



**FLORA AND FAUNA SURVEYS
AND
AND BIODIVERSITY IMPACT ASSESSMENT
FOR
PROPOSED DEVELOPMENT
AT
2 - 4 JACKSONS ROAD,
WARRIEWOOD, NSW, 2102**

PREPARED FOR:

**NORTHERN BEACHES COUNCIL
C/O JOSHUA LYNCH
TERROIR
LEVEL 2 / 79 MYRTLE ST
CHIPPENDALE 2008**

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EXECUTIVE SUMMARY

In November 2020, ACS Environmental was commissioned by Mr Joshua Lynch of Terroir C/o Northern Beaches Council, to survey for flora and fauna and to undertake a biodiversity impact assessment for the development of a Community Centre for the Northern Beaches Council at 2 - 4 Jacksons Road, Warriewood.

The total area of the subject land proposed for development is estimated at about 9,328m². The land currently contains established community facilities, the Nelson Heather Centre and Meals on Wheels. The land has also been extensively landscaped with locally-indigenous, non-locally indigenous and exotic species of canopy trees, shrubs and ground cover plants (Earthscape Horticultural Services 2019).

The proposal is to demolish the current buildings and construct a new 1950m² community facility, across 1 storey, at Boondah Reserve and includes a foyer/community living room space, four halls, meeting rooms, a small office and amenities

Architectural and landscape plans by Terroir (2020) and Aspect Studios (2020) submitted with this application should be consulted for detail.

The subject site contains two distinctly differing forms of vegetation communities, differentiated on the basis of landscaping patterns. The linear landscaped gardens around the southern, western and northern perimeters of the subject area, and including the central plantings of well established individuals of canopy trees, form distinct landscaped assemblages which contain indigenous species such as Bangalay, Spotted Gum and Tallow Wood, many species being representative of local flora (Figures 1, 3A, 3B, 6, 7, 9 & 10).

Currently along Boondah Road to the west, low trees of species such as Blueberry Ash, Turpentine and Sydney Blue Gum occur.

Along the southern and northern sides of the subject land an array of small tree and shrub species includes Weeping Bottlebrush, Turpentine, Old Man Banksia, and Sally Wattle.

The copse of plants that has been planted at the front of the subject area adjacent to Pittwater Road, appears to be a constructed assemblage representative of Coastal Flats Swamp Mahogany Forest (S_FoW02 in OEH 2016; PCTid: 1795).

The small patch of this woodland plant community includes an area of about 762m² within a perimeter of about 138m and contains dominant tree species including Swamp Mahogany (*Eucalyptus robusta*), Swamp Oak (*Casuarina glauca*) and Coast Banksia (*Banksia integrifolia*) with canopy and shrub species occurring in less frequency including

Flooded Gum (*Eucalyptus grandis*), Prickly Paperbark (*Melaleuca styphelioides*), Wild Yellow Jasmine (*Pittosporum revolutum*), Tick Bush (*Kunzea ambigua*), Coast Boobialla (*Myoporum insulare*) and Tuckeroo (*Cupaniopsis anacardioides*).

The landscaped vegetation is managed and few weeds occur amongst the vegetation but in the front copse of vegetation, a low frequency of weed species occurs including African Veldt Grass, Mickey Mouse Plant, Prairie Grass and Green Cestrum.

Atlas of NSW Wildlife data records for an area of 5km radius around the subject site indicate that 17 flora species of conservation significance have been recorded within the last 20 years.

Habitat at the highly floristically and structurally modified subject site does not appear to be suitable for any of these species. Comprehensive targeted searches for particularly these, but other, conspicuous, mostly large life-form species in the mostly landscaped assemblage of the study area did not locate these, or any other threatened flora species, in the subject area.

The OEH Atlas of NSW Wildlife database 2020 recorded thirty one (37) species of terrestrial and avifauna listed as threatened under the BC Act within a 5 km radius of the site. None of these threatened fauna species have been recorded at the subject site but threatened species such as the Grey-headed Flying Fox, Large Bentwing Bat and Powerful Owl are considered to have potential to occasionally forage at the site. All of these mobile species have very large foraging ranges and the proposal to clear a few individuals of Coast Mahogany, some in poor condition, and an individual of Coast Banksia from the eastern section of the subject land with proposed replacement of this individual, would not be considered to compromise these species' life cycles in relation to foraging, roosting and breeding behaviours.

In regard to threatened species legislation, the proposed development is considered to comply with the desired criteria in relation to The Pittwater Council LEP (2014) and Pittwater 21 Council DCP (2014).

It is considered that the development would be highly unlikely to have any adverse effect on the life cycle of any individual threatened flora or fauna species or their respective habitat. It is considered that for potential impacts to any threatened ecological communities or threatened flora or fauna, concurrence from the Director General of the Department of Planning, Industry and Environment is not required, nor is a Species Impact Statement necessary for the proposed development.

Environmental criteria in relation to requirement for biodiversity offsets is assessed as follows:

- The area of property and area proposed for development is less than 1ha, an area too small to trigger offsets;
- The subject land is not marked on the Biodiversity Values Map as containing any significant biodiversity value (Figure 22) and so not triggering biodiversity offsets; and
- It is assessed and considered that no threatened species (of both flora and fauna) would be significantly impacted by the small area of the proposed development at the eastern vegetated section of the subject land.
- A small patch of a constructed assemblage resembling a component of Coastal Flats Swamp Mahogany Forest occurs along the Pittwater Road frontage of the subject land (Figures 1, 3B, 8, 12, 13 & 16). The components of this constructed assemblage however, contain only two species, Swamp Oak and Swamp Mahogany, that are positively diagnostic for this community (OEH 2016). As such, this assemblage may not be regarded as representative of this community. However, a small patch of this assemblage will be retained *in situ*, (Earthscape Horticultural Services 2020), and elements of this ecological plant community will be landscaped in the feature garden in the central sections of the development to replace that which would be lost from the eastern section of the property (Terroir 2020, Aspect Studios 2020).
- The scale of potential loss of habitat is small (at maximum of <9330m²), and as such, this development based on threatened species occurrence and potential impacts of development, would not be considered to trigger the biodiversity offsets scheme.

As such, it is considered that biodiversity offsets in relation to the development are not required.

GLOSSARY AND ACRONYMS

APZ - Asset Protection Zone

BAM - Biodiversity Assessment Method (2017) - supports the BC Act (2016).

BC Act - *Biodiversity Conservation Act (2016)* - legislation enacted in August 2017

CEEC - Critically Endangered Ecological Community

DAWE - Commonwealth Department of Agriculture, Water and Environment

DPIE - Department of Planning, Industry and Environment

E (threatened species status) - Endangered species

EEC - Endangered Ecological Community as listed by the BC Act and EPBC Act

EPBC Act - Environmental Protection & Biodiversity Conservation Act (1999). Enacted to protect and manage nationally and internationally (migratory) flora, fauna and ecological communities, defined in the Act as matters of national environmental significance (NES)

Habitat - areas occupied, either territorially, periodically or occasionally, by a species, population or ecological community

IPA - Inner Protection Area

KTP - Key threatening process, a process that threatens the survival, life cycle, abundance or potential evolutionary development of native species, populations or ecological communities (Dept of Environment and Conservation 2004). KTP's are listed under the BC Act and the EPBC Act.

Migratory species - listed under the EPBC Act and relating to international agreements to which Australia is a signatory. Includes the Japan-Australia Migratory Bird Agreement (JAMBA), China-Australia Migratory Bird Agreement (CAMBA) Republic of Korea Migratory Bird Agreement (ROKAMBA)

OEH - State Office of Environment and Heritage

PCT - Plant Community Type identified as such using the Bionet Vegetation Classification system (OEH 2018)

PSGF - Pittwater Spotted Gum Forest

RoTAP - Rare or Threatened Australian Plants

Threatened species, populations or ecological communities - Entities listed by the BC Act and EPBC Act as 'Vulnerable to decreasing population growth in time', Endangered as population growth decreasing rapidly leading to eventual extinction' or 'Critically Endangered, a more extreme rate of population decrease than the former'.

V (threatened species status) - Vulnerable

INTRODUCTION

1.1 Proposed development

In November 2020, ACS Environmental was commissioned by Mr Joshua Lynch of Terroir C/o Northern Beaches Council, to survey for flora and fauna and undertake a biodiversity impact assessment for the development of a Community Centre for the Northern Beaches Council at 2 - 4 Jacksons Road, Warriewood.

The total area of the subject land proposed for development is estimated at about 9,328m². The land currently contains the established community facilities, the Nelson Heather Centre and Meals on Wheels. The land has also been extensively landscaped with locally-indigenous, non-locally indigenous and exotic species of canopy trees, shrubs and ground cover plants (Earthscape Horticultural Services 2019).

The proposal is to demolish the current buildings and construct a new 1950m² community facility, across 1 storey, at Boondah Reserve and includes a foyer/community living room space, four halls, meeting rooms, a small office and amenities.

Figure 1 is an aerial image showing the subject land indicating adjoining properties, built structures and areas of landscaped vegetation and remnant patches of bushland.

Figure 2 is a schematic image of the site plan indicating the proposed location of the built structures in relation to the property layout (Terroir 2020).

Figures 3A and 3B are schematic arboricultural tree plan depictions by Earthscape Horticultural Services (2019) showing the current location of canopy trees located on the subject land with various degrees of assessed retention values.

Figures 4A & 4B are schematic arboricultural tree plan depictions by Earthscape Horticultural Services (2020) indicating which trees are likely to be retained and which are likely to be removed and where replacement planting in the feature Landscape Garden central courtyard can occur.

Figure 5 is an aerial depiction of the subject area showing the land in relation to established development in the local area.



Figure 1 - Aerial image of subject land at 2 - 4 Jacksons Road, Warriewood (red outline) including canopy distribution in local area and residential development in surrounding allotments (from SIXmaps 2020)



Figure 2 - Schematic Site Plan of subject proposal indicating location of buildings and carpark facilities, new pedestrian and cycleway routes, feature landscape garden and slip-lane from Jacksons Road to Pittwater Road, Warriewood (for detail refer to Warriewood Valley Community Centre Concept Design - Site Plan Terroir 2020)

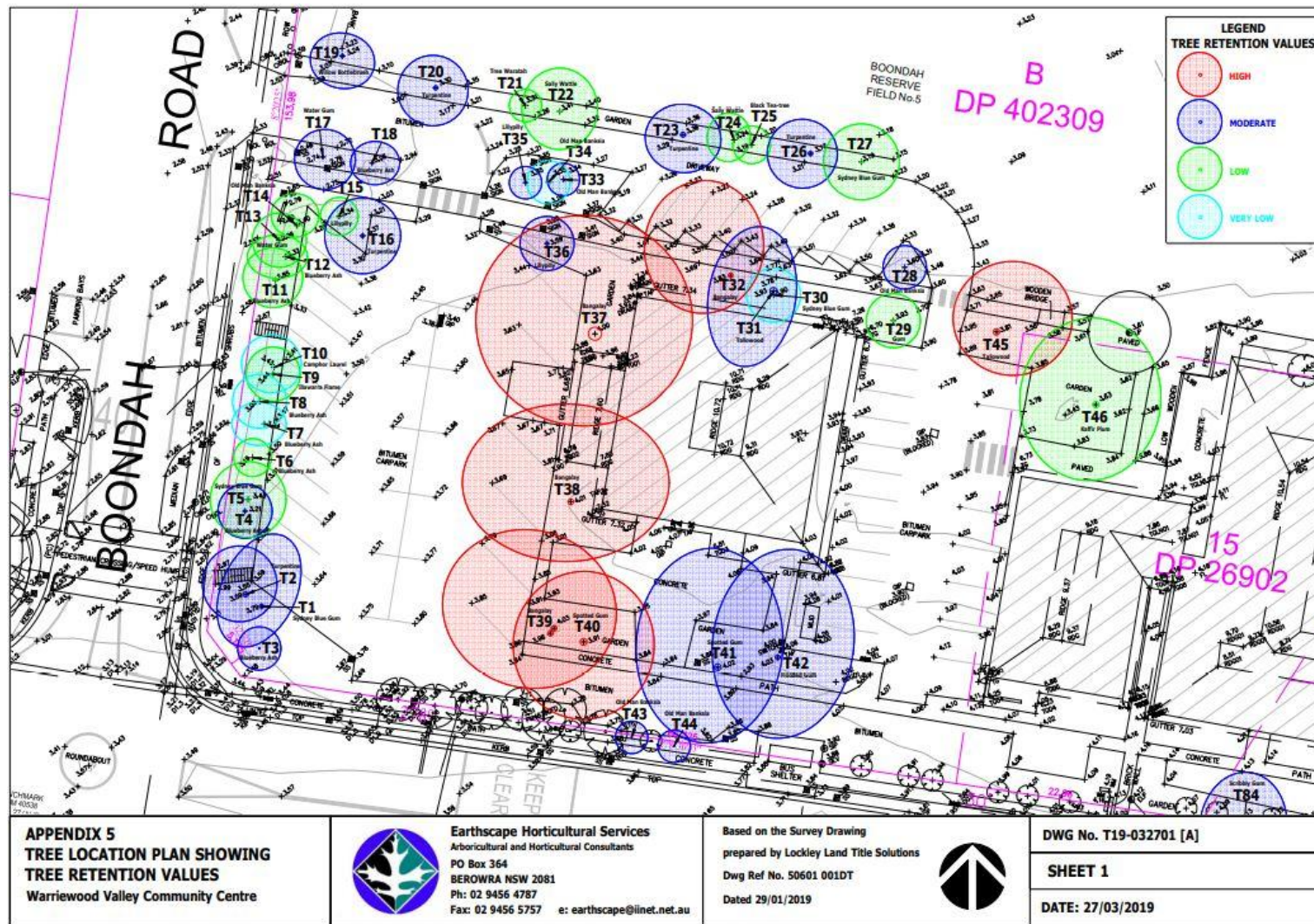


Figure 3A - Canopy tree plan for the westernmost section of the subject site indicating Tree Numbers (from Earthscape Horticultural Services 2019) and indicative retention values

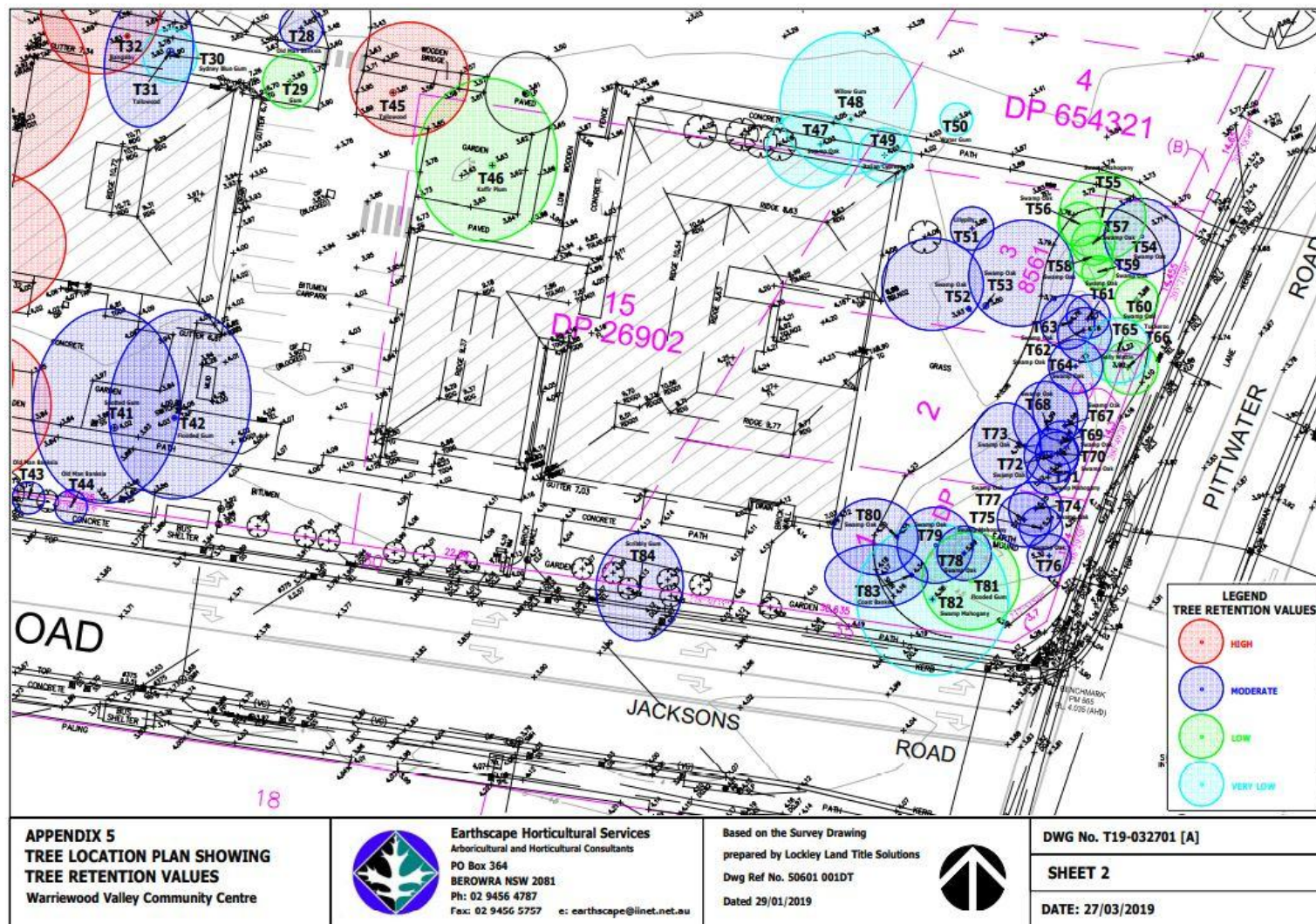


Figure 3B - Canopy tree plan for the easternmost section of the subject site indicating Tree Numbers (from Earthscape Horticultural Services 2019) and indicative retention values

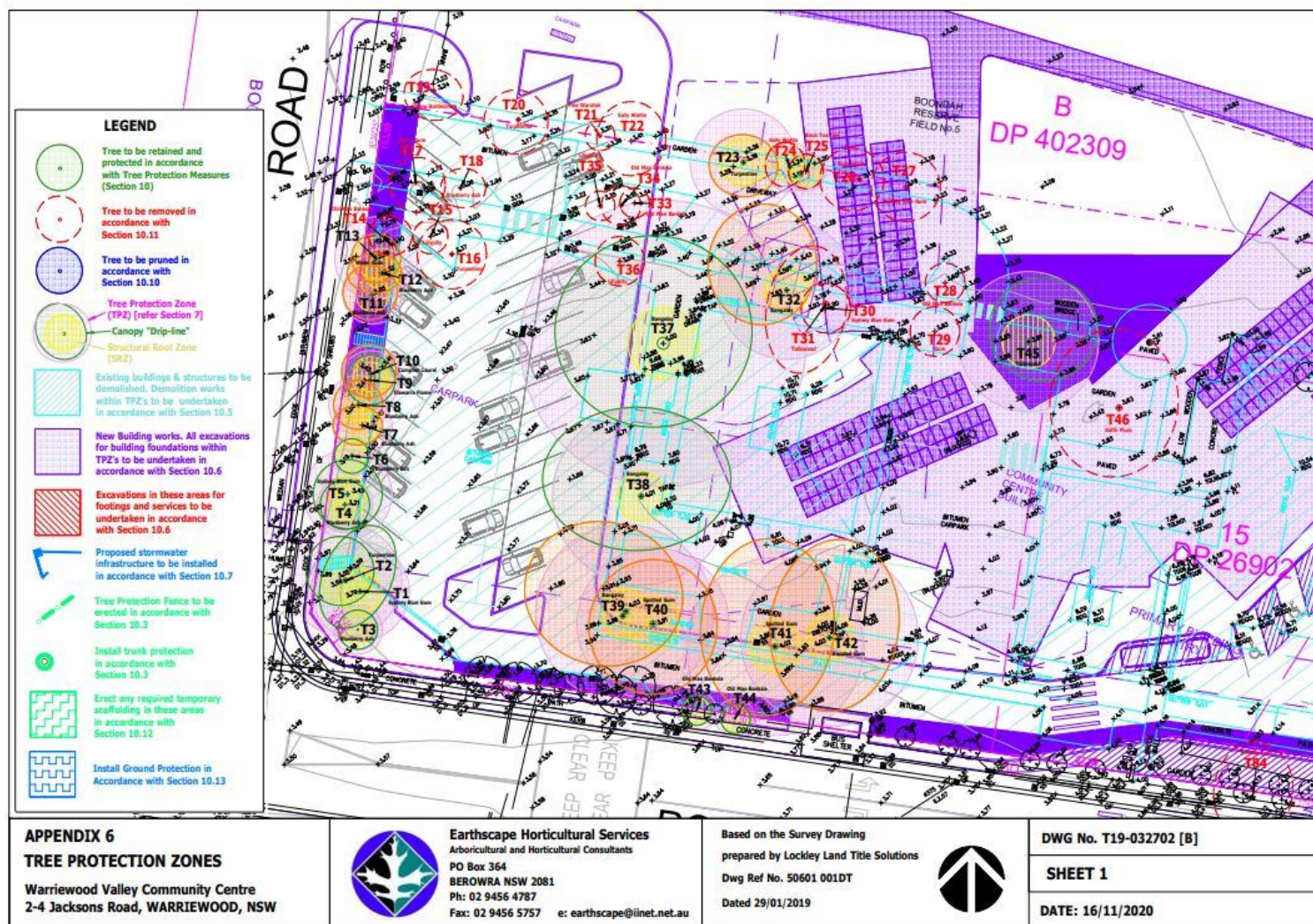


Figure 4A - Canopy tree plan for the westernmost section of the subject site indicating trees that would be retained and those likely to be removed and either occur in poor condition or may be replaced by planting in the Central Courtyard Landscape Garden (Tree Numbers from Earthscape Horticultural Services 2020)

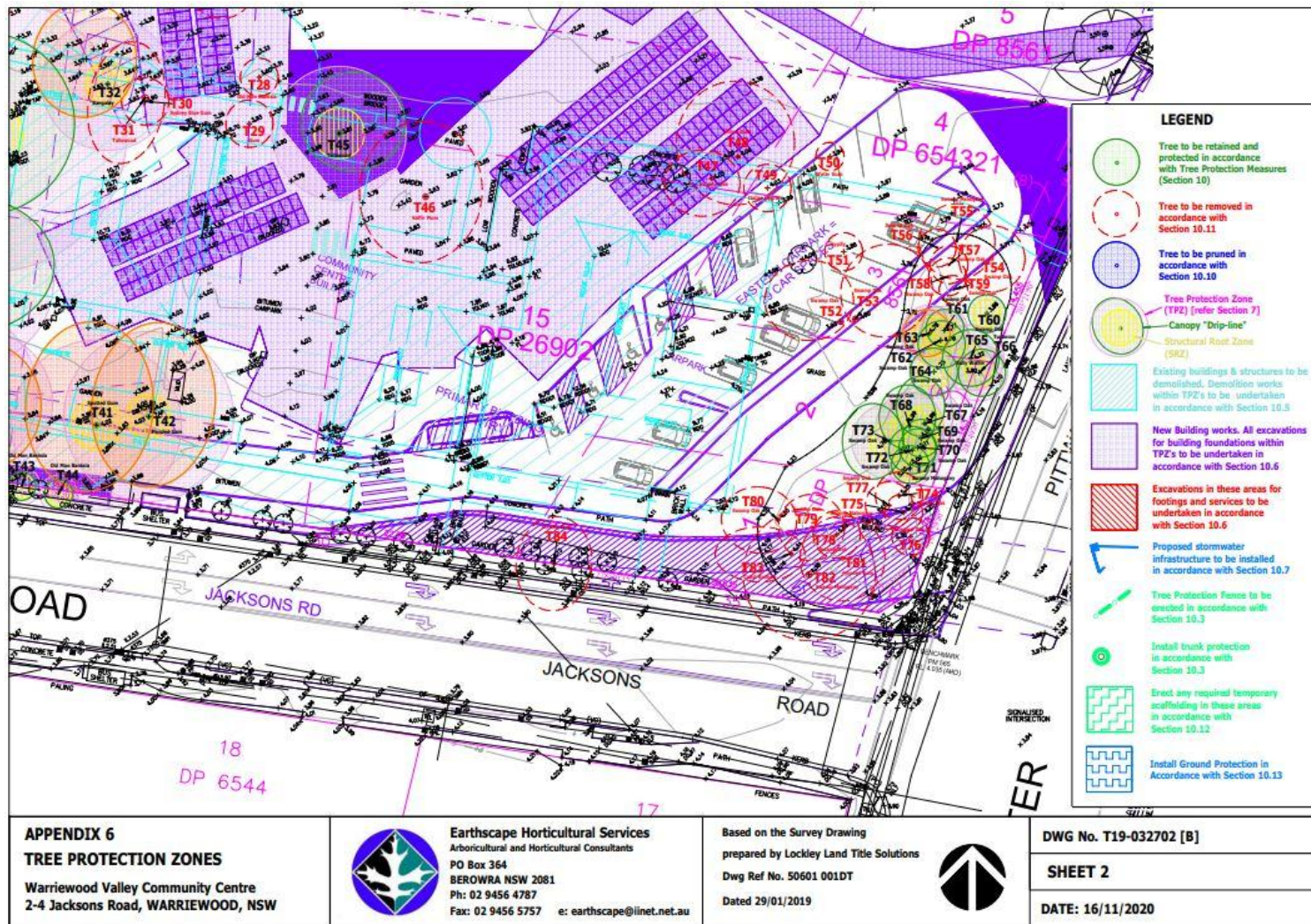


Figure 4B - Canopy tree plan for the easternmost section of the subject site indicating trees that would be retained and those likely to be removed and either occur in poor condition or may be replaced by planting in the Central Courtyard Landscape Garden (Tree Numbers from Earthscape Horticultural Services 2020)



Figure 5 - Aerial view of the subject land at Warriewood (bordered in red outline) in relation to development in locality including roads, residential development, parklands, natural vegetation stands and waterways

1.2 Purpose of biodiversity impact assessment report

The purpose of the flora and fauna surveys and ecological impact assessment is to document existing and expected biota and to ensure all necessary safeguards are described and complied with in relation to the proposal as required by Pittwater LEP 2014 cl. 7.6 Biodiversity and Pittwater 21 DCP 2014.

1.3 Statutory and legislative requirements

Planning controls provided by State and Commonwealth Legislation include the following:

- ◆ Environmental Planning and Assessment Act (EP & A Act) (1979),
- ◆ Commonwealth Environment Protection and Biodiversity Conservation Act (EPBC Act) (1999),
- ◆ Biodiversity Conservation Act (BC Act) (2016). The BC Act (2016) includes Preliminary Determinations of the NSW Scientific Committee (to November 2020) as well as Provisional Listings of Endangered Species on an emergency basis (to November 2020),

The objectives of this Act are:

- to provide for the conservation of threatened species, populations and ecological communities of animals and plants. The Act sets out a number of specific objects relating to the conservation of biological diversity and the promotion of ecologically sustainable development.

- ◆ Biosecurity Weeds Act 2015 (NSW)

The objectives of this Act are:

- to reduce the negative impact of weeds on the economy, community and environment of this State by establishing control mechanisms to:
 - prevent the establishment in this State of significant new weeds, and
 - restrict the spread in this State of existing significant weeds, and
 - reduce the area in this State of existing significant weeds,
- to provide for the monitoring of and reporting on the effectiveness of the management of weeds in this State

Local Council planning controls include the:

- ◆ Pittwater Local Environment Plan (2014) and Pittwater 21 Development Control Plan (2014)

This flora and fauna assessment report includes an account of:

- ◆ Threatened flora and fauna species, populations, endangered ecological communities and their habitats, as listed under the Biodiversity Conservation Act (BC Act), 2016;
- ◆ Nationally significant flora species, as listed under the Environment Protection and Biodiversity Conservation Act (EPBC Act), 1999;

- ◆ Rare or threatened Australian plants (RoTAP) as listed in Briggs and Leigh (1996); and
- ◆ Any regionally or locally significant species in the Northern Beaches Council LGA.

1.4 Documents provided

- ◆ Lockley LTS (Land Title Solutions) (2019) Survey Report for Heather Nelson Senior Citizens Centre, Jacksons Road, Warriewood
- ◆ Earthscape Horticultural Services (2019) Arboricultural Assessment Report, Warriewood Valley Community Centre, 2 - 4 Jacksons Road, Warriewood
- ◆ Earthscape Horticultural Services (2020) Arboricultural Assessment Report, Warriewood Valley Community Centre, 2 - 4 Jacksons Road, Warriewood
- ◆ Terroir (2020) Warriewood Valley Community Centre Stage 2 - Concept Design - Public Exhibition
- ◆ Aspect Studios (2020) Warriewood Community Centre- The Garden Detail Landscape Plan

1.5 Objectives of the study

- ◆ To carry out detailed flora and fauna surveys on the subject land;
- ◆ To prepare a comprehensive report qualifying potential impacts and describing mitigation measures in relation to the above assessments.

1.6 Scope of the study

The survey work was undertaken to provide Terroir with current and detailed information on the following:

- ◆ Identification of the flora and fauna that occur at the subject sites including documentation of species lists and mapping of identifiable plant communities;
- ◆ Identification of Threatened (Endangered and Vulnerable) species, populations, communities and habitats as listed in Schedules 1 & 2 of the Biodiversity Conservation Act 2016 (BC Act) including Preliminary Determinations of the NSW Scientific Committee, and the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), ROTAP species (Briggs & Leigh 1996) and regionally and locally significant species that could potentially be impacted upon by the proposed development;
- ◆ Identify listed migratory species (as listed in international treaties referred to in the EPBC Act);
- ◆ Identification of fauna species, including species of amphibians, reptiles, birds or mammals, not directly recorded during surveys but that could potentially occur in the study area as indicated by the presence of associated habitat;
- ◆ Preparation of a report describing vegetation communities on the subject land indicating their current condition and level of degradation;

- ◆ Recording of the area and extent of Biosecurity (and other significant High Threat Exotic) weed species in the study area;
- ◆ Assessment of potential impacts of the proposal on existing flora and fauna within the study area;
- ◆ Submission of draft report;
- ◆ Incorporation of relevant review comments and amendment of draft report; and
- ◆ Submission of a final report within 1 week of receiving review comments.

2 EXISTING ENVIRONMENT

2.1 Topography, geology and soils

The proposed site is a level rectangular shaped area with its long axis orientated toward the east-west, the length approximating some 140m and width about 70m (Figure 1).

The local substrate geology at the subject area at 2 - 4 Jacksons Road, Warriewood, is Quaternary (Holocene) Sands. The lithology of the sand-based substrate is comprised of sediments including silty to peaty quartz sand, silt and clay, with ferruginous and humic cementation in places with shell layers also common (Herbert 1983).

Soils of this area are typical of the Warriewood Soil Landscape Group, consisting of relatively deep well-sorted, sandy Humus Podzols and dark, mottled Siliceous Sands, overlying buried Acid Peats in depressions; relatively deep (greater than 2000mm) Podzols and pale Siliceous Sands on rises. The landscape of the area generally consists of level to gently undulating swales, depressions and infilled lagoons on Quaternary Holocene sands with slopes of less than 3% (Earthscape Horticultural Services 2019).

2.2 Existing vegetation

The subject land has been landscaped with a mixture of locally-occurring indigenous species, non-locally occurring indigenous species and some exotic ornamental species (Figures 3A, 3B, 4A & 4B from Earthscape Horticultural Services 2019).

Currently along Boondah Road to the west, low trees of species such as Blueberry Ash, Turpentine and Sydney Blue Gum occur (Figure 6).

Some larger mature trees as species such as Bangalay, Spotted Gum and Tallow Wood occur within the central sections of the subject land (Figure 7) and at the Pittwater Road section of the front yard of the property, a copse of Swamp Oak, Coast Banksia and Swamp Mahogany occurs with associated small tree and shrub species (Figure 8). Along the southern and northern sides of the subject land an array of small tree and shrub species includes Weeping Bottlebrush, Turpentine, Old Man Banksia, and Sally Wattle (Figures 9 & 10).

The landscape is managed and few weeds occur amongst the vegetation but in the front copse of vegetation, a low frequency of weed species occurs including African Veldt Grass, Mickey Mouse Plant, Prairie Grass and Green Cestrum (Figure 11).



Figure 6 - Image of line of small trees, shrubs and ground covers along the Boondah Street alignment



Figure 7 - Image of mature individuals of Bangalay occurring within central sections of the subject area



Figure 8 - Image of tall trees of Swamp Mahogany, Coast Banksia and Swamp Oak forming a copse of wetland-affiliated sclerophyll vegetation at the front (Pittwater Road) sections of the subject property.



Figure 9 - Image of low trees of Weeping Bottlebrush forming a linear row of vegetation aligned with the southern perimeter (along Jacksons Road) of the subject property.



Figure 10 - Image of low trees of Turpentine, Sally Wattle and Sydney Blue Gum forming a linear row of vegetation aligned with the northern perimeter (Boondah Reserve) of the subject property.



Figure 11 - Image of typical shrub (Yellow Jasmine) and ground cover strata of copse of woodland at front section (Pittwater Road) of subject area indicating individual of Green Cestrum in centre of image and African Veldt Grass in ground cover.

2.3 *Current and surrounding land use*

The aerial view of the subject land at No. 2 - 4 Jacksons Road, Warriewood, indicates that much of the surrounding landscape has long been established as residential development on relatively level gradients, with extensive areas of parkland and remnant wooded vegetation occurring in the locality (Figure 5; from SIXmaps DPIE 2020).

3 FLORA AND FAUNA SURVEY AND ASSESSMENT

3.1 Methods

3.1.1 Literature review

Existing information on 'Threatened Flora of the Locality', defined as an area of 5km radius around the site, was accessed from the DPIE Atlas of NSW Wildlife (online BioNet), Commonwealth DAWE Environmental Reporting Tool (December 2020) and RoTAP (Briggs and Leigh 1996) databases. Other literature detailing regionally and locally threatened and significant flora and fauna, as well as plant communities of the study area, included NSW Scientific Committee Final Determinations (1996-2020), Benson and Howell (1994), 'The Native Vegetation of the Sydney Metropolitan Catchment Management Authority Area' OEH (2016) and DPIE Mapping (2020).

3.1.2 Site survey

The subject site was surveyed on 24th November 2020.

3.1.3 Flora survey

Currently existing information on 'Threatened Flora of the Locality', defined as a 10km x 10km area centred around the site, was accessed from the DPIE Atlas of NSW Wildlife (December 2020), the Department of Agriculture, Water and Environment (DAWE) Environmental Reporting Tool (December 2020), and RoTAP (Briggs & Leigh, 1996) databases.

Other literature detailing regionally and locally threatened and significant flora, as well as endangered populations and plant communities of the study area, including NSW Scientific Committee Final Determinations (1996 - 2020) were accessed and reviewed.

Comprehensive surveys were undertaken on foot (Diversity Search method of Cropper 1993, and Threatened Biodiversity Surveys and Assessment - Guidelines for Developments and Activities - DEC 2004) to identify the existence of extant flora populations present on the subject area.

As the subject land was in large part, landscaped and structurally and floristically modified, a quadrat-based (20 x 50m) sampling methodology was not considered suitable and was not undertaken.

The survey included a complete floristic inventory of indigenous and exotic species and an assessment of the presence, or likelihood of occurrence, of any threatened, rare, regionally or locally significant species or plant community occurring at the surveyed site.

The extent of noxious and other weed incursions on the subject area of the land were assessed.

3.1.4 Fauna Survey

The survey effort complies with the survey effort recommended by the Draft Guidelines for Threatened Species Assessment under Part 3A (DEC and DPI, 2004) for the study area size, habitat types available on the site and seasonal factors.

A dedicated ground search was undertaken as was a census of extant birds. The survey involved different search strategies and protocols and all extant fauna or evidence of fauna was recorded. Threatened fauna species not recorded in the surveys but with the potential to be present as indicated by habitat are considered in the final assessment.

Strategies employed for the field investigation of the Study Area:

Assessment of the value of habitat suitable for native fauna species and specific habitat structures/resources considered important in life cycles. These structures or resources include:

- Mature trees with hollows for breeding, roosting and/or nesting;
- Particular foraging resources such as certain tree or shrub species;
- Dispersal, migratory or foraging corridors for fauna;
- Leaf litter and ground search for reptiles, frogs and threatened invertebrates;
- Identification of scats and other indirect evidence to suggest fauna utilisation such as tracks, scratch marks or diggings;

3.1.5 Limitations of the study

Limitations of the study may arise where certain cryptic species of plants may occur as soil-stored seed or as subterranean vegetative structures. Some species are identifiable above-ground only after particular environmental circumstances related to factors such as periodic fire frequency, intensity or seasonality, soil moisture regime, grazing pressure, biological life-cycle patterns as in the case of small geophytic taxa such as species of orchids etc.

Diurnal surveys at one time of the year cannot be expected to detect the presence of all species occurring, or likely to occur, in the study area. This is because some species may (a) occur seasonally, (b) utilise different areas periodically (as a component of a more extensive home range), or (c) become dormant during specific periods of the year. Rather, the survey provides the opportunity to sample the area, search specifically for species likely to be encountered within the available time frame, and assess the suitability of habitat for particular species.

The criteria used to assess the likelihood of threatened species occurring in the Study Area included the specificity of habitat features such as tree canopy cover, relative soil moisture

regime, relative soil nutrient regimes, extent of historical disturbance and degradation of vegetation and known occurrences of threatened species in the immediate locality.

If all or most of these collective criteria deemed optimal for the occurrence of a particular threatened species occur in relation to the habitat of the Study Area, then the likelihood of its potential occurrence in the habitat of the Study Area could be assessed as being relatively high. If only some of these collective criteria deemed suitable for the occurrence of a particular threatened species occur in the habitat of the Study Area, then its potential occurrence in the area of study may be deemed moderate at best. If few of these collective criteria deemed suitable for the occurrence of a particular threatened species occur in the habitat of the Study Area, then the likelihood of its occurrence would be assessed as being low to very unlikely.

These criteria are qualified in respect of threatened flora species in Appendix 2 of this report and in relation to threatened species of fauna in Appendix 4 of this report.

3.2 Results - Flora

3.2.1 Landscape features

The subject site occurs within the Pittwater IBRA subregion of the Sydney Basin IBRA Region.

3.2.2 Indigenous and exotic plant species

The subject site contains two distinctly differing forms of vegetation communities, differentiated on the basis of landscaping patterns. The linear landscaped gardens around the southern, western and northern perimeters of the subject area, and including the central plantings of well established individuals of canopy trees, form distinct landscaped assemblages which contain indigenous species, many representative of local flora (Figures 1, 3A, 3B, 6, 7, 9 & 10).

The copse of plants that have been planted at the front of the subject area adjacent to Pittwater Road, appears to be an assemblage representative of Coastal Flats Swamp Mahogany Forest (S_FoW02 in OEH 2016; PCTid: 1795) (Figure 8).

The small patch of this woodland plant community includes an area of about 762m² within a perimeter of about 138m and contains dominant tree species including Swamp Mahogany (*Eucalyptus robusta*), Swamp Oak (*Casuarina glauca*) and Coast Banksia (*Banksia integrifolia*) (Figures 8 & 12), with canopy and shrub species occurring in less frequency including Flooded Gum (*Eucalyptus grandis*), Prickly Paperbark (*Melaleuca styphelioides*), Wild Yellow Jasmine (*Pittosporum revolutum*), Tick Bush (*Kunzea ambigua*), Coast Boobialla (*Myoporum insulare*) and Tuckeroo (*Cupaniopsis anarcardioides*) (Figures 8, 11, 12 & 13).



Figure 12 - Patch of planted woodland assemblage resembling Coastal Flats Swamp Mahogany Forest occurring along the Pittwater Road frontage of subject area



Figure 13 - Pittwater Road frontage indicating diverse mix of canopy trees and shrubs forming the copse of constructed Coastal Flats Swamp Mahogany Forest occurring at this location

The arborist report by Earthscape Horticultural Services (2019) lists a total of 84 tall canopy and small canopy trees that are variously located in landscaped areas of the subject land (Figures 1, 3A, 3B, 6, 7, 9, & 10).

Appendix 1 lists the various plant species found to occur within the discrete ecological assemblage that has been planted to resemble a patch of Coastal Flats Swamp Mahogany Forest that occurs at the Pittwater Road frontage of the subject site (Figures 1, 3B, 8, 11, 12, & 13) .

A total of 6 exotic weed species were recorded within this frontal section of the subject land, all occurring at low cover values (Appendix 1).

Species nomenclature follows that of Harden (1990 – 2002; 2020 online).

3.2.3 Plant community

Previous mapping

The local ecological plant communities that occur at the Study Area have been mapped by DPIE (2020) compiling data from API and environmental attributes of geology, average annual rainfall, topography, elevation, Soil Landscape Series type and extent of disturbance (condition), and including some ground-truthing. This mapping does not indicate any remnant native plant community occurring at the locality. Mapping by OEH (2016) indicates an area of 'Urban natives and Exotics' as occurring within the central section of the subject site (Figure 14).

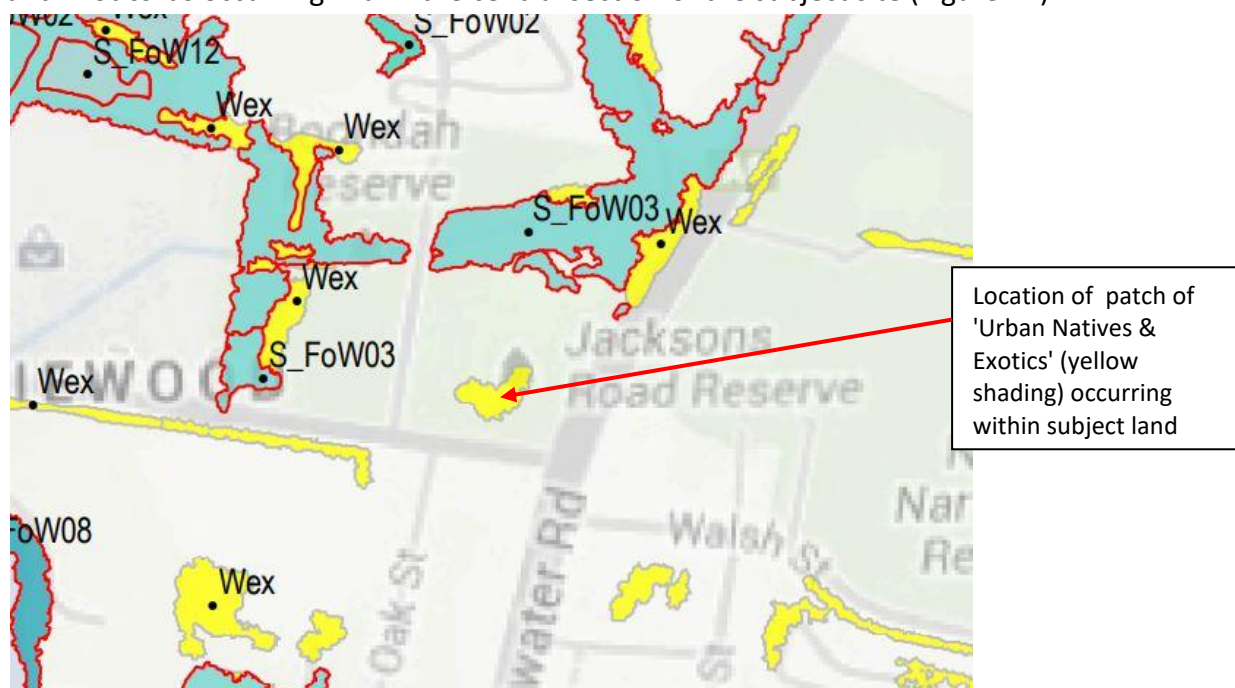


Figure 14 - Mapping by OEH (2016) of area of subject land indicating no natural vegetation community though with patches of Coastal freshwater Swamp Forest (S_FoW03; PCTid: 1232) occurring in natural areas to the north and to the west of the surveyed land

3.2.4 Description and conservation status of constructed Coastal Flats Swamp Mahogany Forest ecological community occurring onsite.

Description and status of ecological community

Natural stands of Coastal Flats Swamp Mahogany Forest occur in areas of impeded drainage near coastal swamps, lagoons and along low-lying drainage flats (OEH 2016). Natural open forest assemblages are dominated by Swamp Mahogany with a smaller tree layer of Swamp Oak and paperbark species such as Prickly Paperbark (OEH 2016). Mesic elements in natural stands include species such as Cheese Tree, Cabbage Tree Palm, Snake Vine and common Silkpod with other shrub species including Sweet Pittosporum, Sydney Golden Wattle and Common Hopbush (OEH 2016).

The ground cover is periodically wet in natural stands, though standing water is rarely persistent throughout the year. Common elements of the ground cover include ferns, grasses and herbs rather than sedges (OEH 2016).

The patch of constructed vegetation resembling Coastal Flats Swamp Mahogany Forest does not exhibit these attributes and, of all the species recorded in this patch of vegetation, only two, Swamp Oak and Swamp Mahogany, are diagnostically positive for this community (OEH 2016).

Large remnant natural stands of this community do occur however in the Warriewood Wetlands to the north of the subject site (Figure 15).

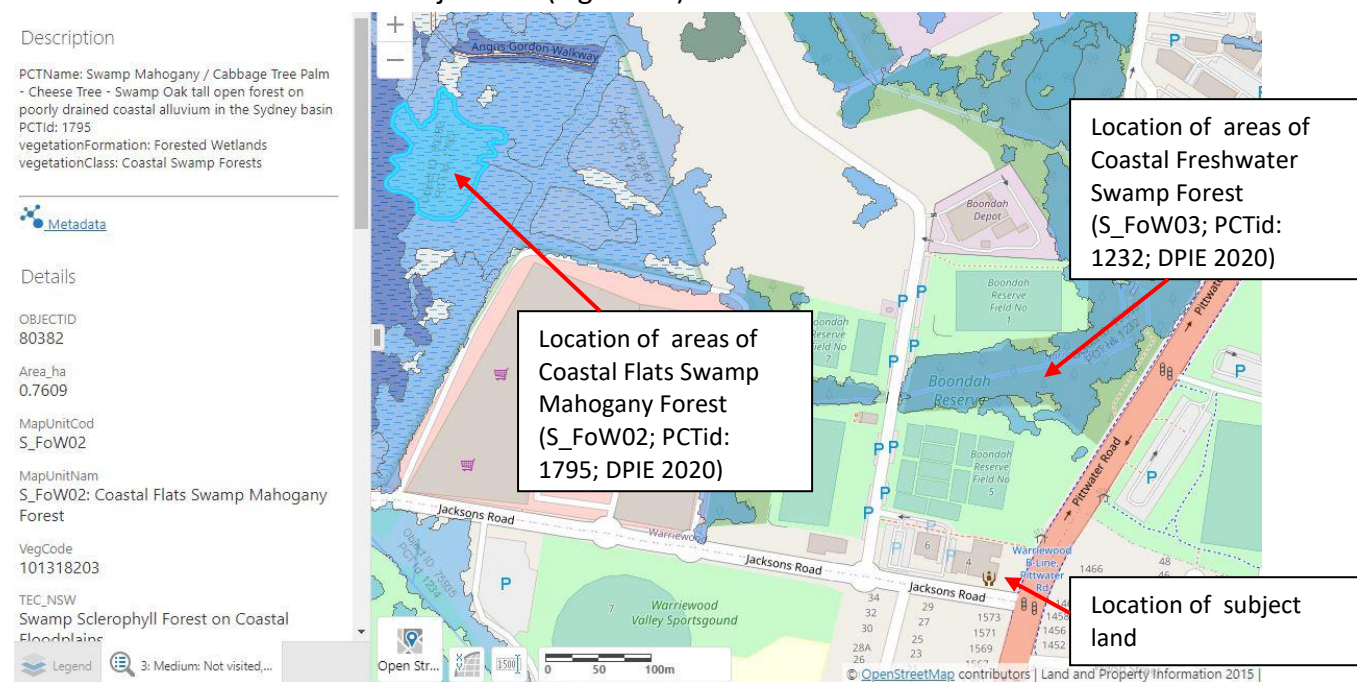


Figure 15 - DPIE (2020) mapping of ecological plant communities in the vicinity of the subject site, indicating the subject land has no natural affinity with either natural vegetation type

3.2.5 Status of constructed Coastal Flats Swamp Mahogany Forest ecological community occurring onsite and mitigation measures.

The copse of vegetation occurring at the Pittwater Road frontage of the subject land appears to have been constructed to resemble a patch of Coastal Flats Swamp Mahogany Forest (Appendix 1) (Figures 8, 11, 12 & 13).

According to Earthscape Horticultural Services (2019), the total number of individuals of 32 canopy trees that occur in this clump of vegetation (tree numbers 51 - 83 in Earthscape Horticultural Services 2019) (Figure 16), includes individuals of Swamp Mahogany, Swamp Oak, Flooded Gum, Prickly Paperbark, Water Gum (*Tristaniopsis laurina*), Lillypilly (*Syzygium australe*), Sally Wattle (*Acacia floribunda*), Tuckeroo (*Cupaniopsis anacardioides*) and Coast Banksia (*Banksia integrifolia*).



Figure 16 - Copse of wooded vegetation planted at road frontage to Pittwater Road, Warriewood, at corner with 2 Jacksons Road, Warriewood

A total number of 13 of these individuals will be retained and not affected by the proposal and a total number of 14 of these individuals, which have a 'moderate retention value' according to Earthscape Horticultural Services (2019), and that require removal, will be replaced by the same species as proposed for removal (Earthscape Horticultural Services 2020). The location for the replacement species planting would occur within the new feature landscape gardens in the central section of the proposed development shown in Figure 2.

A total of only 7 individuals of low to very low retention value (Earthscape Horticultural Services 2019), would be removed and not replaced. These include mostly individuals of Swamp Oak that occur in relatively poor condition at the northern section of the copse (Figure 3B).

As such, of the 32 individuals documented for this copse of vegetation that occurs at the Pittwater Road frontage of the subject land (Figure 16), only 22% of these individuals will not be retained or replaced as a result of the proposal, these being mostly individuals of Swamp Oak of which there are a total of 25 individuals occurring at the subject site (Earthscape Horticultural services 2019).

3.2.6 Status of the mostly linear rows and central plantings of landscaped vegetation occurring onsite and mitigation measures.

The landscaped vegetation that was established along the southern, western and northern perimeters of the subject area contained a total of 51 tall and small canopy trees, these listed in the arborist report by Earthscape Horticultural Services (2019).

The retained canopy trees include some 6 high retention value trees, some 6 moderately high retention value trees and some 3 low value retention trees (Earthscape Horticultural Services 2020).

A total of 14 moderately high value retention trees would be removed but replaced by the same species in the central landscaped feature gardens as a part of the proposed development (Figure 2) (Earthscape Horticultural Services 2020).

A total of 21 trees with low to very low retention values require removal for the new development and would not be replaced (Earthscape Horticultural Services 2020). This amounts to about 25% of the total tree population of the subject land, with 75% of the, particularly high or moderately high retention value trees, to be either retained or have replacement plantings accommodated in the central landscaped feature gardens of the new development proposal (Figure 2) (Earthscape Horticultural Services 2020).

3.2.7 Flora species of conservation significance

Threatened species

The OEH Atlas of NSW Wildlife (2020) records for an area of 5km radius around the subject site indicate that 17 species of conservation significance have been recorded within a radius of 5km of the site within the last 20 years (Table 1).

Nine (9) of these species are listed as Endangered on the BC Act with 8 listed as Vulnerable, with 5 species listed as Endangered and 6 Vulnerable on the Commonwealth EPBC Act.

Appendix 2 lists these species with an account of their threatened status, geographical range, physiognomic attributes, habitat features and likelihood of occurrence.

Family	Common name	Scientific name	<u>NSW</u> <u>status</u>	<u>Comm.</u> <u>status</u>	No. of records
Elaeocarpaceae		<i>Tetratheca glandulosa</i>	V		85
Ericaceae		<i>Epacris purpurascens</i> var. <i>purpurascens</i>	V		1
Euphorbiaceae	Sand Spurge	<i>Chamaesyce</i> <i>psammogeton</i>	E1		11
Fabaceae (Mimosoideae)	Sunshine Wattle	<i>Acacia terminalis</i> subsp. <i>terminalis</i>	E1	E	1
Grammitidaceae	Narrow-leaf Finger Fern	<i>Grammitis stenophylla</i>	E1		1
Lamiaceae	Villous Mint-bush	<i>Prostanthera densa</i>	V	V	1
Malvaceae		<i>Lasiopetalum joyceae</i>	V	V	1
Myrtaceae	Netted Bottle Brush	<i>Callistemon linearifolius</i>	V		1
	Camfield's Stringybark	<i>Eucalyptus camfieldii</i>	V	V	12
		<i>Kunzea rupestris</i>	V	V	1
	Scrub Turpentine	<i>Rhodamnia rubescens</i>	E4A		17
	Magenta Lilly Pilly	<i>Syzygium paniculatum</i>	E1	V	16
Orchidaceae	Bauer's Midge Orchid	<i>Genoplesium baueri</i>	E1	E	1
	Angus's Onion Orchid	<i>Microtis angusii</i>	E1	E	1
Proteaceae	Caley's Grevillea	<i>Grevillea caleyi</i>	E4A	CE	173
	Hairy Geebung	<i>Persoonia hirsuta</i>	E1	E	23
Thymelaeaceae		<i>Pimelea curviflora</i> var. <i>curviflora</i>	V	V	15

Table 1 - Seventeen (17) species of threatened flora that have been recorded within a 10km area centred around the subject site within the last 20 years (DPIE 2020)

For all of these species, the highly landscaped habitat of the subject site appears unsuitable for their occurrence (Appendix 2) (Figures 1, 3A, 3B, 6, 7, 8, 9, 10, 11 & 12).

Figure 17 indicates the recorded sightings of the five most recorded flora species of conservation significance.

Most recordings of Magenta Lilly Pilly (*Syzygium paniculata*) are planted individuals obtained from nurseries. There is no natural habitat at the subject site that would be suitable for natural occurrences of this species.

Targeted searches located none of these threatened flora species at the subject site and none was expected to occur at or in the vicinity of the subject site (Figure 16)

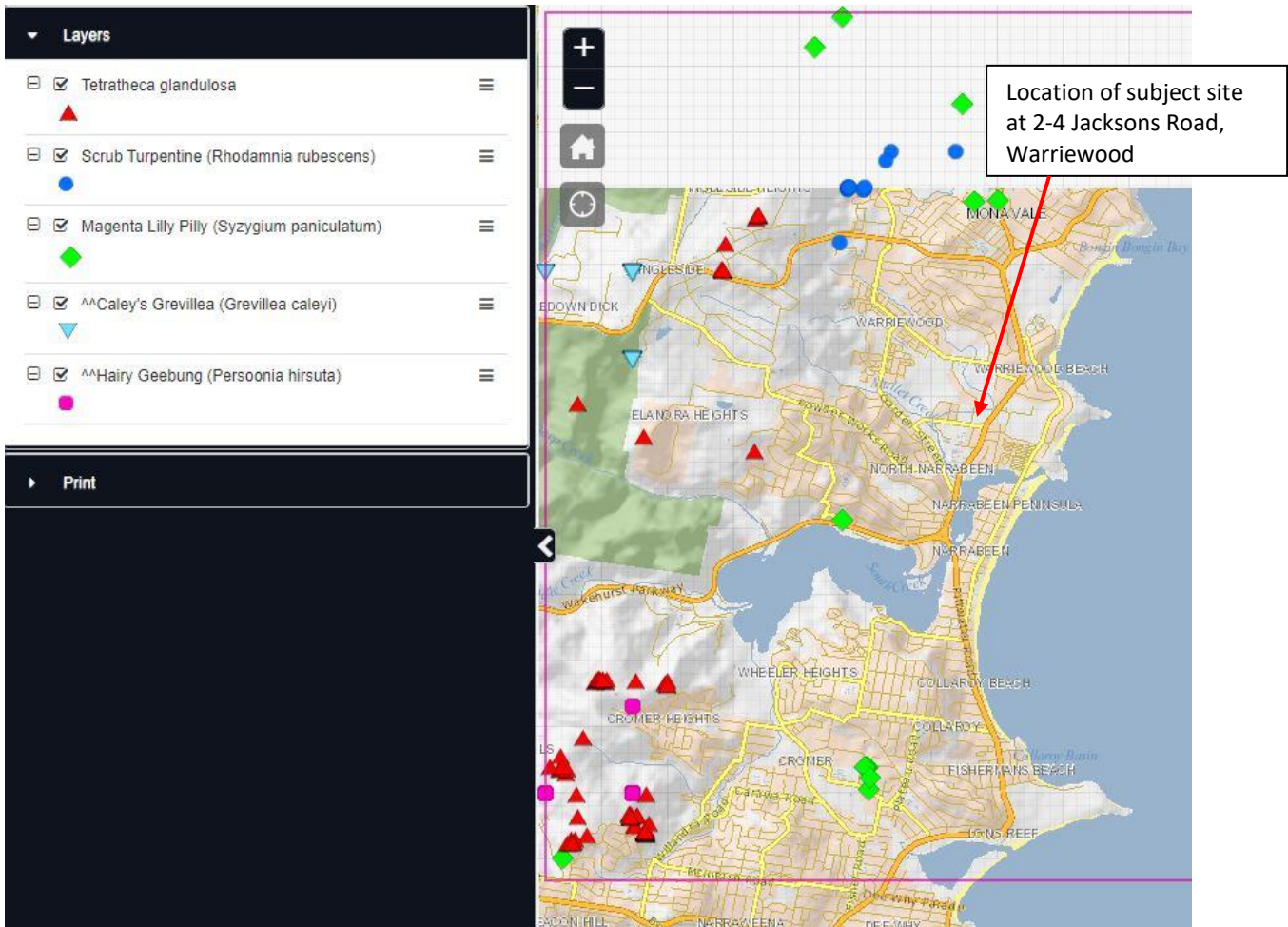


Figure 17 - Recorded sightings of 5 threatened flora species within a 5km radius of the subject site at 2-4 Jacksons Road, Warriewood (DPIE 2020)

3.3 Results - Fauna and habitat potential assessment

The following fauna assessment has been prepared with particular regard to the BC Act, Section 5A of the current EP&A Act and the EPBC Act.

3.3.1 Location and weather conditions of subject surveyed site

Grid co-ordinates of centre of subject land;

latitude: -33.697267°;
 longitude: 151.2998777°

Weather conditions

Warm and relatively humid weather conditions with light winds, no rain

24 th Nov	9am	3pm
Temp	17.6 ⁰	20.8 ⁰

Rel Humidity	89%	58%
Wind	S 11km/hr	SE 13km/hr

A dedicated ground search was undertaken as well as a census of extant birds. The survey involved different search strategies and protocols and all extant fauna or evidence of fauna was recorded.

3.3.2 Habitats present

The habitats of the subject land include:

1. a landscaped array of planted linear rows of established canopy trees, and those planted in central sections of the subject area, varying from tall mature trees to small, low canopy trees, some in poor condition (Figures 1, 3A, 6, 7, 9), and
2. a relatively unmanaged, woodland copse at the eastern front section of the subject land representing an assemblage of Coastal Flats Swamp Mahogany Forest with sparse patches of weed-covered understorey and ground storey vegetation (Figure 11) among relatively tall trees of Swamp Mahogany, Swamp Oak, Coast Banksia and Flooded Gum contained within an area of about 760m² (Figure 8, 12, 13 & 16).

The planted canopy and shrub vegetation may provide some food resources for seed and nectivorous foraging avifauna and arboreal mammals, including the Grey-headed Flying Fox, as well as perching branches for avifauna.

No mature trees contained spouts or hollows suitable for nesting by small birds or microbat species and large hollows for owl species were not recorded within the study area. No arboreal nests were recorded during this survey.

3.3.3 Wildlife corridor potential

The subject area occurs as a mostly landscaped and floristically and structurally modified landscape (Figures 6, 7, 8, 9, 10 & 12). The managed site appears as an outlier to more extensive stands of natural vegetation occurring to the north, north-west and west (Figure 5). The presence of patches of unmanaged open forest vegetation in the locality (Figure 5) including tall canopy trees and a scrub understorey stratum affords some connectivity for avian and arboreal species in the locality (Figure 5).

3.3.4 Fauna recorded

Table 2 - Indicates the fauna recorded or expected to occur within the area of survey at 2 - 4 Jacksons Road, Warriewood.

Class/Family	Common name	Scientific name	Landscaped gardens and partially managed woodland copse at Pittwater Road frontage
REPTILIA Scincidae	Dark-flecked Garden Sunskink	<i>Lampropholis delicata</i>	e
	Eastern Water Skink	<i>Eulamprus quoyii</i>	e
AVES Alcedinidae	Laughing Kookaburra	<i>Dacelo novaeguineae</i>	e
Cacatuidae	Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	x
Psittacidae	Crimson Rosella	<i>Platycercus elegans</i>	e
	Rainbow Lorikeet	<i>Trichoglossus haematodus</i>	x
Maluridae	Superb Fairy-wren	<i>Malurus cyaneus</i>	e
Meliphagidae	Eastern Spinebill	<i>Acanthorhynchus tenuirostris</i>	e
	Noisy Miner	<i>Manorina flavigula</i>	x
	Lewin's Honeyeater	<i>Meliphaga lewinii</i>	e
Corvidae	Australian Raven	<i>Corvus coronoides</i>	x
Hirundinidae	Welcome Swallow	<i>Hirundo neoxena</i>	x
MAMMALIA Pseudocheiridae	Common Ringtail possum	<i>Pseudocheirus peregrinus</i>	e
Phalangeridae	Common Brushtail Possum	<i>Trichosurus vulpecula</i>	e
Pteropodidae	Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	e
Vespertilionidae	Gould's Wattled Bat	<i>Chalinolobus gouldii</i>	e
Muridae	Black Rat*	<i>Rattus rattus</i>	e

Legend:

x - observed either onsite or overhead or heard in vicinity; e - expected to occur onsite and in vicinity

The weather conditions at the time of survey included warm and relatively mild weather conditions with light winds, ideal conditions for bird activity, however, Noisy Miner populations were in high abundance possibly displacing many other potential avian species from the subject site.

Of the bird species observed or expected to occur, most were species that prefer a woodland habitat (Table 5).

The Powerful Owl (*Ninox strenua*) may occasionally forage within the area if prey species are in abundance. However during the survey, prey for this large owl did not appear sufficient in number to attract it to the area at the present time.

The urbanised Common Brushtail Possum (*Trichosurus vulpecula*) and Ringtail Possum (*Pseudocheirus peregrinus*) are expected to occur within the landscaped canopy tree and small closed forest/woodland habitat.

The Little Forest Bat (*Vespadelus vulturnus*), and Gould's Wattled Bat (*Chalinolobus gouldii*) may be expected to occur occasionally for foraging. The Little Forest Bat roosts in hollows in old trees, buildings and timber stacks. These bat species are common insectivorous microbat species in the region.

The larger megabat, Grey-headed Flying Fox (*Pteropus poliocephalus*) was not sighted during the survey, which occurred during mid-morning when the bats would be roosting in camps, but may be attracted to flowering Eucalyptus trees on occasion during the warmer months.

Reptilian habitat was rated as relatively poor within the landscaped vegetation. The absence of leaf litter was rated poor for sheltering. The Dark-flecked skink (*Lampropholis delicata*) could be expected to occur at this location.

Habitat for amphibian species was rated as poor as no drainage lines or ponds occur at the developed subject site

The pest species Black Rat may be expected to occur occasionally at and in the vicinity of the subject site in association with residential development in the near vicinity (Table 1).

3.3.5 Fauna species of conservation significance

3.3.5.1 Threatened species

The criteria used to assess the likelihood of threatened species occurring in the Study Area include the specificity of habitat features such as tree canopy cover, relative soil moisture regime, relative soil nutrient regimes, historical disturbance and degradation of vegetation and known occurrences of threatened species in the immediate locality.

If all or most of these collective criteria deemed optimal for the occurrence of a particular threatened species occur in relation to the habitat of the Study Area, then the likelihood of its potential occurrence in the habitat of the Study Area could be assessed as being relatively high. If only some of these collective criteria deemed suitable for the occurrence of a particular threatened species occur in the habitat of the Study Area, then its potential occurrence in the area of study may be deemed moderate at best. If few of these collective criteria deemed suitable for the occurrence of a particular threatened species occur in the habitat of the Study Area, then the likelihood of its occurrence would be assessed as being low to very unlikely.

The DPIE Atlas of NSW Wildlife database 2020 (Dept Planning, Industry and Environment) listed thirty one (39) species of terrestrial and avifauna considered threatened under the BC Act within a 5 km radius of the site (Table 3). Six of these species are designated as endangered by the NSW Scientific Committee with the remainder designated as vulnerable. Under the EPBC Act 1999, five are listed as endangered (two considered extinct) and six species are listed as vulnerable.

Family	Common name	Scientific name	NSW status	Comm. status	No. of records
Amphibia Myobatrachidae	Giant Burrowing Frog	<i>Heleioporus australiacus</i>	V	V	27
	Red-crowned Toadlet	<i>Pseudophryne australis</i>	V		68
Hylidae	Green and Golden Bell Frog	<i>Litoria aurea</i>	E1	V	1
Reptilia Varanidae	Rosenberg's Goanna	<i>Varanus rosenbergi</i>	V		68
Aves Columbidae	Rose-crowned Fruit-Dove	<i>Ptilinopus regina</i>	V		2
	Superb Fruit-Dove	<i>Ptilinopus superbus</i>	V		3
Apodidae	White-throated Needletail	<i>Hirundapus caudacutus</i>		V,C,J,K	10
Ardeidae	Australasian Bittern	<i>Botaurus poiciloptilus</i>	E1	E	2
	Black Bittern	<i>Ixobrychus flavicollis</i>	V		20
Accipitridae	White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	V		40
	Little Eagle	<i>Hieraaetus morphnoides</i>	V		5
	Square-tailed Kite	<i>Lophoictinia isura</i>	V		3
Burhinidae	Bush Stone-curlew	<i>Burhinus grallarius</i>	E1		13
Cacatuidae	Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	V		2
	Glossy Black-Cockatoo	<i>Calyptorhynchus lathami</i>	V		79
Psittacidae	Little Lorikeet	<i>Glossopsitta pusilla</i>	V		10
	Swift Parrot	<i>Lathamus discolor</i>	E1	CE	17
	Turquoise Parrot	<i>Neophema pulchella</i>	V		1
Strigidae	Barking Owl	<i>Ninox connivens</i>	V		25
	Powerful Owl	<i>Ninox strenua</i>	V		216
Tytonidae	Masked Owl	<i>Tyto novaehollandiae</i>	V		1
Meliphagidae	Regent Honeyeater	<i>Anthochaera phrygia</i>	E4A	CE	33
	Black-chinned Honeyeater (eastern subspecies)	<i>Melithreptus gularis gularis</i>	V		1
Neosittidae	Varied Sittella	<i>Daphoenositta chrysoptera</i>	V		5
Petroicidae	Scarlet Robin	<i>Petroica boodang</i>	V		1
Mammalia Dasyuridae	Spotted-tailed Quoll	<i>Dasyurus maculatus</i>	V	E	5
Peramelidae	Southern Brown Bandicoot (eastern)	<i>Isodon obesulus obesulus</i>	E1	E	3

Family	Common name	Scientific name	NSW status	Comm. status	No. of records
Burramyidae	Eastern Pygmy-possum	<i>Cercartetus nanus</i>	V		333
Petauridae	Squirrel Glider	<i>Petaurus norfolcensis</i>	V		4
Pteropodidae	Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	V	V	134
Molossidae	Eastern Coastal Free-tailed Bat	<i>Micronomus norfolkensis</i>	V		19
Vespertilionidae	Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	V	V	14
	Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	V		1
	Southern Myotis	<i>Myotis macropus</i>	V		52
	Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	V		5
	Eastern Cave Bat	<i>Vespadelus trougtoni</i>	V		1
Muridae	New Holland Mouse	<i>Pseudomys novaehollandiae</i>		V	2
Miniopteridae	Little Bent-winged Bat	<i>Miniopterus australis</i>	V		50
	Large Bent-winged Bat	<i>Miniopterus orianae oceanensis</i>	V		112

Legend to Table 3 - BC Act, EPBC Act, Migratory Bird Agreements

Key	
Environmental Protection and Biodiversity Conservation Act (EPBC Act) 1999	Biodiversity Conservation Act (BC Act) 2016
CE - Critically Endangered	E1 - Endangered
E - Endangered	E4 - critically endangered
V - Vulnerable	V - Vulnerable
	C CAMBA Migratory bird agreement between Australia and China

Table 3 - 39 species of threatened fauna recorded within a 5km radius of the subject site within the previous 20 years (DPIE Bionet Atlas 2020).

3.3.5.2 Threatened species with potential to occur at the subject land

All threatened species listed require specific habitat for foraging, nesting or roosting. The subject land was assessed for these habitat requirements (refer to Appendix 3).

Due to the highly modified and dlandscaped habitat of the subject site, no threatened fauna species are considered likely to regularly occur as indicated by the recorded sightings of threatened fauna species in the locality. Figures 18, 19 and 20 indicate the most recorded threatened fauna species that occur in the locality.

Figure 18 indicates the locations of sightings and calls of the Powerful Owl and White-bellied Sea Eagle in the locality.

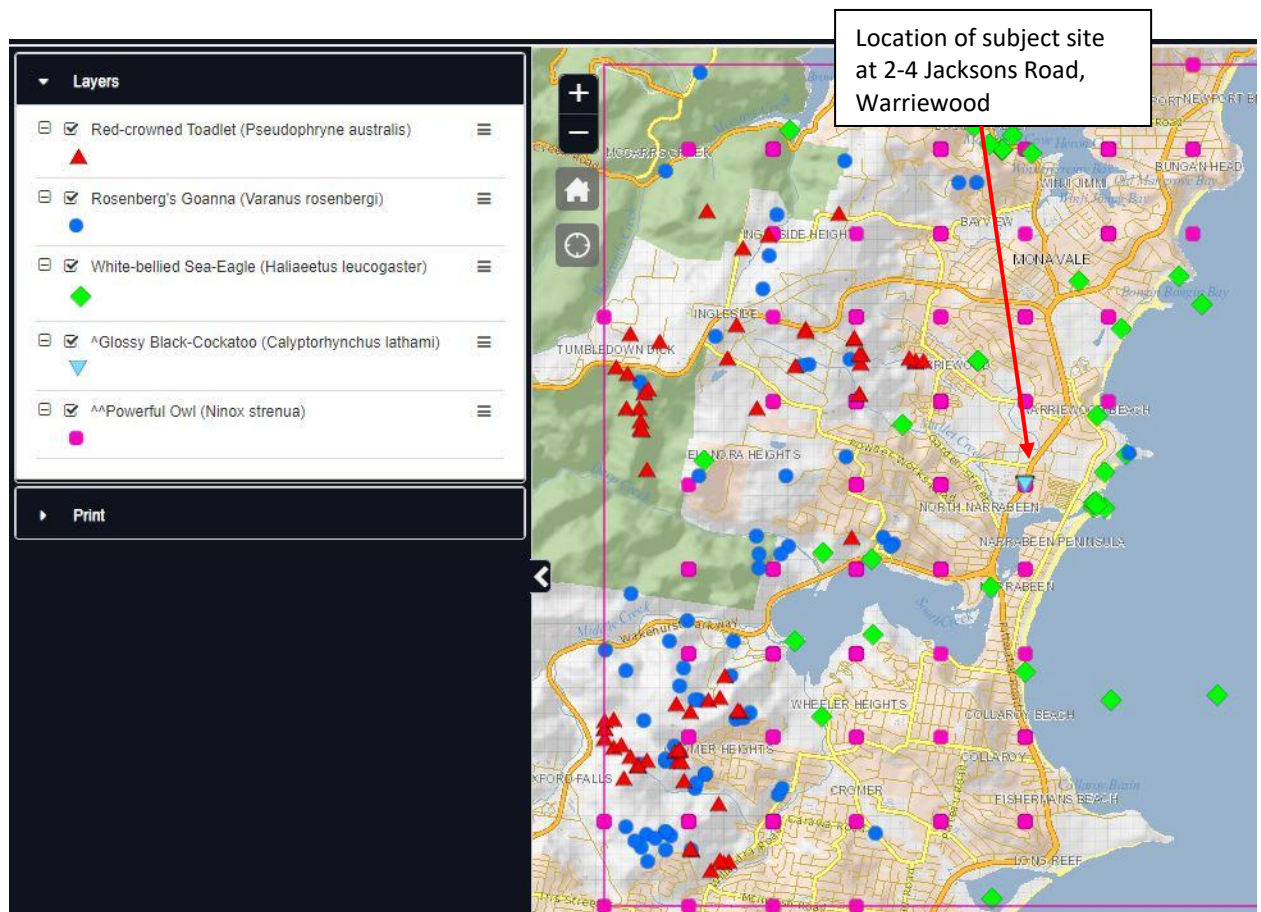


Figure 18 - Indicates recorded sightings of 5 threatened fauna species in the locality of the subject site, including for the Powerful Owl where visual sightings and calls heard are mapped in a 1sq km grid pattern.

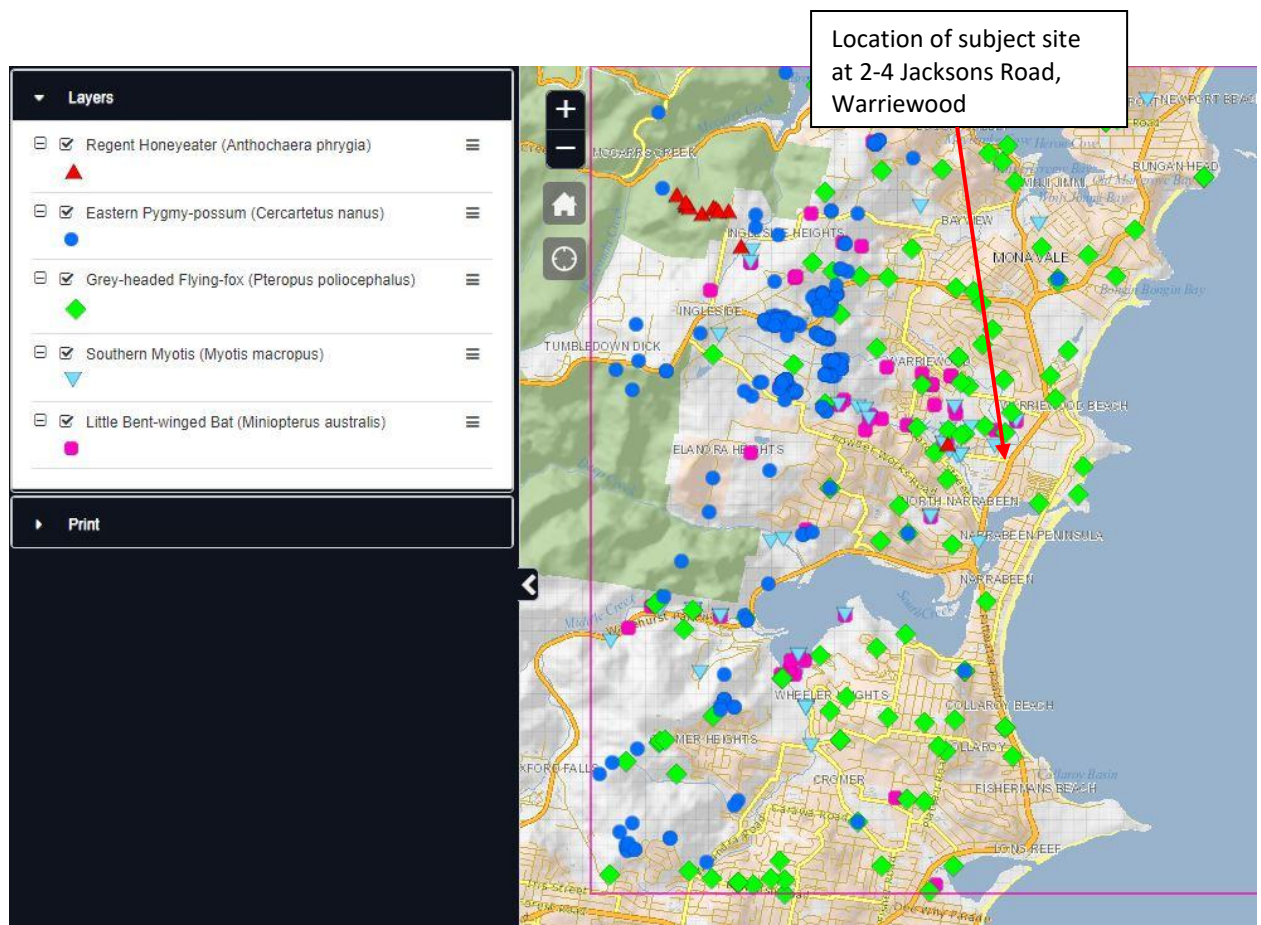


Figure 19 - Indicates recorded sightings of 5 threatened fauna species in the locality of the subject site, including for the Grey-headed Flying Fox which feeds on nectar and fruit in seasonal conditions of flowering and fruiting as well as the Little Bentwing Bat that forages at dusk on insects beneath the tree canopy

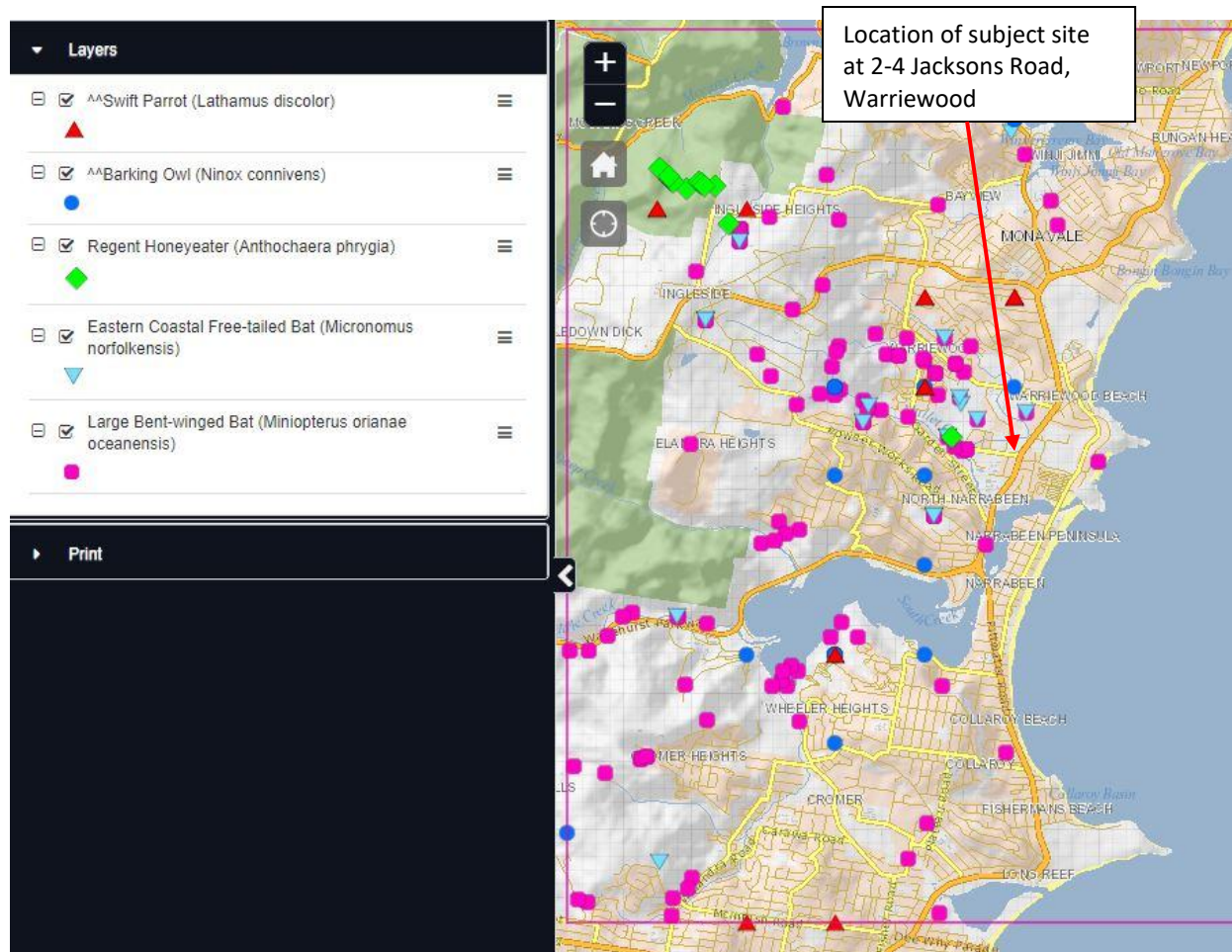


Figure 20 - Indicates recorded sightings of 5 threatened fauna species in the locality of the subject site, including for the Large Bentwing Bat that forages at dusk on insects above the tree canopy

Three threatened species occurring closest, or in the vicinity, of the site include the following (See Appendix 3 for habitat assessment):

1. Powerful Owl (*Ninox strenua*) The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest.

The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine *Syncarpia glomulifera*, Black She-oak *Allocasuarina littoralis*, Blackwood *Acacia melanoxylon*, Rough-barked Apple *Angophora floribunda*, Cherry Ballart *Exocarpus cupressiformis* and a number of eucalypt species (DPIE 2020).

The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider. Flying foxes are important prey in some areas; birds comprise about 10-50% of the diet depending on the availability of

preferred mammals. As most prey species require hollows and a shrub layer, these are important habitat components for the owl (DPIE 2020).

Pairs of Powerful Owls demonstrate high fidelity to a large territory, the size of which varies with habitat quality and thus prey densities. In good habitats a mere 400ha can support a pair; where hollow trees and prey have been depleted the owls need up to 4000 ha (DPIE 2020).

The Powerful Owl may forage in the area of the subject land from time to time and be an infrequent visitor to the subject area. However, no large high value retention trees that occur within the subject land will be removed and the proposal is not expected to affect the life-cycle or viability of populations of the Powerful Owl in the locality.

2. Grey-headed Flying Fox (*Pteropus poliocephalus*). This species congregates in large camps and is found in a variety of habitats including rainforest, mangroves, Melaleuca swamps, wet and dry sclerophyll forests and also cultivated areas. The species feeds on the blossoms of more than 80 plant species, especially eucalyptus blossom and the fruits of a number of palm species. Flowering species of eucalypts such as Swamp Mahogany (*Eucalyptus robusta*) and Forest Red Gum (*Eucalyptus tereticornis*) and Paperbarks (*Melaleuca quinquenervia*), are particularly important. Distances of up to 30km from the camp are often travelled, with 60-70km sometimes covered per night to reach a particular food source.

The Grey-headed Flying Fox (*Pteropus poliocephalus*) was not sighted during the survey, which occurred during mid-morning when the bats would be roosting in camps, but individuals may be attracted to flowering Eucalyptus and Turpentine trees on occasion during the warmer months.

The habitat for this species may occur at the subject site as it forages for nectar within the eucalypt or small tree canopy. It is considered that as the area that is proposed to be impacted is very small compared to the large foraging range in the locality, this species will not be compromised by the proposed development proposed for the subject site (DPIE 2020).

3. Large Bentwing Bat (*Miniopterus orianae oceanensis*)

Roosting habitat for this species includes caves, mines near or above water, discarded buildings and tunnels. No suitable structures described are present on the subject land. Suitable roosting habitat for this threatened microchiropteran bat species is likely to be found within moister valleys of the locality rather than the exposed area of the subject land.

This bat forages in well timbered valleys above the tree canopy on small flying insects (Strahan 1995). Potential occasional foraging habitat is present over the land and within

the immediate vicinity. Core likely foraging habitat for the Large Bentwing Bat is likely concentrated in the larger areas of mature vegetation such as tall open Pittwater Spotted Gum Forest vegetation that occurs in surrounding suburbs to the north (Figure 5). Some sections of the vegetation will be impacted by the proposal but it is considered that no significant adverse impact on the life-cycle or population dynamics of the Large Bentwing Bat is expected from the proposed development (DPIE 2020).

4 POTENTIAL IMPACTS AND COMPLIANCE WITH DEVELOPMENT IN PITTWATER COUNCIL LGA

4.1 Introduction

All development in Warriewood must comply with Pittwater Council LEP (2014) and Pittwater Council 21 DCP (2014). This plan applies to all land within the Pittwater Council LGA to which LEP 2014 applies.

4.2 Pittwater Council LEP (2014)

Clause 7.6 refers to the following:

(1) The objective of this clause is to maintain terrestrial, riparian and aquatic biodiversity by: (a) protecting native fauna and flora, and (b) protecting the ecological processes necessary for their continued existence, and (c) encouraging the conservation and recovery of native fauna and flora and their habitats.

(2) This clause applies to land identified as “Biodiversity” on the Biodiversity Map. The land at 2 - 4 Jacksons Road, Warriewood, is included in the overall marking of Biodiversity on the Council Biodiversity Map (current at 2020)

(3) The consent authority must consider: (a) whether the development is likely to have: (i) any adverse impact on the condition, ecological value and significance of the fauna and flora on the land,

Comment: The proposal includes the retention (including the intention to retain) of up to 31 native trees (or 37% of the total tree population) that have all been planted in landscape plans within the subject land at various times (see Earthscape Horticultural Services 2019 for specific details of tree species and attributes), including 6 individuals having a 'high retention value' (Eandscape Horticultural Services 2019).

Another 26 individuals of various landscaped canopy species having a 'moderately high retention value' (Eandscape Horticultural Services 2019) would be removed but the species replaced in a proposed landscape plan within a feature garden to central courtyard indicated in Figure 2. As such, another 31% of total canopy species of moderate retention value would be replaced as a result of the proposal.

Only 27 canopy trees, all of 'low retention value' as assessed by Earthscape Horticultural Services (2019) or 32% of the total tree population that currently occurs at the subject

site, would be lost from the area (though mostly the same species would be retained) (Earthscape Horticultural Services 2019).

The proposed feature landscape garden indicated in Figure 2 would also include such elements as a 'Forest Oasis', Cabbage Tree Palms, Coastal Garden, Melaleuca Grove, and many other features of interest, including the feature Tallowwood tree planted by N Wran in 1981.

A section of the current copse of trees occurring at the eastern end of the subject area at the Pittwater Road frontage will be retained (13 individuals mostly of Swamp Oak) and many will be replaced in the Forest Oasis section of the landscape feature garden (Figure 2) to emulate 'Swamp Sclerophyll Forest' (Warriewood Community Centre Concept Design by Aspect Studios 2020).

As such, it is considered that in most part the retention and replacement planting of various native canopy species complies with the components of Clause 7.6 of the LEP and the vegetative elements of the subject site will similarly be augmented by the various sections of the landscape feature garden in the central courtyard area as indicated in Figure 2.

(ii) any adverse impact on the importance of the vegetation on the land to the habitat and survival of native fauna,

Comment: The proposal to remove up to 27 canopy trees of low retention value (Earthscape Horticultural Services 2020) and retain or replace the remaining 57 individuals is not expected to adversely impact on the potential foraging, sheltering or breeding habitat of any local fauna.

(iii) any potential to fragment, disturb or diminish the biodiversity structure, function and composition of the land,

Comment: The land contains landscaped canopy tree plantings and as such, is already highly modified, floristically, structurally and in functionality. The proposal to retain and offset many losses by replacement planting of species would be considered adequate to enhance the condition, ecological value and habitat for flora and fauna within the subject land. Further fragmentation or diminishing of biodiversity elements would not be considered to occur as a result of the proposal.

(iv) any adverse impact on the habitat elements providing connectivity on the land,

Comment: The land contains landscaped canopy tree plantings and as such, is already highly modified, floristically, structurally and in functionality. The proposal to retain and offset many losses by replacement planting of species would be considered adequate to

enhance the condition, ecological value and habitat for flora and fauna within the subject land. As such, it is considered that there would be no adverse impact of the proposal on the habitat elements providing limited connectivity on the subject land.

(3) The consent authority must consider whether (b) there any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development.

Comment: The land contains landscaped canopy tree plantings and as such, is already highly modified, floristically, structurally and in functionality. The proposal to retain and offset many losses by replacement planting of species would be considered adequate to enhance the condition, ecological value and habitat for flora and fauna within the subject land.

The proposed feature landscape garden indicated in Figure 2 would include such elements as a 'Forest Oasis', Cabbage Tree Palms, Coastal Garden, Melaleuca Grove, and many other features of interest, including the feature Tallowwood tree planted by N Wran in 1981.

A section of the current copse of trees occurring at the eastern end of the subject area at the Pittwater Road frontage will be retained (13 individuals mostly of Swamp Oak) and many will be replaced in the Forest Oasis section of the landscape feature garden (Figure 2) to emulate 'Swamp Sclerophyll Forest' (Warriewood Community Centre Concept Design by Aspect Studios 2020).

(4) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that:

(a) the development is designed, sited and will be managed to avoid any significant adverse environmental impact, or (b) if that impact cannot be reasonably avoided by adopting feasible alternatives—the development is designed, sited and will be managed to minimise that impact, or (c) if that impact cannot be minimised—the development will be managed to mitigate that impact.

The land contains landscaped canopy tree plantings and as such, is already highly modified, floristically, structurally and in functionality. The proposed development is designed to retain and offset many losses by replacement planting of species, and as such, would be considered adequate to enhance the condition, ecological value and habitat for flora and fauna within the subject land.

4.3 Pittwater Council 21 DCP (2014)

One of the aims of this DCP is to ensure that controls relating to biodiversity conservation and vegetation and wildlife management are undertaken when any development is proposed in

areas containing natural bushland. The objective to maintain terrestrial biodiversity aims to ensure the following (Pittwater 21 DCP):

- protection of native fauna and flora,
- protection of ecological processes necessary to maintain their continued existence, and
- the encouragement of the conservation and recovery of native fauna and flora and their habitats.

This aim serves to protect and conserve the biodiversity of the local area through the retention of natural vegetation where applicable and to maintain, enhance and/or establish wildlife corridors that enable existing plant and animal communities to survive and potentially expand their range where possible (Pittwater Council 21 DCP 2014).

Applicable to DCP Section B4 (Natural Environment) is the control requiring developments to result in no net loss of trees.

Comment: In regard to the proposed development, the location or positioning of the proposed buildings (Terroir 2020) have taken account of the environmental constraints of the subject area and, as such, the retention of elements of natural bushland or their direct replacements have been facilitated wherever possible. The 27 'low retention value' trees that are to be lost (Earthscape Horticultural Services 2020) would be adequately offset by augmented plantings in the feature landscape gardens to be constructed in the central sections of the proposed development (Figure 2) (Aspect Studios 2020).

4.4 Proposed impacts to floristic biodiversity

4.4.1 Potential impacts of development

The arboricultural impact assessment report by Earthscape Horticultural Services (2020) lists a total of 84 primary trees within the landscaped property boundaries with 27 low value retention trees proposed for removal and 57 moderately high to high value retention trees to either be retained or to be directly replaced in a landscape plan together with other plantings as part of the new development (Earthscape Horticultural Services 2020).

As such, the overall impact of the proposal would appear to result in no net loss of canopy trees offset by an enhanced landscape plan to construct a feature garden in the central section of the courtyard of the development (Figure 2).

4.4.2 Recommended mitigation measures

The land contains landscaped canopy tree plantings and as such, is already highly modified, floristically, structurally and in functionality. The proposal to retain and offset many losses by replacement planting of species (Earthscape Horticultural Services 2020)

would be considered adequate to enhance the condition, ecological value and habitat for flora and fauna within the subject land.

The proposed feature landscape garden indicated in Figure 2 would include such elements as a 'Forest Oasis', Cabbage Tree Palms, Coastal Garden, Melaleuca Grove, and many other features of interest, including the feature Tallowood tree planted by N Wran in 1981.

A section of the current copse of trees occurring at the eastern end of the subject area at the Pittwater Road frontage will be retained (13 individuals mostly of Swamp Oak) and many will be replaced in the Forest Oasis section of the landscape feature garden (Figure 2) to emulate 'Swamp Sclerophyll Forest' (Warriewood Community Centre Concept Design by Aspect Studios 2020).

This landscape plan is considered effective in offsetting the losses of 27 'low value retention trees' as assessed by Earthscape Horticultural Services (2020).

4.5 Compliance with Threatened Species Legislation

4.5.1 Threatened species

No threatened individuals of flora or fauna were recorded at or expected to occur at the landscaped subject site. Of the 27 'low value retention trees' (Earthscape Horticultural Services 2020) many include those in poor condition and those that would not have been locally-indigenous in the natural habitat of the subject site.

4.5.2 Threatened Ecological Community

A small patch of a constructed assemblage resembling a component of Coastal Flats Swamp Mahogany Forest occurs along the Pittwater Road frontage of the subject land (Figures 1, 3B, 8, 12, 13 & 16). The components of this constructed assemblage, however, contain only two species, Swamp Oak and Swamp Mahogany, that are positively diagnostic for this community (OEH 2016). As such, this assemblage cannot be regarded as representative of this community. However, a small patch of this assemblage will be retained *in situ*, (Earthscape Horticultural Services 2020) and elements of this ecological plant community will be landscaped in the feature garden in the central sections of the development to replace that which would be lost from the eastern section of the property (Terroir 2020, Aspect Studios 2020).

4.6 Compliance with Effluent and Stormwater Disposal

The site is serviced by sewage and storm water infrastructure.

4.7 Conclusions

With the appropriate management of potential environmental constraints and the undertaking of effective mitigation measures as outlined in this report, the proposed tree retention and landscape development is considered to comply with the desired criteria in relation to Pittwater Councils 21 DCP (2014).

4.8 SEPP (Coastal Management) - Coastal Wetlands Proximity Area

Figure 21 indicates the mapping for the Coastal Wetlands Proximity Area in relation to the subject land.

The mapping indicates the southern boundary of the Proximity Area to include the most northern section of the proposed development where two planted individuals of Swamp Oak of heights 9m and 15m respectively, that occur adjacent to Pittwater Road may be lost as a result of the development (Figure 2).

It is considered however, that as much of the Proximity Area lies within the playing field area of Boondah Reserve, and the development only marginally encroaches on this area (Figure 2), there would be no significant impact of the development on this zone of Coastal Wetlands Proximity Area (Figure 21).

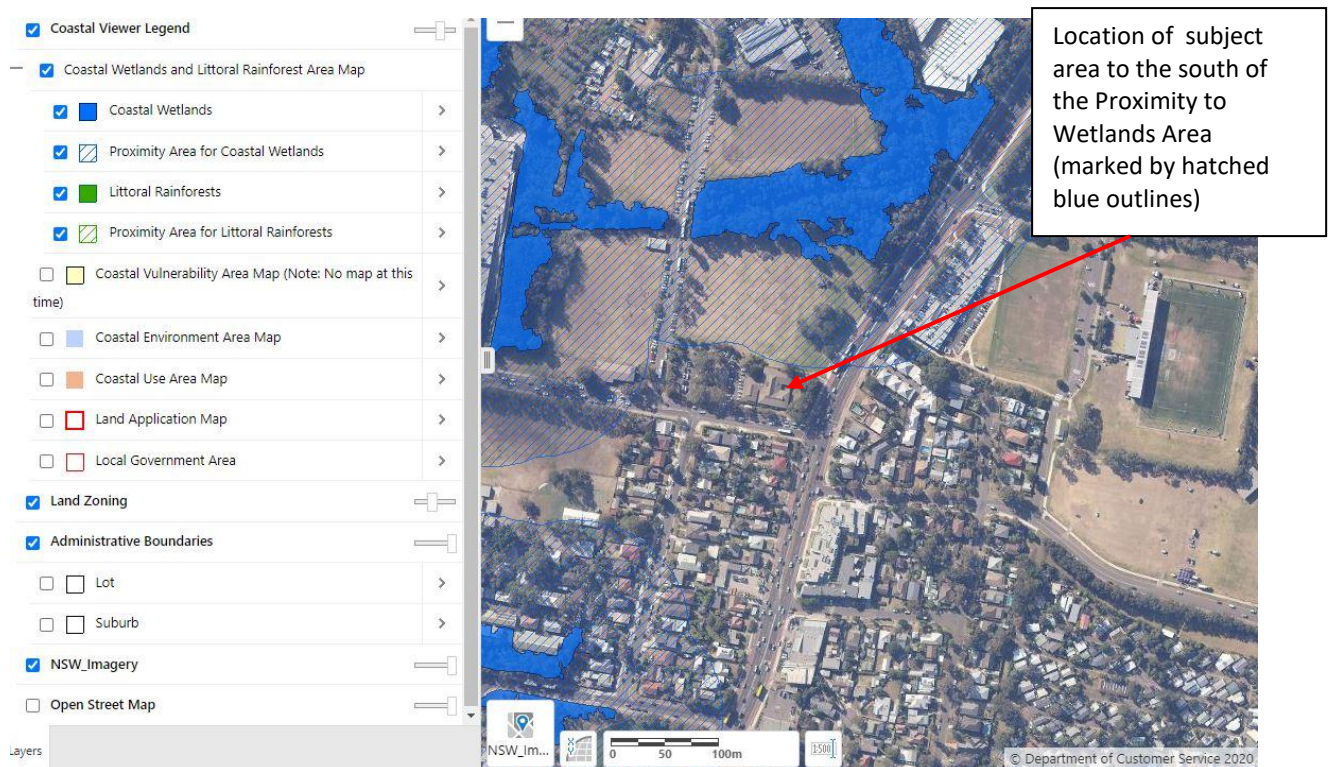


Figure 21 - Mapping of Coastal Wetlands Proximity Area of the SEPP (Coastal Management) in relation to the subject land (from Dept of Customer Service 2020)

5 ADDRESSING THE PROPOSED DEVELOPMENT IN RELATION TO THE BAM (BIODIVERSITY ASSESSMENT METHOD) AS REQUIRED BY THE BC ACT (2016)

5.1 Offset Scheme Thresholds

5.1.1 Area criteria

The threshold for clearing above which the BAM and offsets apply is 1ha (BAM 2016). Of this 1ha area, if the area to be developed is >0.25ha then offsets apply (BAM 2016). If the area of the property is >1ha, then up to 0.5ha of vegetation can be cleared before offsets apply (BC Act 2016).

The property described as 2 - 4 Jacksons Road, Warriewood, comprises a total area of about 9,328m² (Figure 1) (SIXmaps 2020).

The maximum area of potential natural bushland occurring at the subject site that is proposed to be impacted is estimated at about 2,600m² (from SIXmaps 2020).

The development does not meet the offset criteria in relation to potential area to be impacted.

5.1.2 Biodiversity Values Map

The Biodiversity Values Map (BV Map) identifies land with high biodiversity value, as defined by the *Biodiversity Conservation Regulation 2017*. The Biodiversity Offsets Scheme applies to all local developments, major projects or the clearing of native vegetation where the *State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017* applies. Any of these will require entry into the Biodiversity Offsets Scheme if they occur on land mapped on the Biodiversity Values Map (DPIE 2020).

The location of the subject property on the Biodiversity Values Map is indicated in Figure 22.

The subject property is not indicated as containing any significant Biodiversity Value (Figure 22).

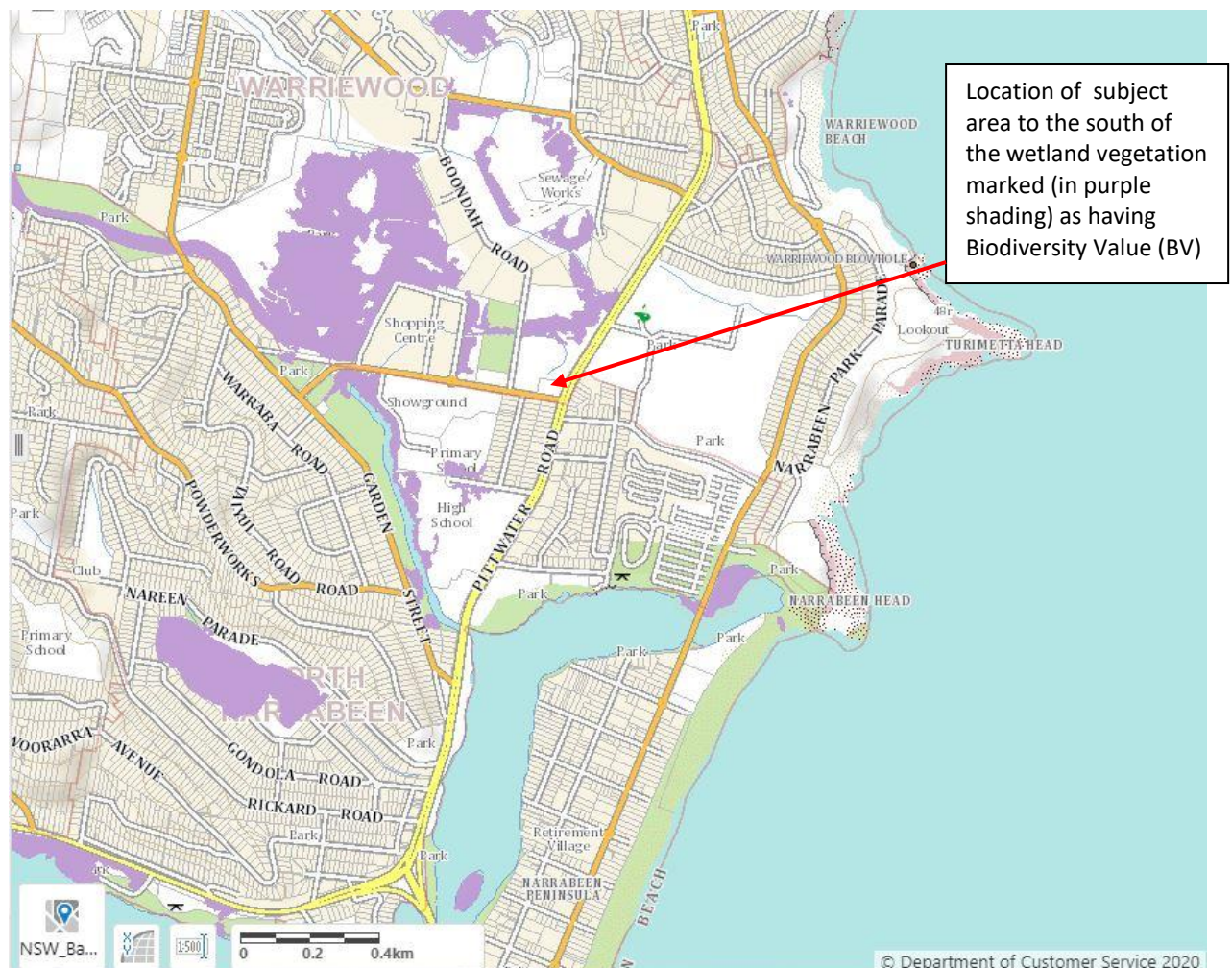


Figure 22 - Biodiversity Values Mapping of subject site at 2-4 Jacksons Road, showing no biodiversity values mapped for the subject land (DPIE 2020).

5.1.3 Threatened species, populations and/or ecological communities.

No threatened species of flora or fauna will be impacted by the development proposal.

No threatened individuals of flora or fauna were recorded at or expected to occur at the landscaped subject site. Of the 27 'low value retention trees' (Earthscape Horticultural Services 2020) many include those in poor condition and those that would not have been locally-indigenous in the natural habitat of the subject site.

A small patch of a constructed assemblage resembling a component of Coastal Flats Swamp Mahogany Forest occurs along the Pittwater Road frontage of the subject land (Figures 1, 3B, 8, 12, 13 & 16). The components of this constructed assemblage, however, contain only two species, Swamp Oak and Swamp Mahogany, that are positively diagnostic for this community (OEH 2016). As such, this assemblage may not be regarded as representative of this community. However, a small patch of this assemblage will be retained *in situ*, (Earthscape Horticultural Services 2020) and elements of this ecological plant community will be landscaped in the

feature garden in the central sections of the development to replace that which would be lost from the eastern section of the property (Terroir 2020, Aspect Studios 2020).

6 REFERENCES AND LITERATURE REVIEWED

- Aspect Studios (2020) Warriewood Community Centre- The Garden Detail Landscape Plan
- Benson, D. and Howell, J. (1994) The natural vegetation of the Sydney 1: 100,000 map sheet. *Cunninghamia* **3**:677 – 787.
- Briggs, J.D. and Leigh, J.H.C. (1996) Rare or Threatened Australian Plants: CSIRO Division of Plant Industry/Australian National Parks and Wildlife Service. CSIRO Publishing, Melb.
- Chapman, G.A. and Murphy, C.L. (1989) *Soil landscapes of the Sydney 1;100 000 sheet*. (Soil Conservation Service of N.S.W.: Sydney).
- Churchill, S., (1998). *Australian Bats*. Reed New Holland Publishers.
- Cogger, H. G. (2000). Reptiles and Amphibians of Australia. 6th ed. Reed New Holland, Sydney.
- Commonwealth DAWE Protected Matters Environmental Search Tool (2020)
- Cropper, S (1993) *Management of Endangered Plants* CSIRO Pub. East Melbourne
- DEC (2002) *Final Edition of 'Native Vegetation of the Cumberland Plain'*. Conservation Programs and Planning Division, Central Directorate.
- DEC (2004) Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities
- DECCW (2011) Cumberland Plain Recovery Plan.
- DPIE Atlas of NSW Wildlife (2020). NPWS Geographic Information Systems Division, Hurstville NSW, 2220.
- Dwyer, P.D. (1995) Common Bentwing-bat *Miniopterus schreibersii* Pp. 494-5 in Strahan, R. (ed.) The Mammals of Australia. Reed Books, Sydney.
- Earthscape Horticultural Services (2019) Arboricultural Assessment Report, Warriewood Valley Community Centre, 2 - 4 Jacksons Road, Warriewood
- Fairley, A. & Moore, P. (2010) Native Plants of the Sydney District – An Identification Guide. Kangaroo Press, Kenthurst, Sydney.
- Fairley, A. (2004) Seldom Seen – Rare Plants of Greater Sydney. New Holland Publ Sydney, Aust.

- Gibbons P, Lindenmayer D (2000) 'Tree Hollows and Wildlife Conservation in Australia'. (CSIRO Publishing: Canberra)
- Harden, G. J. (ed.) (1990 – 2002; 2020 online) Flora of New South Wales, Royal Botanic Gardens, Sydney NSW.
- Herbert, C. (1983) '*Geology of the 1:100 000 Sheet 9130*'. Geological Survey of NSW, Sydney.
- Lockley LTS (Land Title Solutions) (2019) Survey Report for Heather Nelson Senior Citizens Centre, Jacksons Road, Warriewood
- Lumsden, L.F. and Menkhorst, P. (1995) Yellow-bellied Sheath-tail-bat. Pp 161-2 in Menkhorst, P.W. (ed.) *Mammals of Victoria*. Oxford University Press, Melbourne.
- Menkhorst, P & F Knight (2001). *A field guide to the Mammals of Australia*. Victoria: Oxford University Press.
- NSW Scientific Committee. Final Determinations (1996 – 2020) Determinations relating to listings of threatened species, ecological communities and key threatening processes in the Schedules of the *Biodiversity Conservation Act 1995*.
- OEH (2016) 'The Native Vegetation of the Sydney Metropolitan Catchment Management Authority Area'.
- Pizzey, G. and Knight, F. (2003). *The Field Guide to the Birds of Australia*. Angus and Robinson Pubs.
- Smith A.P & Murray (2002) Habitat requirements of the squirrel glider (*Petaurus norfolcensis*) and associated possums and gliders on the New South Wales central coast. *Wildlife Research* 30(3) 291-301
- Specht, R. L., Specht, A., Whelan, M.B., Hegarty, E. E. (1995) Conservation Atlas of Plant Communities in Australia. Southern Cross Univ Press Lismore
- Strahan, R. 1995 *Complete Book of Australian Mammals*, Second Edition. Sydney: ReedBooks.
- Terroir (2020) Warriewood Valley Community Centre Stage 2 - Concept Design - Public Exhibition

Appendix 1: Landscaped floristic species assemblage recorded at the Pittwater Road frontage of the subject land at 2 Jacksons Road, Warriewood

KEY
Status
* Exotic species
HTW - High Threat Weed (DPIE 2020)
Vegetation
Floristically, structurally and functionally modified vegetation of constructed assemblage of Coastal Flats Swamp Mahogany Forest
Relative cover value (% cover) and where relevant, number of trees

STATUS	SCIENTIFIC NAME	COMMON NAME	COPSE OF WOODLAND/FOREST AT PITTWATER ROAD FRONTAGE
	MAGNOLIOPSIDA: MAGNOLIDAE		
*	Apocynaceae <i>Nerium oleander</i>	Oleander	5
	Casuarinaceae <i>Casuarina glauca</i>	Swamp Oak	70
	Dilleniaceae <i>Hibbertia scandens</i>	Climbing Guinea Flower	1
	Mimosaceae <i>Acacia floribunda</i>	Sally Wattle	3
	<i>Acacia longifolia</i> subsp. <i>longifolia</i>	Sydney Golden Wattle	5
	Myrtaceae <i>Callistemon viminalis</i>	Weeping Bottlebrush	5
	<i>Eucalyptus grandis</i>	Flooded Gum	7
	<i>Eucalyptus robusta</i>	Swamp Mahogany	10
	<i>Kunzea ambigua</i>	Tick Bush	5
	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	5
	<i>Syzygium australe</i>	Lillypilly	5 (to 6m tall)

STATUS	SCIENTIFIC NAME	COMMON NAME	COPSE OF WOODLAND/FOREST AT PITTWATER ROAD FRONTAGE
HTW	Ochnaceae <i>Ochna serrulata</i>	Mickey Mouse Plant	1
*	Oxalidaceae <i>Oxalis latifolia</i>		1
	Pittosporaceae <i>Pittosporum revolutum</i>	Hairy Pittosporum	5
	<i>Pittosporum undulatum</i>	Sweet Pittosporum	5
	Proteaceae <i>Banksia integrifolia</i>	Coast Banksia	7
pl*	<i>Grevillea 'Robyn Gordon'</i>	Grevillea hybrid	1
	Sapindaceae <i>Cupaniopsis anacardioides</i>	Tuckeroo	5
	Scrophulariaceae <i>Myoporum insulare</i>	Boobialla	2
*	Solanaceae <i>Solanum nigrum</i>	Black Nightshade	1
	MAGNOLOPSIDA: LILIDAE		
*	Iridaceae <i>Dietes bicolor</i>	Fortnight Lily	1
	Lomandraceae <i>Lomandra longifolia</i>	Spiky-headed Mat-rush	2
*	Poaceae <i>Bromus catharticus</i>	Brome	10
*	<i>Ehrharta erecta</i>	African Veldt Grass	20
*	<i>Pennisetum clandestinum</i>	Kikuyu	20

Appendix 2: Plant species of conservation significance recorded within a 5km radius of the surveyed area since 2000 where potential habitat may occur (DPIE Bionet Atlas of NSW Wildlife 2020^α) or where potential habitat is deemed to potentially occur (Commonwealth Environmental Reporting Tool 2020^β)

Scientific Name	Status (EPBC Act 1999)	Status (BC Act 2016)	RoTAP	Habit/potential habitat/general geographic location	Likelihood of occurrence in surveyed areas	Reference material derived from 'Final Determinations' (Scientific Committee) and others listed below:
<i>Acacia terminalis</i> ssp <i>terminalis</i> ^{α β}	E*	E1		Erect or spreading shrub or small tree to 6m tall. Dry sclerophyll forest in coastal Sydney region. Occurs in coastal scrub and dry sclerophyll woodland in sandy soils	Highly unlikely – Absence of conspicuous large-life form individuals indicate non-occurrence. No further assessment required.	DPIE Bionet Atlas of NSW Wildlife (2020); Fairley & Moore (2004)
<i>Callistemon linearifolius</i> ^α		V	2RCi	Erect shrub to 2.5m tall. Occurs in damp situations in woodland or scrub on sandstone substrates	Unlikely - Habitat unsuitable. Nearest record at North Avalon headland. Absence of conspicuous large-life form individuals indicate non-occurrence. No further assessment required.	DPIE Atlas of NSW Wildlife (2020); Robinson (2000), James <i>et al</i> (1999)
<i>Persoonia hirsuta</i> subsp <i>hirsuta</i> ^{α β}	E*	E1	3KCi	Spreading to decumbent shrub found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.	Unlikely – Habitat suitable. Nearest record to the south-west associated with Hawkesbury Sandstone landscapes. The absence of relatively distinct large life-form individuals in area of study indicates non-occurrence. No further assessment required	Bionet Atlas Of NSW Wildlife (2020); James <i>et al</i> (1999); Fairley & Moore (2000); Fairley (2004).
<i>Rhodamnia rubescens</i> ^α		E4A		Shrub or small tree to 25 m high with reddish/brown, fissured bark (OEH 2019). Occurs in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest (OEH 2019).	Unlikely – Habitat unsuitable. Nearest records occur to the north near Mona Vale (DPIE 2020). No individuals were found to occur in the surveyed area. No further assessment required.	DPIE Bionet Atlas of NSW Wildlife (2020)

Scientific Name	Status (EPBC Act 1999)	Status (BC Act 2016)	RoTAP	Habit/potential habitat/general geographic location	Likelihood of occurrence in surveyed areas	Reference material derived from 'Final Determinations' (Scientific Committee) and others listed below:
<i>Syzygium paniculatum</i> ^{α β}	V*	V	3VCi	Shrub or small tree to 8m tall, occurs in or near rainforest from littoral sands to sheltered gullies, especially near watercourses on sandy soils	Unlikely – Habitat not suitable. Record indicates landscaped individuals evident to the north and south of the subject site. However, the absence of conspicuous large-life form individuals of this species indicates non-occurrence. No further assessment required.	DPIE Atlas of NSW Wildlife (2020); Robinson (1991), Fairley & Moore (2000)
<i>Tetratheca glandulosa</i> ^{α β}	V*	V	2VC-	Small erect shrub to 50cm high, branching close to the woody rootstock, found in sandy and rocky heath, scrub and woodland north of Sydney Harbour.	Highly unlikely – habitat not occurring at subject site, the absence of conspicuous large-life form individuals of this species indicates non-occurrence. No further assessment required.	DPIE Bionet Atlas of NSW Wildlife (2020), Fairley & Moore (2004), Robinson (2000), Fairley (2004).
<i>Epacris purpurascens</i> var <i>purpurascens</i> ^α	V*	V	2KC-	Erect shrub to 150cm tall, in dry sclerophyll forest. Occurs on damp soils in woodland and forest on sandstone, shale or rocky sites, confined to coastal plateaus in the Sydney region from Gosford to Sydney district.	Highly unlikely - habitat not occurring at subject site, the absence of conspicuous large-life form individuals of this species indicates non-occurrence. No further assessment required.	DPIE Bionet Atlas of NSW Wildlife (2020), Fairley & Moore (2004)
<i>Lasiopetalum joyceae</i> ^α	V*	V	2RC-	Erect shrub to 1 to 2m tall, occurring on lateritic to shaley ridgetops on the Hornsby Plateau.	Highly unlikely – Habitat unsuitable. Occurs in heath on sandstone. The absence of conspicuous large-life form individuals of this species indicates non-occurrence. No further assessment required.	DPIE Bionet Atlas of NSW Wildlife (2020); Robinson (2000); Fairley (2004)
<i>Eucalyptus camfieldii</i> ^{α β}	V*	V	2VCi	Mallee or small tree 1 – 4m tall. Occurs on shallow sandstone soils bordering coastal heath in association with other mallee eucalypts.	Highly Unlikely – Habitat unsuitable. Occurs in heath on sandstone at Cromer. The absence of conspicuous large-life form individuals of this species indicates non-occurrence. No further assessment required.	DPIE Bionet Atlas of NSW Wildlife (2020); Fairley & Moore (2004), Harden (2002)

Scientific Name	Status (EPBC Act 1999)	Status (BC Act 2016)	RoTAP	Habit/potential habitat/general geographic location	Likelihood of occurrence in surveyed areas	Reference material derived from 'Final Determinations' (Scientific Committee) and others listed below:
<i>Microtis angusii</i> ^α	E*	E1	2E	Terrestrial orchid to 60cm tall, flowering between May and October. Habitat of recorded site in vicinity of subject site is heavily disturbed. Natural habitat unknown but may have been introduced from nearby Duffys Forest Ecological Community	Unlikely - Nearest record is about 260m to the south along Pittwater Road, North Narrabeen No further assessment required at present	DPIE Bionet Atlas of NSW Wildlife (2020)
<i>Pimelea curviflora</i> var <i>curviflora</i> ^α	V*	V		Much-branched subshrub or shrub 20 to 100cm. Occurs in woodlands of the northern area of Sydney on shale-sandstone transition areas and laterite soils.	Unlikely - The absence of relatively distinct large life-form individuals in area of study indicates non-occurrence. No further assessment required at present	DPIE Bionet Atlas of NSW Wildlife (2020); James et al (1999)
<i>Prostanthera densa</i> ^α	V*	V	3VC-	Compact shrub to 2m tall, occurs on a few coastal headlands and nearby ranges on sandstone outcrops and in sandy heath.	Highly unlikely: Habitat unsuitable. No further assessment required at present	DPIE Bionet Atlas of NSW Wildlife (2020), Robinson (1994), Fairley (2004).
<i>Kunzea rupestris</i> ^β	V*	V	2VCa	Clonal shrub to 1.5m tall, occurring in heath on rock platforms	Unlikely - Habitat unsuitable. The absence of relatively distinct large life-form individuals in area of study indicates non-occurrence. No further assessment required at present	DPIE Bionet Atlas of NSW Wildlife (2020); Robinson (2000)
<i>Grevillea caleyi</i> ^{αβ}	E*	E1	2ECi	Large bushy shrub to 3m tall, occurs in sandy soils in open forest.	Unlikely - Habitat unsuitable. Often associated with ironstone gravels, none of which occur at subject site. The absence of relatively distinct large life-form individuals in area of study indicates non-occurrence. No further assessment required at present	DPIE Bionet Atlas of NSW Wildlife (2020); Fairley & Moore (2004)

Scientific Name	Status (EPBC Act 1999)	Status (BC Act 2016)	RoTAP	Habit/potential habitat/general geographic location	Likelihood of occurrence in surveyed areas	Reference material derived from 'Final Determinations' (Scientific Committee) and others listed below:
<i>Grammitis stenophylla</i> ^α		E1		Small erect fern with fronds <5cm long. Occurs on rocks in rainforest and in wet sclerophyll forest	Unlikely: Habitat unsuitable No further assessment required at present	DPIE Bionet Atlas of NSW Wildlife (2020); Harden (2000)

Key to Conservation Status:

Commonwealth legislation

Environmental Protection and Biodiversity Conservation Act, 1999

EX – Presumed extinct

E* - Endangered

V* - Vulnerable

NSW legislation

Biodiversity Conservation Act, 2016

E4A – Schedule 1 Part 1 – Presumed extinct, recently recorded

E1 Schedule 1 Part 1 – Endangered

V Schedule 2 - Vulnerable

RoTAP

Conservation code

2 - geographic range <100km

3 - geographic range >100km

Conservation status

E - endangered to point of extinction if current land use and other threats continue to operate

V - vulnerable, at risk of depletion over 20-50- years if land use that threatens survival is maintained

C - at least one population conserved in a national park or proclaimed conservation area

Size class of reserved populations

a - >1000 plants in conservation reserve

i - < 1000 plants in conservation reserve

- reserved population size not accurately known

Appendix 3 - Likelihood of occurrence of some fauna species of conservation significance recorded within a 5km radius of the Study Area at 2-4 Jacksons Road, Warriewood (DPIE Bionet Atlas of NSW Wildlife 2020) or where potential habitat is deemed to potentially occur (DAWE 2020).

<i>Amphibians</i>	BC Act	EPBC Act	Habitat	Record (source)	Likelihood of Occurrence	Assessment of Significance required
Red-crowned Toadlet <i>Pseudophryne australis</i>	V		Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones at the sandstone-shale interface. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses. Shelters under rocks and amongst masses of dense vegetation or thick piles of leaf litter.	68 DPIE Bionet Atlas (2020)	Highly unlikely - habitat highly modified; no suitable habitat on the subject land.	No
Giant Burrowing Frog <i>Heleioporus australiacus</i>	V	V	Distribution; The Giant Burrowing Frog occurs from the NSW Central Coast to eastern Victoria, but is most common on the Sydney sandstone. It has been found from the coast to the Great Dividing Range. Habitat; Found in heath, woodland and open forest with sandy soils. Generally lives in the heath or forest and will travel several hundred metres to creeks to breed. Burrows into deep litter or loose soil, emerging to feed or breed after rain. Breeding; Breeds from August to March and the eggs are laid in a white foam-mass under vegetation in creeks or in yabby holes. Feeding; Diet includes ground-dwelling invertebrates such as ants, beetles and spiders.	27 DPIE Bionet Atlas (2020)	Highly unlikely - habitat highly modified; no suitable habitat on the subject land.	No
<i>Birds</i>	BC Act	EPBC Act	Habitat	No sighted (source)	Likelihood of Occurrence	Assessment of Significance required
Rose-crowned Fruit Dove <i>Ptilinopus regina</i>	V		Occurs mainly in sub-tropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest, where fruit is plentiful. They are shy pigeons, not easy to see amongst the foliage, and are more often heard than seen. They feed entirely on fruit from vines, shrubs, large trees and palms, and are thought to be locally nomadic as they follow the ripening of fruits.	2 DPIE Bionet Atlas (2020)	Highly unlikely - habitat highly modified; no suitable habitat on the subject land	No

Birds	BC Act	EPBC Act	Habitat	No sighted (source)	Likelihood of Occurrence	Assessment of Significance required
Superb Fruit Dove <i>Ptilinopus superbus</i>	V		Distribution; The Superb Fruit-Dove is found along the coast and nearby ranges of Queensland and New South Wales south to Moruya. Habitat; Inhabits rainforest, wet sclerophyll forest. Open forest and sometimes mangroves of eastern Australia. Uncommon to rare south of Keppel Bay, Queensland (Pizzey & Knight 1997). Breeding; Rarely breeds (if ever) in New South Wales or Victoria. Nests in October to January on a small frail platform of twigs, on a horizontal fork in a tree, between 5-1- metres from the ground (Beruldsen 2003). Feeding; eats 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.	3 DPIE Bionet Atlas (2020)	Highly unlikely - habitat highly modified; no suitable habitat on the subject land.	No
Black Bittern <i>Ixobrychus flavicollis</i>	V	C	Black Bitterns roost and nest in trees, and are found in tree-lined wetlands and in mangroves. They forage in both daylight and darkness, mainly from shady trees over water, but may be seen during the day in open areas of short marshy vegetation and along creeks.	20 DPIE Bionet Atlas (2020)	Unlikely - habitat unsuitable	No
White-bellied Sea-Eagle <i>Haliaeetus leucogaster</i>	V	C	Low potential for habitat to occur at site. Occurs in wooded areas near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest. May overfly site on occasion.	40 DPIE Bionet Atlas (2020)	Low - May overfly the area as part of a wider foraging range	No
Little Eagle <i>Hieraetus morphnoides</i>	V		The Little Eagle is seen over woodland and forested lands and open country, extending into the arid zone. It tends to avoid rainforest and heavy forest. The Little Eagle searches for prey on the wing or from a high exposed perch, taking prey from the ground, the shrub layer or the canopy. Prey includes rabbits, other live mammals and insects. <i>May overfly the area as part of a wider foraging range but will not be affected by the development.</i>	5 OEH Bionet Atlas (2020)	Low - Moderate - May overfly the area as part of a wider foraging range	No

Birds	BC Act	EPBC Act	Habitat	No sighted (source)	Likelihood of Occurrence	Assessment of Significance required
Square-tailed Kite <i>Lophoictinia isura</i>	V		In NSW the Square-tailed Kite is often associated with ridge and Gully forests dominated by Woollybutt <i>Eucalyptus longifolia</i> , Spotted Gum <i>Eucalyptus maculata</i> , or Peppermint Gum <i>Eucalyptus elata</i> . It has also been sighted in forests containing <i>Angophora spp.</i> and <i>Callitris spp.</i> with a shrubby understorey and Box-Ironbark woodland. It feeds on honeyeating birds and insects in the tree canopy. They have a large foraging range and hunt prey early morning and evening. Nesting sites are along or close to watercourses in a fork or large horizontal limb of a <i>Eucalyptus</i> or <i>Angophora</i> species (Pizzey and Knight 2003).	3 DPIE Bionet Atlas (2020)	Low -Habitat unsuitable	No
Bush Stone-curlew <i>Burhinus grallarius</i>	E1		The Bush Stone Curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and in the south-east it is either rare or extinct throughout its former range. Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Largely nocturnal, being especially active on moonlit nights. Feed on insects and small vertebrates, such as frogs, lizards and snakes. Nest on the ground in a scrape or small bare patch.	13 DPIE Bionet Atlas (2019)	Low -Sightings centred around Careel Bay, Avalon and Newport . Habitat unsuitable	No
Glossy Black Cockatoo <i>Calyptorhynchus lathami</i>	V		Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of she-oak species, particularly Black She-oak (<i>Allocasuarina littoralis</i>), Forest She-oak (<i>A. torulosa</i>) occur. Forest She-oak is the preferred foraging resource. Roosts in the canopy of tall trees, occasionally in tree hollows. <i>As no Glossy Black-cockatoos were recorded and no chewed cones or evidence of feeding was noted, the likelihood of this species being impacted by the development is unlikely</i>	79 DPIE Bionet Atlas (2020)	Low -Individuals observed about 260m to south of subject site along Pittwater Road.	No

<i>Birds</i>	BC Act	EPBC Act	Habitat	No sighted (source)	Likelihood of Occurrence	Assessment of Significance required
Little Lorikeet <i>Glossopsitta pusilla</i>	V		Little Lorikeets mostly occur in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes. Little lorikeets are considered to be nomadic, likely in a response to food availability. These lorikeets usually forage in small flocks, feeding mainly on nectar and pollen, but also fruit of eucalypts, melaleucas and mistletoes. The little lorikeet breeds from May to September, nesting in tree hollows, with small diameter entrance holes. Most breeding records are located on the western slopes. <i>May forage in the subject site with other species of lorikeets during peak flowering events.</i>	10 DPIE Atlas of NSW Wildlife (2020)	Low - Most mature canopy trees within vegetation areas retained. Proposed landscaping is considered not to impact on foraging habitat of this species.	No
Turquoise Parrot <i>Neophema pulchella</i>	V		Range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Usually seen in pairs or small, possibly family, groups and have also been reported in flocks of up to thirty individuals. Prefers to feed in the shade of a tree and spends most of the day on the ground searching for the seeds or grasses and herbaceous plants, or browsing on vegetable matter. Forages quietly and may be quite tolerant of disturbance. However, if flushed it will fly to a nearby tree and then return to the ground to browse as soon as the danger has passed. Nests in tree hollows, logs or posts, from August to December. It lays four or five white, rounded eggs on a nest of decayed wood dust.	1 DPIE Atlas of NSW Wildlife (2020)	Low - Most mature canopy trees within vegetation areas retained. Proposed landscaping is considered not to impact on foraging habitat of this species.	No

Birds	BC Act	EPBC Act	Habitat	No sighted (source)	Likelihood of Occurrence	Assessment of Significance required
Barking Owl <i>Ninox connivens</i>	V		Inhabits eucalypt woodland, open forest, swamp woodlands and, especially in inland areas, timber along watercourses. Dense vegetation is used occasionally for roosting. During the day they roost along creek lines, usually in tall understorey trees with dense foliage such as <i>Acacia</i> and <i>Casuarina</i> species, or the dense clumps of canopy leaves in large <i>Eucalypts</i> . Live alone or in pairs. Territories range from 30 to 200 hectares and birds are present all year (Debus 1997).	25 DPIE Bionet Atlas (2020)	Low - Recorded in a 1km grid pattern around subject site as a result of nocturnal calling. Landscaping of proposed site will maintain potential habitat at subject land.	No
Powerful Owl <i>Ninox strenua</i>	V		Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. It roosts by day in dense vegetation comprising species such as Turpentine <i>Syncarpia glomulifera</i> , Black She-oak <i>Allocasuarina littoralis</i> , Blackwood <i>Acacia melanoxylon</i> , Rough-barked Apple <i>Angophora floribunda</i> , Cherry Ballart <i>Exocarpus cupressiformis</i> and a number of other eucalypt species. <i>No evidence (presence of pellets or droppings at base of trees or on tree trunks) of this species using the subject site for roosting. The subject site is not regarded as core habitat for Powerful Owl.</i>	216 DPIE Bionet Atlas (2020)	Low - Even if occurs occasionally in bushland within property, then little impact on habitat of this species	No
Masked Owl <i>Tyto novahollandiae</i>	V		Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. There is no seasonal variation in its distribution. Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to 1000 hectares. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.	1 DPIE Bionet Atlas (2020)	Low - With retained trees and proposed landscaping at site, considered little impact on habitat of this species. Nearest record is the north at Barrenjoey Head.	No

Birds	BC Act	EPBC Act	Habitat	No sighted (source)	Likelihood of Occurrence	Assessment of Significance required
Regent Honeyeater <i>Dasyomis brachypterus</i>	E4A	CE	The Regent Honeyeater is a flagship threatened woodland bird whose conservation will benefit a large suite of other threatened and declining woodland fauna. The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests, particularly on the central coast and occasionally on the upper north coast. Birds are occasionally seen on the south coast. In the last 10 years Regent Honeyeaters have been recorded in urban areas around Albury where woodlands tree species such as Mugga Ironbark and Yellow Box were planted 20 years ago. The Regent Honeyeater is a generalist forager, although it feeds mainly on the nectar from a relatively small number of eucalypts that produce high volumes of nectar. Key eucalypt species include Mugga Ironbark, Yellow Box, White Box and Swamp Mahogany. Other tree species may be regionally important. For example the Lower Hunter Spotted Gum forests have recently been demonstrated to support regular breeding events. Flowering of associated species such as Thin-leaved Stringybark <i>Eucalyptus eugenioides</i> and other Stringybark species, and Broad-leaved Ironbark <i>E. fibrosa</i> can also contribute important nectar flows at times. Nectar and fruit from the mistletoes <i>Amyema miquelii</i>, <i>A. pendula</i> and <i>A. cambagei</i> are also utilised. When nectar is scarce lerp and honeydew can comprise a large proportion of the diet. Insects make up about 15% of the total diet and are important components of the diet of nestlings.	1 DPIE Bionet Atlas (2020)	Low - more likely to occur within tracts of undisturbed bushland. The Landscaped woodland and forest vegetation at the subject site is planted in a linear array and provides unsuitable habitat. Mpst records occur to the north-west in Ku-ring-gai National Park, however, a record occurs some 780m to the west of the subject site.	No

<i>Birds</i>	BC Act	EPBC Act	Habitat	No sighted (source)	Likelihood of Occurrence	Assessment of Significance required
Swift Parrot <i>Lathamus discolor</i>	E1	CE	Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes. Migrates to the Australian south-east mainland between March and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany <i>Eucalyptus robusta</i> , Spotted Gum <i>Corymbia maculata</i> , Red Bloodwood <i>C. gummifera</i> , Mugga Ironbark <i>E. sideroxylon</i> , and White Box <i>E. albens</i> .	17 DPIE Atlas of NSW Wildlife (2020)	Low - more likely to occur where there is undisturbed forested areas	No
Scarlet Robin <i>Petroica boodang</i>	V		The species inhabits dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. Prefers abundant logs and fallen timber which do not occur at the subject site. <i>Not optimal habitat for the Scarlet Robin. The proposed development should not impact on the foraging activity of this species.</i>	1 DPIE Atlas of NSW Wildlife (2020)	Low - more likely to occur where there are large areas of undisturbed forest and woodland..	No
<i>Mammals</i>	BC Act	EPBC Act	Habitat	No sighted (source)	Likelihood of Occurrence	Assessment of Significance required
Spotted-tailed Quoll <i>Dasyurus maculatus</i>	V	E	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. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites (Edgar & Belcher 1995).	5 Bionet Atlas of NSW Wildlife (2020)	Unlikely - Landscaped vegetation in habitated areas unsuitable	No

<i>Mammals</i>	BC Act	EPBC Act	Habitat	No sighted (source)	Likelihood of Occurrence	Assessment of Significance required
Southern Brown Bandicoot <i>Isodon obesulus obesulus</i>	E1	E	The Southern Brown Bandicoot has a patchy distribution. In south-eastern NSW, found east of the Great Dividing Range south from the Hawkesbury River. Southern Brown Bandicoots are largely crepuscular (active mainly after dusk and/or before dawn). They are generally only found in heath or open forest with an understorey on sandy or friable soils.	3 Bionet Atlas of NSW Wildlife (2020)	Unlikely - Landscaped vegetated areas unsuitable habitat.	No
<i>Mammals</i>	BC Act	EPBC Act	Habitat	No sighted (source)	Likelihood of Occurrence	Assessment of Significance required
Eastern Pygmy Possum <i>Cercartetus nanus</i>	V		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; an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable.	333 DPIE Atlas of NSW Wildlife (2020)	Highly unlikely - habitat highly modified and mostly canopy trees with few flowering shrubs. Most records associated with natural areas on sandstone substrates to the north-west, west and south-west of the subject site	No
Squirrel Glider <i>Petaurus norfolcensis</i>	V		Distribution; The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. Within Sydney the species is only known on the Barrenjoey Peninsula and in the Kurrajong-Wilberforce area Habitat; Inhabits dry sclerophyll forests and woodlands but is generally absent from rainforests and closed forests (Menkhorst and Collier 1988). Their coastal habitats range from low, scrubby eucalypt woodlands and banksia thickets to tall, wet eucalypt forests bordering on rainforest (Lindenmayer 2002). In coastal New South Wales they typically inhabit areas	4 DPIE Bionet Atlas (2020)	Low - Subject site is landscaped and highly modified. Foraging source within the property for the Squirrel Glider are insects and potential sap flows from Spotted Gum. No foraging activity recorded.	No

			with a diversity of tree and shrub species, including high nectar-producing species and winter-flowering Species. Feeding: Diet consists of sap from wattle and eucalypt trees, invertebrates, nectar and pollen. (Lindenmayer 2002). During winter when other food sources are scarce the Squirrel Glider may obtain its energy from winter flowers of a number of plant species. Favoured within the Pittwater area is Coastal Banksia, Old Man Banksia, Grey Ironbark, Red bloodwood, Spotted Gum and Sydney Red Gum.		Nearest record to the north at Avalon.	
Grey-headed Flying-fox <i>Pteropus poliocephalus</i>	V	V	Grey-headed Flying Fox (<i>Pteropus poliocephalus</i>). This species congregates in large camps and is found in a variety of habitats including rainforest, mangroves, Melaleuca swamps, wet and dry sclerophyll forests and also cultivated areas. The species feeds on the blossoms of more than 80 plant species, especially eucalyptus blossom and the fruits of a number of palm species. Flowering species of eucalypts such as Swamp Mahogany (<i>Eucalyptus robusta</i>) and Forest Red Gum (<i>Eucalyptus tereticornis</i>) and Paperbarks (<i>Melaleuca quinquenervia</i>), are particularly important. Distances of up to 30km from the camp are often travelled, with 60-70km sometimes covered per night to reach a particular food source. The Grey-headed Flying Fox (<i>Pteropus poliocephalus</i>) was not sighted during the survey, which occurred during mid-morning when the bats would be roosting in camps, but may be attracted to flowering Eucalyptus trees on occasion.	134 DPIE Bionet Atlas (2020)	Low - Moderate- May on occasion forage in the area as part of a wider foraging range in the locality. The species appears widespread across the locality (Figure 19). The proposed development is not expected to impact on populations of the Grey-headed Flying Fox.	No
Eastern Freetail Bat <i>Micronomus norfolkensis</i>	V		Occur in dry sclerophyll forest and woodland east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures. Insectivorous.	19 DPIE Bionet Atlas (2020)	Low - Nearest records occur in vicinity of subject site. May on occasion forage above the tree canopy for insects. Development not expected to impact on this species	No

<i>Mammals</i>	BC Act	EPBC Act	Habitat	No sighted (source)	Likelihood of Occurrence	Assessment of Significance required
Large-eared Pied Bat <i>Chalinobus dwyeri</i>	V	V	These bats roost in shallow caves in escarpments, particularly in sandstone and forage in remnant native dry and wet open forests, woodlands and rainforests.	14 DPIE Bionet Atlas (2020)	Low - May on occasion forage in the area as part of a wider foraging range. It is considered that species will not be compromised by the proposed development at the subject site (DPIE 2020).	No
Southern Myotis <i>Myotis macropus</i>	V		Prefers permanent and/or flowing water. The Southern Myotis is commonly a cave dwelling microchiropteran, but will utilise tree hollows, mines, stormwater drains, bridges and dense vegetation (Churchill 1998). Roosting sites can be located within a wide variety of habitats, usually located in close proximity to permanent, slow flowing water. Breeding occurs between November and December, with young being weaned after three to four weeks (Churchill 1998). The Southern Myotis commonly forages over water bodies for insects and small fish (Churchill 1998).	52 DPIE Bionet Atlas (2020)	Low -no foraging habitat on the subject land though has been recorded in adjacent wetland habitat to the west of the subject site.	No
Greater Broadnose Bat <i>Scoteanax ruepellii</i>	V		The preferred foraging habitat of this species appears to be tree-lined creeks and the interface between forested land and cleared areas. This species usually roosts in tree hollows, with large live or dead emergent hollow bearing trees preferred. The roof spaces of old buildings are also used as roost sites. The Greater Broad-nosed Bat has been observed to travel from a forested foraging area, several kilometres to a roost tree hollow adjacent to the edge of a town. A colony of up to 80 individuals was using the roost. Large, individual paddock trees have also been found to be used by this species. This indicates that an individual tree may be extremely important, at least on a seasonal basis.	5 DPIE Atlas of NSW Wildlife (2020)	Low -- Habitat of landscaped site unsuitable. May on occasion forage at the subject site as part of a wider foraging range. It is not expected that the Greater Broadnose Bat will be impacted upon by the proposed development.	No

<i>Mammals</i>	BC Act	EPBC Act	Habitat	No sighted (source)	Likelihood of Occurrence	Assessment of Significance required
Eastern Cave Bat <i>Vespadelus troughtoni</i>	V		This bat species is found in a broad band on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT. Very little is known about the biology of this uncommon species. A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. Occasionally found along cliff-lines in wet eucalypt forest and rainforest. Little is understood of its feeding or breeding requirements or behaviour	1 DPIE Bionet Atlas (2020)	Low -Appears to occur mainly in upper North Coast of NSW, proposed development will not impact on this species.	No
Little Bentwing Bat <i>Miniopterus australis</i>	V		Habitat in moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and at night forage for small insects beneath the canopy of densely vegetated habitats.	50 DPIE Bionet Atlas (2020)	Low-Moderate Records occur in close proximity to the subject site, likely in extensive wetland areas to the north and west of the subject land.	No
Large Bentwing Bat <i>Miniopterus orianae oceanensis</i>	V		This sub species of Bentwing Bat occurs from Cape York to central Vic. Occurs in wet and dry sclerophyll forests and rainforests. Roost within man-made structures. Known roost sites include caves, disused mines, storm-water drains, culverts and buildings. However maternity roosts occur in sandstone or limestone cave systems. Will form scattered smaller colonies, mostly within 300km of the larger maternity cave (Churchill 1998).	112 DPIE Bionet Atlas (2020)	Moderate - Records occur in close proximity to the subject site, foraging habitat likely occurs in extensive wetland areas to the north and west of the subject	No

			Active all year round, foraging mostly on moths above the tree canopy. Feeds over large areas of land and has been reported to travel up to 70 km in one night (Dwyer 1995) <i>The Eastern Bentwing Bat will not be impacted upon by the proposed development.</i>		land.	
<i>Reptiles</i>	BC Act	EPBC Act	Habitat	No sighted (source)	Likelihood of Occurrence	Assessment of Significance required
Rosenberg's Goanna <i>Varanus rosenbergi</i>	V		Found in heath, open forest and woodland. Shelters in hollow logs, rock crevices and in burrows, which they may dig for themselves, or they may use other species' burrows, such as rabbit warrens. Runs along the ground when pursued (as opposed to the Lace Monitor, which climbs trees (Cogger 2000)).	68 DPIE Bionet Atlas (2019)	Highly unlikely - habitat highly modified; no suitable habitat on the subject land. Most records well to the north-west, west and south-west of the subject land	No

