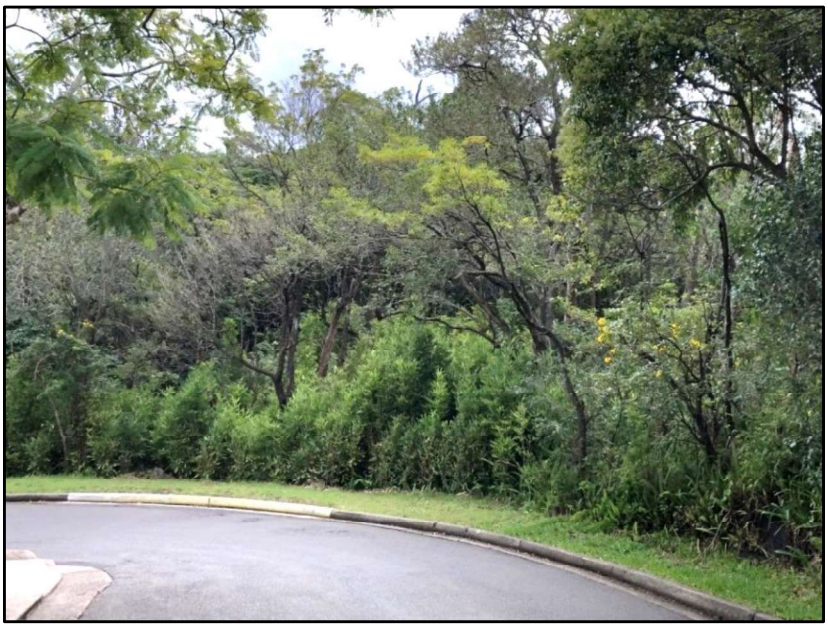


Plate 6. Character of the disturbed scrub. Photograph taken looking west along Gurney Crescent.

Plate 7. Aerial shot of subject site (approximate boundaries shown in yellow). Source: Lesryk 14/05/19. Photograph obtained using an unmanned aerial vehicle.

Appendix 2. Threatened flora and fauna species previously recorded in the study region and their 'likelihood of occurrence'

Key

V - vulnerable E - endangered CE - critically endangered M - migratory Ma - marine

A State or nationally listed threatened species is considered to have a:

- **High** likelihood of occurrence if it has been recorded within 10 km of the study area and there is either suitable habitat present or the potential for the species to fly over the site (while species may fly over, it is acknowledged that for some species no suitable habitat will be present within the study area).
- **Moderate** likelihood of occurrence if they have a predicted occurrence (via the EPBC Act Protected Matters Search Tool or OEH geographic search) and there is either suitable habitat present or the potential for the species to fly over the site (while species may fly over, it is acknowledged that for some species no suitable habitat will be present within the study area).
- **Low** likelihood of occurrence if suitable habitat for a species is not present regardless of whether they have been recorded within 10 km, or have a predicted occurrence.

Note: Species underlined are those which only the EPBC PMST predicted as having habitat in the search area. All other species have been recorded within 10 km of the study area.

Note: As these habitats are not present, no pelagic, estuarine or wetland species have been considered in the following table.

* - habitat requirements were generally extracted from DEE (2019a), OEH (2019a), Harden (1992-2002), Frith (2007), Churchill (2008), Cogger (2014) and Van Dyck and Strahan (2008) with other references used being identified in the bibliography.

Common and Scientific Name	Legislation		Primary habitat requirements	Likelihood of Occurrence[3]
	EPBC Act	BC Act		
PLANTS				
Bynoe's Wattle *Acacia bynoeana*	V	E	Occurs in heath or dry sclerophyll forest on sandy soils.	Low. No suitable habitat present.
Downy Wattle *Acacia pubescens*	V	V	Occurs in open woodland and forest, in a variety of plant communities on characteristically gravely soils often with ironstone.	Low. No suitable habitat present.
Sunshine Wattle *Acacia terminalis* subsp. *terminalis*	E	E	Restricted to coastal scrub and dry sclerophyll woodland on sandy soils in near-coastal areas from the northern shores of Sydney Harbour south to Botany Bay.	Low. No suitable habitat present.
Allocasuarina glareicola	E	E	Only in woodland of Angophora bakeri and Eucalyptus sclerophylla.	Low. No suitable habitat present.
Allocasuarina portuensis	E	E	Shallow sandy soils in Sydney Harbour National Park.	Low. No suitable habitat present.
Asterolasia elegans	E	E	Restricted to a few gullies in the Wisemans Ferry Area where it grows on lower sheltered slopes.	Low. No suitable habitat present.
Thick-leaf Star-hair *Astrotricha crassifolia*	V	V	Restricted to metapopulations near Gosford and Sutherland.	Low. No suitable habitat present.
Thick-lipped Spider-orchid *Caladenia tessellata*	V	E	Generally found in grassy sclerophyll woodland on clay loam or sandy soils.	Low. No suitable habitat present.
Netted Bottle Brush *Callistemon linearifolius*		V	Grows in dry sclerophyll forest on the coast and adjacent ranges.	Low. No suitable habitat present.
Leafless Tongue Orchid *Cryptostylis hunteriana*	V	V	Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. Recorded nearby on Red Rocks plateau, Cambewarra Range Nature Reserve (NPWS 2009)	Low. No suitable habitat present.
Darwinia biflora	V	V	Heath on sandstone or in the understorey of woodland on shale-capped ridges.	Low. No suitable habitat present.
Camfield's Stringybark *Eucalyptus camfieldii*	V	V	Coastal scrub heath on sandy soils on sandstone, often of restricted drainage.	Low. No suitable habitat present.
Narrow-leaved Black Peppermint *Eucalyptus nicholii*	V	V	Grows in dry grassy woodland, on shallow and infertile soils, mainly on granite.	Low. No suitable habitat present.
Genoplesium baueri		E	Grows in sparse sclerophyll forest and moss gardens over sandstone.	Low. No suitable habitat present.
Caley's Grevillea *Grevillea caleyi*	E	E	Restricted to an 8 km square area around Terrey Hills within open forest, generally dominated by *Eucalyptus sieberi* and *E. gummifera*.	Low. No suitable habitat present.
Haloragodendron lucasii	E	E	Restricted to the Hornsby-Gordon area of the northern suburbs of Sydney where it grows in low open woodland or open forest on sheltered aspects and inhabits gentle slopes below cliff lines near	Low. No suitable habitat present.

[3] For the site to support, and be important for the lifecycle requirements of, a locally viable population of this species.

Common and Scientific Name	Legislation		Primary habitat requirements	Likelihood of Occurrence[3]
	EPBC Act	BC Act		
			creeks.	
Julian's Hibbertia *Hibbertia spanantha*	CE	CE	Severely restricted distribution. Grows in forest with canopy species including *Eucalyptus pilularis, E. resinifera, Corymbia gummifera* and *Angophora costata.* The understorey is open with species of Poaceae, Orchidaceae, Fabaceae and Liliaceae.	Low. No suitable habitat present.
Kunzea rupestris	V	V	Severely restricted distribution. Grows in shallow depressions on large flat sandstone rock outcrops.	Low. No suitable habitat present.
Lasiopetalum joyceae	V	V	Woodland and heath on clayey ridge-tops on sandstone.	Low. No suitable habitat present.
Leptospermum deanei	V	V	Forested slopes near watershed of Lane Cove River.	Low. No suitable habitat present.
Biconvex Paperbark *Melaleuca biconvexa*	V	V	Scattered and dispersed populations of this species are found in the Jervis Bay and the Gosford-Wyong areas. It occurs in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects.	Low. No suitable habitat present.
Deane's Melaleuca *Melaleuca deanei*	V	V	Woodland on broad flat ridgetops, dry ridges and slopes on low nutrient soils.	Low. No suitable habitat present.
Micromyrtus blakelyi	V	V	Restricted to areas near the Hawkesbury River.	Low. No suitable habitat present.
Microtis angusii	E	E	Known population restricted to ridgetop lateritic soils in the Duffys Forest - Terrey Hills - Ingleside and Belrose areas.	Low. No suitable habitat present.
Hairy Geebung *Persoonia hirsuta*	E	E	Woodland and heath on clayey ridge-tops on sandstone.	Low. No suitable habitat present.
Persoonia mollis subsp. *maxima*	E	E	Highly restricted – Hornsby Heights – Mt Colah area.	Low. No suitable habitat present.
Pimelea curviflora var. *curviflora*	V	V	Undergrowth in woodland on sandstone.	Low. No suitable habitat present.
Spiked Rice-flower *Pimelea spicata*	E	E	On the Cumberland Plain it is associated with Grey Box and Ironbark on well-structured clay soils. In the Illawarra region, P. spicata is found in open woodland and also in coastal grassland communities with emergent shrubs.	Low. No suitable habitat present.
Villous Mint-bush *Prostanthera densa*	V	V	Generally grows in sclerophyll forest and shrubland on coastal headlands and near coastal ranges, chiefly on sandstone, and rocky slopes near the sea.	Low. No suitable habitat present.
Somersby Mintbush *Prostanthera junonis*	E	E	Restricted to the Somersby Plateau/Sydney Town soil landscapes, on sandstone within open forest, low woodland, open scrub.	Low. No suitable habitat present.
Prostanthera marifolia	CE	CE	On ridgetops, in clay-loam soils associated with ironstone and scattered shale lenses around the Duffys Forest area.	Low. No suitable habitat present.

Common and Scientific Name	Legislation		Primary habitat requirements	Likelihood of Occurrence[3]
	EPBC Act	BC Act		
Magenta Lilly Pilly *Syzygium paniculatum*	V	E	Found only in NSW, in a narrow, linear coastal strip from Upper Lansdowne to Conjola State Forest. On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest.	Low. No suitable habitat present.
Tetratheca glandulosa	V	V	Heath and woodland on sandstone.	Low. No suitable habitat present.
Triplarina imbricata	E	E	Grows in heath, often in damp places	Low. No suitable habitat present.
Zieria involucrata	V	E	Found primarily in sheltered forests on mid- to lower slopes and valleys, e.g. in or adjacent to gullies which support sheltered forest, although some populations extend upslope into drier vegetation. Also known from at least two atypical ridgetop locations.	Low. No suitable habitat present.
MAMMALS				
Spotted-tailed Quoll *Dasyurus maculatus*	E	V	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.	Low. Targeted, not recorded No suitable habitat present.
Southern Brown Bandicoot *Isoodon obesulus obesulus*	E	E	Generally only found in heath or open forest with a heathy understorey on sandy or friable soils.	Low. Targeted, not recorded No suitable habitat present.
Koala *Phascolarctos cinereus*	V	V	Open eucalypt forest and woodland, containing a variety of 'preferred' food tree species.	Low. No suitable habitat present.
Eastern Pygmy-possum *Cercartetus nanus*		V	Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes.	Low. No suitable habitat present.
Grey-headed Flying-fox *Pteropus poliocephalus*	V	V	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.	Moderate. May potentially fly over and forage within the study area; however, this species would not be reliant on the study area for any of its life cycle requirements.
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*		V	Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	Moderate. May potentially fly over and forage within the study area. However, as no hollow-bearing trees will be removed, this species would not be reliant on the study area for any of its life cycle requirements.

Common and Scientific Name	Legislation		Primary habitat requirements	Likelihood of Occurrence[3]
	EPBC Act	BC Act		
Large-eared Pied Bat *Chalinolobus dwyeri*	V	V	Cave-roosting bat that forages in timbered woodland and dry sclerophyll forest.	Moderate. May potentially fly over and forage within the study area. However, no caves are present within the area investigated; the species would not be reliant on the study area for any of its life cycle requirements.
Southern Myotis *Myotis macropus*		V	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface.	Moderate. May potentially fly over and forage within the study area. However, as no hollow-bearing trees will be removed, this species would not be reliant on the study area for any of its life cycle requirements.
Greater Broad-nosed Bat *Scoteanax rueppellii*		V	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Usually roosts in tree hollows but also in buildings.	Moderate. May potentially fly over and forage within the study area. However, as no hollow-bearing trees will be removed, this species would not be reliant on the study area for any of its life cycle requirements.
Little Bentwing-bat *Miniopterus australis*		V	Generally found in well-timbered areas. Roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day.	Moderate. May potentially fly over and forage within the study area. However, no caves are present within the area investigated; the species would not be reliant on the study area for any of its life cycle requirements.
Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*		V	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures.	Moderate. May potentially fly over and forage within the study area. However, no caves are present within the area investigated; the species would not be reliant on the study area for any of its life cycle requirements.

Common and Scientific Name	Legislation		Primary habitat requirements	Likelihood of Occurrence[3]
	EPBC Act	BC Act		
Eastern Freetail-Bat *Mormopterus norfolkensis*		V	Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures.	Moderate. May potentially fly over and forage within the study area. However, as no hollow-bearing trees will be removed, this species would not be reliant on the study area for any of its life cycle requirements.
New Holland Mouse *Pseudomys novaehollandiae*	V		Open heathland, open woodland with a heathland understorey and vegetated sand dunes.	Low. Targeted, not recorded No suitable habitat present..
BIRDS				
Superb Fruit-Dove *Ptilinopus superbus*		V	Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees.	Low. No suitable habitat present.
Wompoo Fruit-Dove *Ptilinopus magnificus*		V	Occurs in, or near rainforest, low elevation moist eucalypt forest and brush box forests.	Low. No suitable habitat present.
White-throated Needletail *Hirundapus caudacutus*	M, Ma		Almost exclusively aerial. Takes insects on wing over a range of habitat types. Recorded most often above wooded areas, including open forest and rainforest.	Low. May potentially fly over the study area. However, this species would not be reliant on the study area for any of its lifecycle requirements.
Fork-tailed Swift *Apus pacificus*	M, Ma		Almost exclusively aerial. Takes insects on wing over a range of habitat types, but also less than 1 m above open areas or over water. Mostly occur over inland plains but sometimes above foothills or in coastal areas.	Low. May potentially fly over study area. However, this species would not be reliant on the study area for any of its lifecycle requirements.
Cattle Egret *Ardea ibis*	Ma		The Cattle Egret is a communal bird that forages mainly within wet pastures in groups of two to twenty plus. This bird feeds on a variety of insects and, occasionally, small aquatic animals. The Cattle Egret rests and nests colonially in trees and shrub that line waterways.	Low. No suitable habitat present.
Great Egret *Ardea alba*	Ma		The Great Egret is a solitary and territorial waterbird that forages within waters that are up to 30 cm deep. Ths bird is found throughout Australia in association with lakes, swamps, rivers and dams. Though listed under the international migratory bird agreement, the Great Egret is a sedentary bird that does not migrate northwards during the winter months. Breeding occurs between the months of October and December and March to May, the Great Egret constructs a stick nest within trees at a height of up to 15 m.	Low. No suitable habitat present.

Common and Scientific Name	Legislation		Primary habitat requirements	Likelihood of Occurrence[3]
	EPBC Act	BC Act		
Eastern Reef Egret *Egretta sacra*	Ma		The Eastern Reef Egret is distributed throughout coastal Australia except southern Victoria and Tasmania breeding any time of year, but mostly August to April. Occupies coral reefs, tidal flats and rock platforms and feeds mostly on small fish and occasionally crustaceans and insects.	Low. No suitable habitat present.
Black Bittern *Ixobrychus flavicollis*		V	Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves.	Low. No suitable habitat present.
Australasian Bittern *Botaurus poiciloptilus*	E	E	Occupies shallow, vegetated freshwater or brackish swamps, usually dominated by tall, dense reed beds of *Typha* sp., *Juncus* sp. and *Phragmites* sp. Nests on platforms of reeds and rushes, usually built over water in dense cover.	Low. No suitable habitat present.
Glossy Ibis *Plegadis falcinellus*	M, Ma		Fresh water marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation.	Low. No suitable habitat present.
Eastern Osprey *Pandion cristatus*	M, Ma	V	Occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands.	Low. No suitable habitat present.
Square-tailed Kite *Lophoictinia isura*		V	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses.	Low. No suitable habitat present.
White-bellied Sea-Eagle *Haliaeetus leucogaster*	Ma	V	Found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia.	Low. May potentially fly over and forage within the study area; however, this species would not be reliant on the study area for any of its life cycle requirements.
Little Eagle *Hieraaetus morphnoides*		V	Occupies open eucalypt forest, woodland or open woodland. Sheoak or *Acacia* woodlands and riparian woodlands of interior NSW are also used.	Low. May potentially fly over and forage within the study area; however, this species would not be reliant on the study area for any of its life cycle requirements.
Glossy Black-cockatoo *Calyptorhynchus lathami*		V	Inhabits eucalypt woodland and feeds almost exclusively on Casuarina fruits.	Low. No suitable habitat present.
Gang-gang Cockatoo *Callocephalon fimbriatum*		V	Prefers tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests during summer, these being at higher altitudes. In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, or in dry forest in coastal areas.	Low. No suitable habitat present.

Common and Scientific Name	Legislation		Primary habitat requirements	Likelihood of Occurrence[3]
	EPBC Act	BC Act		
Little Lorikeet *Glossopsitta pusilla*		V	Forages primarily in the open Eucalypt forest and woodland canopies, particularly along water courses; occasionally in Angophoras, Melaleucas and other tree species, also riparian habitats are used.	Low. No suitable habitat present.
Swift Parrot *Lathamus discolor*	CE	E	Eucalypt forests. When over-wintering on the mainland, this species is dependent on winter-flowering eucalypt species.	Low. No suitable habitat present.
Turquoise Parrot *Neophema pulchella*		V	Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland.	Low. No suitable habitat present.
Oriental Cuckoo *Cuculus optatus*	M, Ma		Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland.	Low. No suitable habitat present.
Powerful Owl *Ninox strenua*		V	Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest.	Low. No suitable habitat present.
Barking Owl *Ninox connivens*		V	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland.	Low. No suitable habitat present.
Sooty Owl *Tyto tenebricosa*		V	Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests.	Low. No suitable habitat present.
Regent Honeyeater *Anthochaera phrygia*	CE	CE	Inhabits dry open forest and woodland. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes.	Low. No suitable habitat present.
Varied Sittella *Daphoenositta chrysoptera*		V	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland.	Low. No suitable habitat present.
Dusky Woodswallow *Artamus cyanopterus cyanopterus*		V	Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris.	Low. No suitable habitat present.
Rufous Fantail *Rhipidura rufifrons*	M, Ma		Mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts.	Moderate. Potential habitat present. No individuals observed during study.
Satin Flycatcher *Myiagra cyanoleuca*	M, Ma		Mainly inhabit eucalypt forests, often near wetlands or watercourses.	Low. No suitable habitat present.
Black-faced Monarch *Monarcha melanopsis*	M, Ma		Rainforest and wet eucalypt forest.	Moderate. Potential habitat present. No individuals observed during study.
Spectacled Monarch *Monarcha trivirgatus*	M, Ma		Rainforest, mangroves and moist gloomy gullies of dense eucalypt forest.	Low. No suitable habitat present.
Scarlet Robin *Petroica boodang*		V	Lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs.	Low. No suitable habitat present.

Common and Scientific Name	Legislation		Primary habitat requirements	Likelihood of Occurrence[3]
	EPBC Act	BC Act		
Diamond Firetail *Stagonopleura guttata*		V	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum *Eucalyptus pauciflora* Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland.	Low. No suitable habitat present.
REPTILES				
Rosenberg's Goanna *Varanus rosenbergi*		V	Found in heath, open forest and woodland.	Low. No suitable habitat present.
AMPHIBIANS				
Giant Burrowing Frog *Heleioporus australiacus*	V	V	Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based.	Low. No suitable habitat present.
Red-crowned Toadlet *Pseudophryne australis*		V	Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones.	Low. No suitable habitat present.

Appendix 3. Flora species recorded during the field investigation

Key
* - introduced species
N - weed listed as Priority Weed and/or Schedule 3 and/or WoNS

	Scientific Name	Common Name
FILICOPSIDA		
Davalliaceae	*Nephrolepis cordifolia**	Fishbone Fern
MAGNOLIOPSIDA - DICOTYLEDONS		
Apocynaceae	*Aruajia hortorum**	Moth Plant
Asteraceae	*Ageratina adenophora* *	Crofton Weed
	Bidens pilosa	Farmer's Friend
	Conyza bonariensis *	Fleabane
Caprifoliaceae	*Lonicera japonica**	Japanese Honeysuckle
Casuarinaceae	*Allocasuarina littoralis*	Black She-Oak
Convolvulaceae	*Ipomoea indica** N	Morning Glory
Euphorbiaceae	*Glochidion ferdinandi*	Cheese Tree
Fabaceae: Faboideae	*Trifolium repens* *	White Clover
Fabaceae: Caesalpinioideae	*Senna pendula var. glabrata*	Cassia
Myrtaceae	*Angophora costata*	Smooth-barked Apple
	Kunzea ambigua	Tick Bush
Oleaceae	*Ligustrum lucidum* * N*	Large-leaved Privet
	Ligustrum sinense * N*	Small-leaved Privet
	Olea europaea subsp. *cuspidata**	African Olive
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum
Plantaginaceae	*Plantago lanceolata**	Plantain
Rosaceae	*Rubus fruticosus* agg. spp. * N*	Blackberry
	Cotoneaster sp.	
Solanaceae	*Cestrum parqui*	Green Cestrum
Verbenaceae	*Lantana camara*	Lantana
MAGNOLIOPSIDA - MONOCOTYLEDONS		
Asparagaceae	*Asparagus aethiopicus** N	Asparagus 'Fern'
Poaceae	*Andropogon virginicus*	Whisky Grass
	*Cortaderia selloana** N *	Pampas Grass
	Cynodon dactylon *	Couch
	Paspaul urvillei *Pennisetum clandestinum* * *Phyllostachys aurea*	Vasey Grass Kikuyu Grass Fishpole Bamboo

Appendix 4. Fauna species known to occur in the vicinity of the subject site

Source of Records
1 = OEH (2019)
2 = Lesryk (2001a)

Key
A – species listed under the EPBC Act
B – species listed under the BC Act
V – species is Vulnerable
E – species is Endangered
C – species is Critically Endangered
F – migratory Family listed under the EPBC Act
M – species listed as migratory listed under the EPBC Act
Ma – species listed as marine under the EPBC Act
* – indicates introduced species

A	B	Common Name	Family and Scientific Name	1	2
		BIRDS			
			Megapodiidae		
		Australian Brush Turkey	*Alectura lathami*	x	
			Phasianidae		
		Stubble Quail	*Coturnix pectoralis*	x	
		Brown Quail	*Coturnix ypsilophora*	x	
		King Quail	*Coturnix chinensis*	x	
F			**Anatidae**		
		Black Swan	*Cygnus atratus*	x	
		Wandering Whistling-Duck	*Dendrocygna arcuata*	x	
		Plumed Whistling-duck	*Dendrocygna eytoni*	x	
		Australian Shelduck	*Tadorna tadornoides*	x	
		Pacific Black Duck	*Anas superciliosa*	x	
		* Mallard	*Anas platyrhynchos*	x	
		Grey Teal	*Anas gracilis*	x	
		Chestnut Teal	*Anas castanea*	x	
		Australasian Shoveler	*Anas rhynchotis*	x	
		Hardhead	*Aythya australis*	x	
		Australian Wood Duck	*Chenonetta jubata*	x	x
			Podicipedidae		
		Hoary-headed Grebe	*Poliocephalus poliocephalus*	x	
		Australasian Grebe	*Tachybaptus novaehollandiae*	x	
			Columbidae		
	V	Superb Fruit-dove	*Ptilinopus superbus*	x	
	V	Wompoo Fruit-dove	*Ptilinopus magnificus*	x	
		Topknot Pigeon	*Lopholaimus antarcticus*	x	
		White-headed Pigeon	*Columba leucomela*	x	
		* Rock Dove	*Columba livia*	x	
		* Spotted Dove	*Streptopelia chinensis*	x	x
		Brown Cuckoo-Dove	*Macropygia amboinensis*	x	
		Peaceful Dove	*Geopelia striata*	x	
		Diamond Dove	*Geopelia cuneata*	x	
		Bar-shouldered Dove	*Geopelia humeralis*	x	
		Emerald Dove	*Chalocophaps indica*	x	
		Common Bronzewing	*Phaps chalcoptera*	x	
		Brush Bronzewing	*Phaps elegans*	x	
		Crested Pigeon	*Ocyphaps lophotes*	x	x
		Wonga Pigeon	*Leucosarcia picata*	x	
			Podargidae		
		Tawny Frogmouth	*Podargus strigoides*	x	x

A	B	Common Name	Family and Scientific Name	1	2
			Eurostopodidae		
		White-throated Nightjar	*Eurostopodus mystacalis*	x	
			Aegothelidae		
		Australian Owlet-nightjar	*Aegotheles cristatus*	x	
			Apodidae		
M,Ma		White-throated Needletail	*Hirundapus caudacutus*	x	
M,Ma		Fork-tailed Swift	*Apus affinis*	x	
			Phalacrocoracidae		
		Great Cormorant	*Phalacrocorax carbo*	x	
		Pied Cormorant	*Phalacrocorax varius*	x	
		Little Pied Cormorant	*Phalacrocorax melanoleucos*	x	
		Little Black Cormorant	*Phalacrocorax sulcirostris*	x	
			Pelecanidae		
		Australian Pelican	*Pelecanus conspicillatus*	x	x
			Ardeidae		
		White-necked Heron	*Ardea pacifica*	x	
		White-faced Heron	*Egretta novaehollandiae*	x	x
Ma		Cattle Egret	*Ardea ibis*	x	
Ma		Great Egret	*Ardea alba*	x	
		Intermediate Egret	*Egretta intermedia*	x	
Ma		Eastern Reef Egret	*Egretta sacra*	x	
		Striated Heron	*Butorides striatus*	x	
		Nankeen Night Heron	*Nycticorax caledonicus*	x	
	V	Black Bittern	*Ixobrychus flavicollis*	x	
E	E	Australasian Bittern	*Botaurus poiciloptilus*	x	
			Threskiornidae		
M,Ma		Glossy Ibis	*Plegadis falcinellus*	x	
		Australian White Ibis	*Threskiornis molucca*	x	
		Straw-necked Ibis	*Threskiornis spinicollis*	x	
		Royal Spoonbill	*Platalea regia*	x	
F			**Accipitridae**		
		Pacific Baza	*Aviceda subcristata*	x	
		Black-shouldered Kite	*Elanus axillaris*	x	
M,Ma	V	Eastern Osprey	*Pandion haliaetus*	x	
	V	Square-tailed Kite	*Lophoictinia isura*	x	
		Black Kite	*Milvus migrans*	x	
		Whistling Kite	*Haliastur sphenurus*	x	
Ma	V	White-bellied Sea-eagle	*Haliaeetus leucogaster*	x	
		Wedge-tailed Eagle	*Aquila audax*	x	
	V	Little Eagle	*Hieraaetus morphnoides*	x	
		Brown Goshawk	*Accipiter fasciatus*	x	
		Grey Goshawk	*Accipiter novaehollandiae*	x	
		Collared Sparrowhawk	*Accipiter cirrhocephalus*	x	
		Swamp Harrier	*Circus approximans*	x	
F			**Falconidae**		
		Peregrine Falcon	*Falco pergrinus*	x	
		Brown Falcon	*Falco berigora*	x	
		Australian Hobby	*Falco longipennis*	x	
		Nankeen Kestrel	*Falco cenchroides*	x	
			Rallidae		
		Buff-banded Rail	*Gallirallus phillippensis*	x	
		Lewin's Rail	*Rallus pectoralis*	x	
		Australian Spotted Crake	*Porzana fluminea*	x	
		Spotless Crake	*Porzana tabuensis*	x	
		Dusky Moorhen	*Gallinula tenebrosa*	x	
		Purple Swamphen	*Porphyrio porphyrio*	x	
		Eurasian Coot	*Fulica atra*	x	

A	B	Common Name	Family and Scientific Name	1	2
F			**Charadriidae**		
		Masked Lapwing	*Vanellus miles*	x	
			Turnicidae		
		Painted Button-quail	*Turnix varia*	x	
		Red-chested Button-quail	*Turnix pyrrhothorax*	x	
			Laridae		
		Silver Gull	*Larus novaehollandiae*	x	
		Kelp Gull	*Larus dominicanus*	x	
			Cacatuidae		
	V	Glossy Black-Cockatoo	*Calyptorhynchus lathami*	x	
		Yellow-tailed Black Cockatoo	*Calyptorhynchus funereus*	x	
	V	Gang-gang Cockatoo	*Callocephalon fimbriatum*	x	
		Galah	*Eolophus roseicpilla*	x	
		Long-billed Corella	*Cacatua tenuirostris*	x	
		Little Corella	*Cacatua sanguinea*	x	
		Sulphur-crested Cockatoo	*Cacctua galerita*	x	
		Cockatiel	*Nymphicus hollandicus*	x	
			Psittacidae		
		Rainbow Lorikeet	*Trichoglossus haematodus*	x	x
		Scaly-breasted Lorikeet	*Trichoglossus chlorolepidotus*	x	
		Musk Lorikeet	*Glossopsitta concinna*	x	
	V	Little Lorikeet	*Glossopsitta pusilla*	x	
		Australian King Parrot	*Alisterus scapularis*	x	
		Red-winged Parrot	*Aprosmictus erythropterus*	x	
		Budgerigar	*Melopsittacus undulatus*	x	
C,Ma	E	Swift Parrot	*Lathamus discolor*	x	
		Crimson Rosella	*Platycercus elegans*	x	
		Eastern Rosella	*Platycercus eximius*	x	x
		Pale-headed Rosella	*Platycercus adscitus*	x	
		Australian Ringneck	*Barnardius zonarius*	x	
	V	Turquoise Parrot	*Neophema pulchella*	x	
			Cuculidae		
M,Ma		Oriental Cuckoo	*Culculus optatus*	x	
		Pallid Cuckoo	*Cacomantis pallidus*	x	
		Brush Cuckoo	*Cacomantis variolosus*	x	
		Fan-tailed Cuckoo	*Cacomantis flabelliformis*	x	
		Horsfield's Bronze-Cuckoo	*Chrysococcyx basalis*	x	
		Shining Bronze-Cuckoo	*Chrysococcyx lucidus*	x	
		Eastern Koel	*Eudynamys scopopacea*	x	
		Channel-billed Cuckoo	*Scythrops novaehollandiae*	x	
		Pheasant Coucal	*Centropus phasianinus*	x	
			Strigidae		
	V	Powerful Owl	*Ninox strenua*	x	
		Southern Boobook	*Ninox novaeseelandiae*	x	
	V	Barking Owl	*Ninox connivens*	x	
			Tytonidae		
	V	Sooty Owl	*Tyto tenebricosa*	x	
		Eastern Barn Owl	*Tyto javanica*	x	
			Alcedinidae		
		Azure Kingfisher	*Ceyx azureus*	x	
			Halcyonidae		
		Laughing Kookaburra	*Dacelo naxaeguineae*	x	x
		Sacred Kingfisher	*Todiramphus sanctus*	x	
		Forest Kingfisher	*Todiramphus macleayii*	x	
			Coraciidae		
		Dollarbird	*Eurystomus orientalis*	x	
			Pittidae		

A	B	Common Name	Family and Scientific Name	1	2
		Noisy Pitta	*Pitta versicolor*	x	
			Menuridae		
		Superb Lyrebird	*Menura novaehollandiae*	x	
			Climacteridae		
		White-throated Treecreeper	*Cormobates leucophaea*	x	
			Ptilonorhynchidae		
		Satin Bowerbird	*Ptilonorhychus violaceus*	x	
			Maluridae		
		Superb Fairy-wren	*Malurus cyaneus*	x	x
		Variegated Fairy-wren	*Malurus lamberti*	x	
			Acanthizidae		
		Rockwarbler	*Origma solitaria*	x	
		Large-billed Scrubwren	*Sericornis magnirostra*	x	
		White-browed Scrubwren	*Sericornis frontalis*	x	x
		Yellow-throated Scrubwren	*Sericornis citreogularis*	x	
		Chestnut-rumped Heathwren	*Hylacola pyrrhopygia*	x	
		White-throated Gerygone	*Gerygone olivacea*	x	
		Brown Gerygone	*Gerygone mouki*	x	
		Brown Thornbill	*Acanthiza pusilla*	x	x
		Buff-rumped Thornbill	*Acanthiza reguloides*	x	
		Yellow Thornbill	*Acanthiza nana*	x	
		Striated Thornbill	*Acanthiza lineata*	x	
		Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	x	
		Unidentified Thornbill	*Acanthiza sp.*	x	
			Pardalotidae		
		Spotted Pardalote	*Pardalotus punctatus*	x	x
		Striated Pardalote	*Pardalotus striatus*	x	
		Unidentified Pardalote	*Pardalotus sp.*	x	
			Meliphagidae		
		Red Wattlebird	*Anthochaera carunculata*	x	x
		Little (Brush) Wattlebird	*Anthochaera chrysoptera*	x	
		Unidentified Wattlebird	*Anthochaera sp*	x	
		Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	x	
		Noisy Friarbird	*Philemon corniculatus*	x	
		Noisy Miner	*Manorina melanocephala*	x	x
C	C	Regent Honeyeater	*Anthochaera phrygia*	x	
		Lewin's Honeyeater	*Meliphaga lewinii*	x	
		Yellow-faced Honeyeater	*Lichenostomus chrysops*	x	
		White-eared Honeyeater	*Lichenostomus leucotis*	x	
		Yellow-tufted Honeyeater	*Lichenostomus melanops*	x	
		Fuscous Honeyeater	*Lichenostomus fuscus*	x	
		Brown-headed Honeyeater	*Melithreptus brevirostris*	x	
		White-naped Honeyeater	*Melithreptus lunatus*	x	
		White-cheeked Honeyeater	*Phylidonyris nigra*	x	
		White-plumed Honeyeater	*Lichenostomus pencillatus*	x	
		New Holland Honeyeater	*Phylidonryis novaehollandiae*	x	
		Tawny-crowned Honeyeater	*Phylidonryis melanops*	x	
		Eastern Spinebill	*Acanthorhynchus tenuirostris*	x	
		Scarlet Honeyeater	*Myzomela sanguinolenta*	x	
			Orthonychidae		
		Eastern Whipbird	*Psophodes olivaceus*	x	x
			Neosittidae		
	V	Varied Sittella	*Daphoenositta chrysoptera*	x	
			Campephagidae		
		Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	x	x
		White-bellied Cuckoo-shrike	*Coracina papuensis*	x	
		Varied Triller	*Lalage leucomela*	x	

A	B	Common Name	Family and Scientific Name	1	2
			Pachycephalidae		
		Crested Shrike-tit	*Falcunculus frontatus*	x	
		Grey Shrike-thrush	*Colluricincla harmonica*	x	
		Golden Whistler	*Pachycephala pectoralis*	x	
		Rufous Whistler	*Pachycephala rufiventris*	x	
			Oriolidae		
		Olive-backed Oriole	*Oriolus sagittatus*	x	
		Australasian Figbird	*Sphecotheres vieilloti*	x	
			Artamidae		
		White-browed Woodswallow	*Artamus superciliosus*	x	
		Masked Woodswallow	*Artamus personatus*	x	
	V	Dusky Woodswallow	*Artamus cyanopterus*	x	
		Grey Butcherbird	*Cracticus torquatus*	x	x
		Pied Butcherbird	*Cracticus nigrogularis*	x	
		Australian Magpie	*Gymnorhina tibicen*	x	x
		Pied Currawong	*Strepera graculina*	x	x
			Dicruridae		
		Spangled Drongo	*Dicrurus bracteatus*	x	
			Rhipiduridae		
		Grey Fantail	*Rhipidura fuliginosa*	x	x
M,Ma		Rufous Fantail	*Rhipidura rufifrons*	x	
		Willie Wagtail	*Rhipidura leucophrys*	x	
			Corvidae		
		Australian Raven	*Corvus coronoides*	x	x
		Little Raven	*Corvus mellori*	x	
			Monarchidae		
		Leaden Flycatcher	*Myiagra rubecula*	x	
M,Ma		Satin Flycatcher	*Myiagra cyanoleuca*	x	
		Restless Flycatcher	*Myiagra inquieta*	x	
M,Ma		Black-faced Monarch	*Monarcha melanopsis*	x	
M,Ma		Spectacled Monarch	*Symposiarchus trivirgatus*	x	
		Magpie Lark	*Grallina cyanoleuca*	x	x
			Corcoracidae		
		White-winged Chough	*Corcorax melanorhamphos*	x	
			Petroicidae		
		Rose Robin	*Petroica rosea*	x	
	V	Scarlet Robin	*Petroica multicolor*	x	
		Eastern Yellow Robin	*Eopsaltria australis*	x	
		Jacky Winter	*Microeca fascinans*	x	
			Alaudidae		
		* Eurasian Skylark	*Alauda arvensis*	x	
F			**Cisticolidae**		
		Golden-headed Cisticola	*Cisticola exilis*	x	
F			**Megaluridae**		
		Rufous Songlark	*Cincloramphus mathewsi*	x	
		Tawny Grassbird	*Megalurus timoriensis*	x	
			Timaliidae		
		Silvereye	*Zosterops lateralis*	x	
			Hirundinidae		
		Welcome Swallow	*Hirundo neoxena*	x	x
		Tree Martin	*Petrochelidon nigricans*	x	
			Pycnonotidae		
		* Red-whiskered Bulbul	*Pycnonotus jocosus*	x	x
F			**Turdidae**		
		Bassian Thrush	*Zoothera lunulata*	x	
		Russet-tailed Thrush	*Zoothera heinei*	x	
			Sturnidae		

A	B	Common Name	Family and Scientific Name	1	2
		* Common Starling	*Sturnus vulgaris*	x	
		* Common Myna	*Acridotheres tristis*	x	x
			Nectariniidae		
		Mistletoebird	*Dicaeum hirundinaceum*	x	
			Estrildidae		
		Double-barred Finch	*Taeniopygia bichenovii*	x	
		Zebra Finch	*Taeniopygia guttata*	x	
		Red-browed Finch	*Neochmia temporalis*	x	
	V	Diamond Firetail	*Stagonopleura guttata*	x	
		* Nutmeg Mannikin	*Lonchura puntulata*	x	
			Passeridae		
		* House Sparrow	*Passer domesticus*	x	
			Motacillidae		
		Australasian Pipit	*Anthus naovaeseelandiae*	x	
			Fringillidae		
		* European Goldfinch	*Carduelis carduelis*	x	
		MAMMALS			
			Tachyglossidae		
		Short-beaked Echidna	*Tachyglossus aculeatus*	x	
			Dasyuridae		
		Yellow-footed Antechinus	*Antechinus flavipes*	x	
		Brown Antechinus	*Antechinus stuartii*	x	
E	V	Spotted-tailed Quoll	*Dasyurus maculatus*	x	
			Peramelidae		
E	E	Southern Brown Bandicoot	*Isoodon obesulus*	x	
		Long-nosed Bandicoot	*Perameles nasuta*	x	
			Phascolarctidae		
V	V	Koala	*Phascolarctos cinereus*	x	
			Burramyidae		
	V	Eastern Pygmy-possum	*Cercartetus nanus*	x	
			Petauridae		
		Sugar Glider	*Petaurus breviceps*	x	
			Pseudocheiridae		
		Common Ringtail Possum	*Pseudocheirus peregrinus*	x	x
			Acrobatidae		
		Feathertail Glider	*Acrobates pygmaeus*	x	
			Phalangeridae		
		Common Brushtail Possum	*Trichosurus vulpecula*	x	x
			Macropodidae		
		Swamp Wallaby	*Wallabia bicolor*	x	
			Pteropodidae		
		Black Flying Fox	*Pteropus alecto*	x	
V	V	Grey-headed Flying-fox	*Pteropus poliocephalus*	x	
		Little Red Flying-fox	*Pteropus scapulatus*	x	
			Emballonuridae		
	V	Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	x	
			Rhinolophidae		
		Eastern Horseshoe Bat	*Rhinolophus megaphyllus*	x	
			Vespertilioidae		
V	V	Large-eared Pied Bat	*Chalinolobus dwyeri*	x	
		Gould's Wattled Bat	*Chalinolobus gouldii*	x	
		Chocolate Wattled Bat	*Chalinolobus morio*	x	
	V	Southern Myotis	*Myotis macropus*	x	
		Lesser Long-eared Bat	*Nyctophilus geoffroyi*	x	
	V	Greater Broad-nosed Bat	*Scoteanax rueppellii*	x	
		Large Forest Bat	*Vespadelus darlingtoni*	x	
		Eastern Forest Bat	*Vespadelus pumilus*	x	

A	B	Common Name	Family and Scientific Name	1	2
		Little Forest Bat	*Vespadelus vulturnus*	x	
			Miniopteridae		
	V	Little Bentwing-bat	*Miniopterus australis*	x	
	V	Eastern Bentwing-bat	*Miniopterus schreibersii oceanensis*	x	
			Molossidae		
		White-striped Freetail Bat	*Austronomus australis*	x	
	V	Eastern Freetail-bat	*Micronomus norfolkensis*	x	
		Eastern Freetail Bat	*Mormopterus ridei*	x	
			Muridae		
V		New Holland Mouse	*Pseudomys novaehollandiae*	x	
		* House Mouse	*Mus musculus*	x	
		Bush Rat	*Rattus fuscipes*	x	
		Swamp Rat	*Rattus lutreolus*	x	
		* Brown Rat	*Rattus norvegicus*	x	
		* Black Rat	*Rattus rattus*	x	
			Felidae		
		* Feral Cat	*Felis catus*	x	
			Canidae		
		* Fox	*Vulpes vulpes*	x	x
		* Dog	*Canis familiaris*	x	x
			Leporidae		
		* Rabbit	*Oryctolagus cuniculus*	x	
		* Brown Hare	*Lepus capensis*	x	
		REPTILES			
			Chelidae		
		Eastern Snake-necked Turtle	*Chelodina longicollis*	x	
			Carphodactylidae		
		Broad-tailed Gecko	*Phyllurus platurus*	x	
		Thick-tailed Gecko	*Underwoodisaurus milii*	x	
			Diplodactylidae		
		Lesueur's Velvet Gecko	*Amalosia lesueurii*	x	
		Wood Gecko	*Diplodactylus vittatus*	x	
		Southern Spiny-tailed Gecko	*Strophurus intermedius*	x	x
			Pygopodidae		
		Burton's Snake-lizard	*Lialis burtonis*	x	
		Common Scaly-foot	*Pygopus lepidopodus*	x	
			Scincidae		
		Red-throated Skink	*Acritoscincus platynotus*	x	
		Wall Skink	*Cryptoblepharus virgatus*	x	
		Robust Ctenotus	*Ctenotus robustus*	x	
		Copper-tailed Skink	*Ctenotus taeniolatus*	x	
		Mainland she-oak skink	*Cyclodomorphus michaeli*	x	
		Cunningham's Skink	*Egernia cunninghami*	x	
		Eastern Water Skink	*Eulamprus quoyii*	x	
		Grass Skink	*Lampropholis delicata*	x	
		Garden Skink	*Lampropholis guichenoti*	x	x
		Eastern Blue-tongued Lizard	*Tiliqua scincoides*	x	
		Three-toed Skink	*Saiphos equalis*	x	
		Weasel Skink	*Saproscincus mustelinus*	x	
		Rainbow Litter Skink	*Lygisaurus foliorum*	x	
			Agamidae		
		Jacky Lizard	*Amphibolurus muricatus*	x	
		Eastern Water Dragon	*Physignathus lesueurii*	x	
		Bearded Dragon	*Pogona barbata*	x	
			Varanidae		
		Gould's Goanna or Sand Monitor	*Varanus gouldii*	x	
	V	Rosenberg's Goanna	*Varanus rosenbergi*	x	

A	B	Common Name	Family and Scientific Name	1	2
		Lace Monitor	*Varanus varius*	x	
			Typhlopidae		
		Blackish Blind snake	*Ramphotyphlops nigrescens*	x	
			Boidae		
		Carpet python	*Morelia spilota*	x	
			Colubridae		
		Brown Tree Snake	*Boiga irregularis*	x	
		Common Tree Snake	*Dendrelaphis punctulata*	x	
			Elapidae		
		Golden-crowned Snake	*Cacophis squamulosus*	x	
		Eastern Small-eyed Snake	*Cryptophis nigrescens*	x	
		Yellow-faced whipsnake	*Demansia psammophis*	x	
		Red-naped Snake	*Furina diadema*	x	
		Marsh snake	*Hemiaspis signata*		
		Eastern Tiger Snake	*Notechis scutatus*	x	
		Red-bellied Black Snake	*Pseudechis porphyriacus*	x	x
		Eastern Brown Snake	*Pseudonaja textilis*		
		Bandy Bandy	*Vermicella annulata*	x	
		AMPHIBIANS			
			Limnodynastidae		
		Tusked Frog	*Adelotus brevis*	x	
V	V	Giant Burrowing Frog	*Heleioporus australiacus*	x	
		Eastern Banjo Frog	*Limnodynastes dumerilii*	x	
		Brown-striped Frog	*Limnodynastes peronii*	x	x
		Spotted Grass Frog	*Limnodynastes tasmaniensis*	x	
		Ornate Burrowing Frog	*Platyplectrum ornatum*	x	
			Myobatrachidae		
		Common Eastern Froglet	*Crinia signifera*	x	x
		Haswell's Frog	*Paracrinia haswelli*	x	
	V	Red-crowned Toadlet	*Pseudophryne australis*	x	
		Brown Toadlet	*Pseudophryne bibronii*	x	
			Hylidae		
		Green Tree Frog	*Litoria caerulea*	x	
		Bleating Tree Frog	*Litoria dentata*	x	
		Eastern Dwarf Tree Frog	*Litoria fallax*	x	
		Rocket Frog	*Litoria nasuta*	x	
		Peron's Tree Frog	*Litoria peronii*	x	
		Leaf Green Tree Frog	*Litoria phyllochroa*	x	
		Verreaux's Tree Frog	*Litoria verreauxii verreauxii*	x	