

13 Endeavour Rd Caringbah - Ecological Constraints Report for Planning Proposal

Aliro Group Pty Ltd

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Template 2.8.1

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Abbreviations

| Abbreviation | Description |
|--------------|--|
| BAM | Biodiversity Assessment Method |
| BC Act | NSW Biodiversity Conservation Act |
| BDAR | Biodiversity Development Assessment Report |
| BOS | Biodiversity Offset Scheme |
| ELA | Eco Logical Australia Pty Ltd |
| EPBC Act | Environment Protection and Biodiversity Conservation Act |
| OEH | NSW Office of Environment and Heritage |
| PCT | Plant Community Type |

1. Introduction

Eco Logical Australia was engaged by Aliro Group Pty Ltd ('Aliro') to prepare an ecological constraints assessment for the former Toyota site at 13 Endeavour Road Caringbah ('the subject site') (Figure 1). This report will be submitted to Sutherland Shire Council as part of a planning proposal.

The site (Lot 2 DP 714965) is approximately 12 ha and zoned B7 Business Park under the Sutherland Local Environmental Plan 2015. The northern boundary adjoins a public boardwalk (zoned RE1 Public Recreation) on the edge of mangroves fringing Woollooware Bay. Solander Playing Fields are on the eastern side of the site, and Captain Cook Drive and Endeavour Road are on the southern and western sides.

Aliro are seeking to submit a site-specific planning proposal to facilitate the following amendments to the Sutherland Shire LEP 2015:

- Additional permitted uses under schedule 1 of the LEP to allow:
 - Retail premises up to 4,310 sqm
 - Tourist and visitor accommodation
 - Function centres
- Increasing the height of building map to within the range of 27-51 m.

The proposed concept masterplan is shown in Figure 2 and the accompanying landscape plan is shown in Figure 3. The masterplan aims to build upon Toyota's strong legacy by creating a high quality employment hub within the local community on the 12.4 ha site.

This report aims to present the ecological values and development constraints of the site, through a desk-top and field validated assessment of the vegetation communities and habitat values present. Discussion of how the proposed development responds to these constraints is discussed in Section 4.



Figure 1: The subject site at 13 Endeavour Rd Caringbah



Figure 2: Concept masterplan (SJB 2020)



Figure 3: Landscape plan (Habit8 2020)

2. Method

2.1 Desktop assessment

The following information was reviewed as part of the desk top assessment:

- Commonwealth online Protected Matters Search Tool (PMST)
- BioNet Atlas of NSW Wildlife database
- Sydney Metro CMA vegetation mapping (OEH 2016)
- Online Biodiversity Values Map (OEH 2018)
- Historical aerial photos (Shire Maps)
- Sutherland LEP 2015
- ePlanning Spatial Viewer (<https://www.planningportal.nsw.gov.au/spatialviewer>)

2.2 Field investigations

A site inspection undertaken by ELA ecologists Lauren Perkins and Beth Medway on 3 February 2020. The aim of the site inspection was to map the vegetation extent within the study area and record any important fauna habitat features, including hollow-bearing trees. Approximately four person hours were spent inspecting the study area. It was raining during the site inspection with a temperature of about 26 °C.

On 2 March 2020, ELA ecologists Griffin Taylor-Dalton and Karen Spicer conducted a site inspection to validate the vegetation within the study site and undertake the required number of vegetation integrity (VI) plots consistent with the NSW Biodiversity Assessment Method (BAM). All vegetation was assigned to a best-fit Plant Community Type (PCT) and then stratified by overall condition to create vegetation zones. Three VI plots were undertaken in total (one plot within each vegetation zone). The weather was fine and hot (21-40 °C) and 14 person hours were spent on site.

The subject site was visited by Dr Rodney Armistead, an ELA zoologist with considerable microbat experience, between 8:00 am and 12:30 pm on 24 June 2020. A rapid visual assessment of the exterior of each building within study area was undertaken to search for evidence of microbats use and potential microbat roosting sites. These searches included:

- cracks or voids in wall cavities
- under the eaves of the buildings
- the roof from the second floor
- other areas with access leading to voids or gaps within the buildings.

A handheld torch, digital camera, binoculars and handheld GPS were used during the search of the building. A GPS unit was used to mark any locations of microbats, evidence of microbat activity (including guano, urine or staining) and potential habitat that may be observed within the subject site. A handheld Echo Meter Touch (Wildlife Acoustics Pty Ltd), which is used to record the ultra-sonic calls made by microbats, was also present during the survey in case roosting microbats were discovered.

3. Results

3.1 Desktop assessment

3.1.1 Historic use

Historic photos (Figure 4) show that Captain Cook Drive was constructed through an estuarine wetland between 1943 and 1955. The subject site was cleared for landfill in the 1960s and a drainage channel was constructed along Endeavour Road. The site remained clear of vegetation until Toyota established in the late 1980s. Landscaping associated with the Toyota occupancy was progressively implemented until 2006. Toyota ceased operations at the site at the end of 2017, but landscape maintenance is continuing.

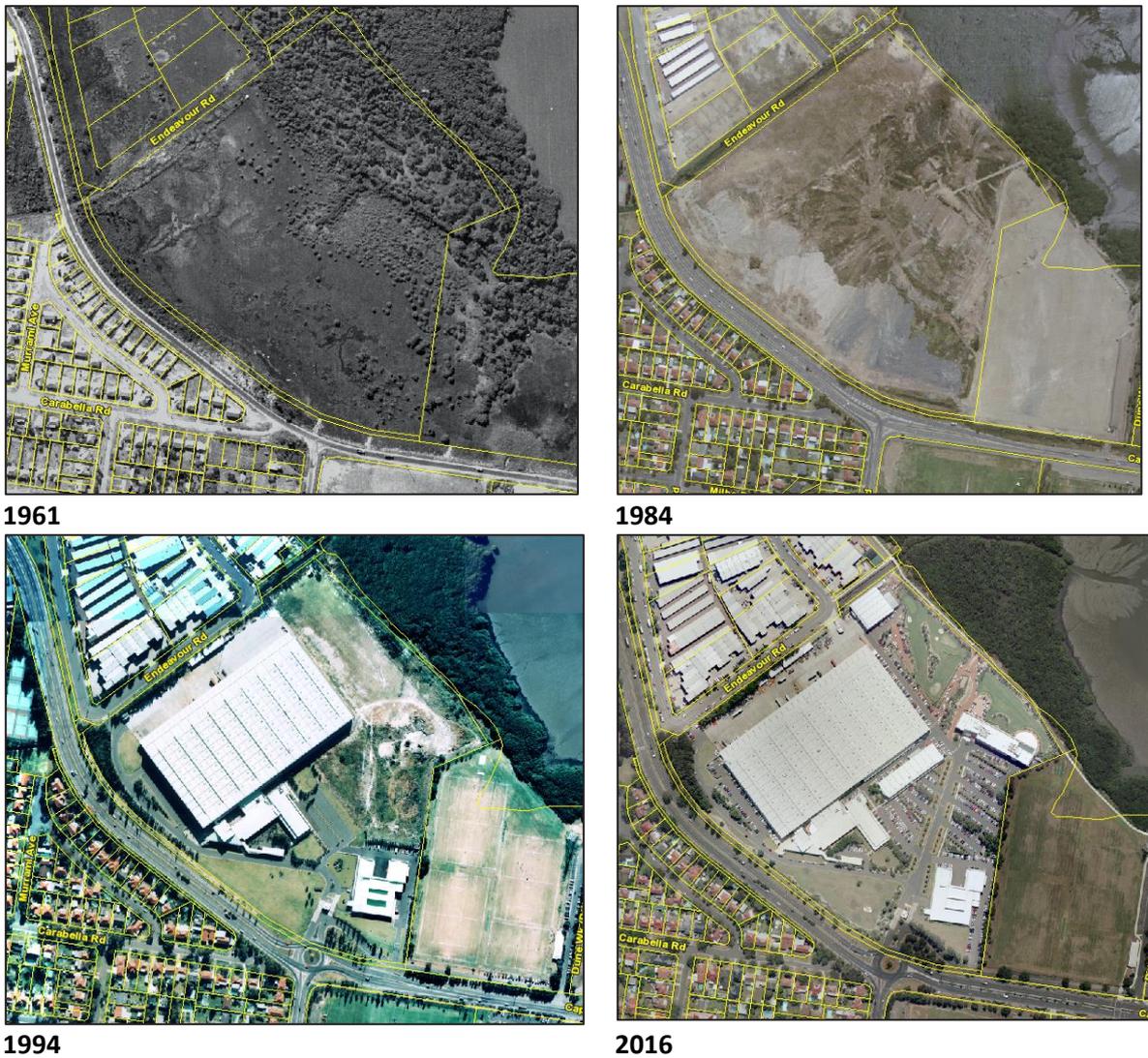


Figure 4: 1961-2016 aerial photos of development site and surrounds (Sutherland Shire Council 'Shire Maps' 2020)

3.1.2 Previous vegetation mapping

Vegetation to the north of the development site has been previously mapped as Estuarine Mangrove Forest with small patches of Estuarine Saltmarsh fringing Woolooware Bay (OEH 2016) (Figure 5). Some of the vegetation around the periphery of the subject site was mapped as Urban Exotic/Native (OEH 2016).

3.1.3 Biodiversity Values Map and Biodiversity Offset Scheme

The *Biodiversity Conservation Act 2016* (BC Act) sets requirements for biodiversity assessment and requires proponents to offset certain biodiversity impacts through the purchase and retirement of biodiversity credits. For a local development under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), the Biodiversity Offset Scheme (BOS) and Biodiversity Assessment Method (BAM) may be triggered by the following means:

- exceeding the 'area clearing threshold' associated with the minimum lot size for the property (Table 1)
- whether the impacts occur on an area mapped on the Biodiversity Value Map
- a potentially significant impact identified through application of the Test of Significance (5-part test).

Table 1: Area clearing threshold

| Minimum lot size associated with a property | Threshold for clearing native vegetation, above which the BAM and offsets scheme apply |
|---|--|
| Less than 1 ha | 0.25 ha or more |
| 1 ha to less than 40 ha | 0.5 ha or more |
| 40ha to less than 1000 ha | 1 ha or more |
| 1000 ha or more | 2 ha or more |

The minimum lot size for the study site is 1 ha, so clearing 0.5 ha or more of native vegetation will trigger the BOS. All vegetation native to New South Wales is included in the clearing threshold, even if this vegetation has been planted.

Removal of native vegetation within land mapped by OEH (2020) as 'high biodiversity value' would trigger the BOS under the BC Act and require the application of the BAM to determine what offsets are required and the preparation of a Biodiversity Development Assessment Report (BDAR). There is no vegetation within the subject site that is mapped by OEH (2020) as 'high biodiversity value'. The mangroves to the north of the site are mapped by OEH (2020) as areas of 'high biodiversity value' (Figure 5), but there is no proposal to remove or indirectly impact these trees.

Further discussion of the BOS in relation to validated vegetation within the subject site is discussed in Section 3.2.1.

3.1.4 Key Fish Habitat and DPI Foreshore Buffer

Figure 6 shows that the northern foreshore of Woollooware Bay, adjacent to the subject site, is recognised as ‘key fish habitat’ by the NSW Department of Primary Industries - Fisheries. The ‘key fish habitat’ map includes areas subject to the highest astronomical tides (king tides). Figure 6 shows these extend onto the subject site, however, the mapping is coarse and may not be an accurate representation of where king tides actually reach.

The NSW Department of Primary Industries 2013 *Policy and Guidelines for Fish Habitat Conservation and Management* (Section 3.2.3.2, Clause 4) states:

NSW DPI will generally not approve developments or activities that do not incorporate foreshore buffer zones of 50- 100 m width adjacent to TYPE 1 marine vegetation and at least 50 m width adjacent to TYPE 2 marine vegetation. Where a buffer zone of at least 50 m is physically unachievable due to land availability constraints, the available buffer width must be maximised to achieve protection of TYPE 1 and 2 marine vegetation (i.e. from edge effects, changes to water quality, flood protection and to allow for climate change adaptation). The buffer zone should not be used for other asset protection purposes (e.g. as a bushfire or mosquito buffer). Please note that this policy does not apply to developments involving maintenance to existing, or construction of new roads or bridges crossing a waterway, but may apply to developments involving roads that are adjacent to, but not crossing a waterway (e.g. new subdivisions, rezoning proposals involving new access roads, new road developments along a new alignment).

The subject site is currently separated from Woollooware Bay and the marine vegetation (mangroves) by a Council-managed boardwalk, approximately 5 m wide.

3.1.5 Marine Estate Management Act 2014

Woollooware Bay is part of the Towra Point Aquatic Reserve listed under the *Marine Parks Act 1997*. Section 56 of the *Marine Estate Management Act 2014* sets out requirements for development within the locality of an aquatic reserve, including the need to consider the potential effects on plants and animals in the Aquatic Reserve. Any proposed development or activity within the subject site needs to consider potential impacts to the adjacent aquatic reserve.

3.1.6 State Environmental Planning Policy (Coastal Management) 2018

Part of the subject site is mapped as a ‘Proximity Area for Coastal Wetlands’ under the *State Environmental Planning Policy (Coastal Management) 2018* (Coastal Management SEPP), (Figure 7). Clause 11 of the SEPP states:

Development consent must not be granted to development on land identified as “proximity area for coastal wetlands” or “proximity area for littoral rainforest” on the Coastal Wetlands and Littoral Rainforests Area Map unless the consent authority is satisfied that the proposed development will not significantly impact on:

(a) the biophysical, hydrological or ecological integrity of the adjacent coastal wetland or littoral rainforest, or

(b) the quantity and quality of surface and ground water flows to and from the adjacent coastal wetland or littoral rainforest.

3.1.7 Water Management Act 2000

Clause 36 of Schedule 4 of the Water Management (General) Regulation 2018 specifies that certain waterfront land that has been identified on a map published on the Department of Industry website as 'exempt waterfront land' does not require controlled activity approval if it has been granted development consent. If consent is granted for the proposed development, a controlled activity approval under the *Water Management Act 2000* will not be required because the foreshore of Woollooware Bay is mapped as exempt waterfront land.

It is noted that the approved foreshore buffer for most of the adjacent Woollooware Bay Town Centre is 40 m, consistent with the former requirements under the Water Management Act, prior to mapping the foreshore of Woollooware Bay as exempt waterfront land.

3.1.8 Sutherland Shire Council LEP 2015

The entire subject site is mapped as 'Environmentally Sensitive Land – terrestrial biodiversity' and 'Environmentally Sensitive Land – riparian land' under the Sutherland LEP 2015. As such, Clauses 6.5 and 6.7 must be addressed in a development application. A summary of each clause is provided below in Table 2.

Table 2: Council considerations for environmentally sensitive land (Terrestrial Biodiversity and Riparian Land)

| Cl. 6.5 Terrestrial Biodiversity | Cl. 6.7 Riparian Land |
|--|--|
| any adverse impact on the condition, ecological value and significance of the fauna and flora on the land, and | the water quality and flows within the watercourse, |
| any adverse impact on the importance of the vegetation on the land to the habitat and survival of native fauna, and | aquatic and riparian species, habitats and ecosystems of the watercourse, |
| any potential to fragment, disturb or diminish the biodiversity structure, function and composition of the land, and | the stability of the bed and banks of the watercourse, |
| any adverse impact on the habitat elements providing connectivity on the land, and | the free passage of fish and other aquatic organisms within or along the watercourse, |
| any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development. | any future rehabilitation of the watercourse and riparian areas, and |
| | whether or not the development is likely to increase water extraction from the watercourse, and |
| | any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development. |

Development consent must not be granted for development on land to which these two clauses apply 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—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 foreshore building line and foreshore area are shown in Figure 7. Development within the foreshore area is restricted and must address the requirements of Clauses 6.9 and 6.10 of the Sutherland LEP.

3.1.9 Sutherland Shire Council Greenweb

The development site is mapped as 'Restoration' under Sutherland Shire Council's Greenweb map and the adjacent mangroves are mapped as 'Core'. The overall aim of the Greenweb Strategy is to identify and manage significant vegetation and vegetated links through the Shire, to ensure the long-term conservation of the biodiversity of the Shire and surrounds.

The Greenweb Sutherland Shire Environmental Specification (2007) states that: *restoration areas provide opportunities for the establishment and vegetation of corridors between core areas. Landscaping in Core, Support and Restoration areas should support the objectives of the Greenweb strategy. In all these areas, the strategy requires that existing suitable trees and areas of native vegetation are retained and that habitat or corridor areas are revegetated. Revegetation, or even individual tree planting using appropriate plants, can enhance the ecological quality of the landscape and assist in reaching Greenweb objectives.*

The Greenweb Specification (Sutherland Shire Council, 2007) suggests a council publication for selecting species for landscaping and revegetation projects. Council also has a web based native plant selector, which provides a list of species for revegetation based on location (<https://www.sutherlandshire.nsw.gov.au/Outdoors/Environment/Plants-and-Bushland/Native-Plant-Selector>). As such, to meet the objectives of the Greenweb Strategy, the native vegetation within the study area and adjacent verges should be retained as far as possible and revegetation/landscape planning should address the Council Greenweb specifications.

3.1.10 Threatened species records

There are no records of threatened species within the subject site but there are multiple records within a 5 km radius of the site (Figure 8 and Figure 9).

The database results from the PMST and Bionet database search results were consolidated into a 'likelihood of occurrence' table (Appendix A). This table was reviewed following the site inspection to determine which threatened species may occur within the development site based on observed available habitat.

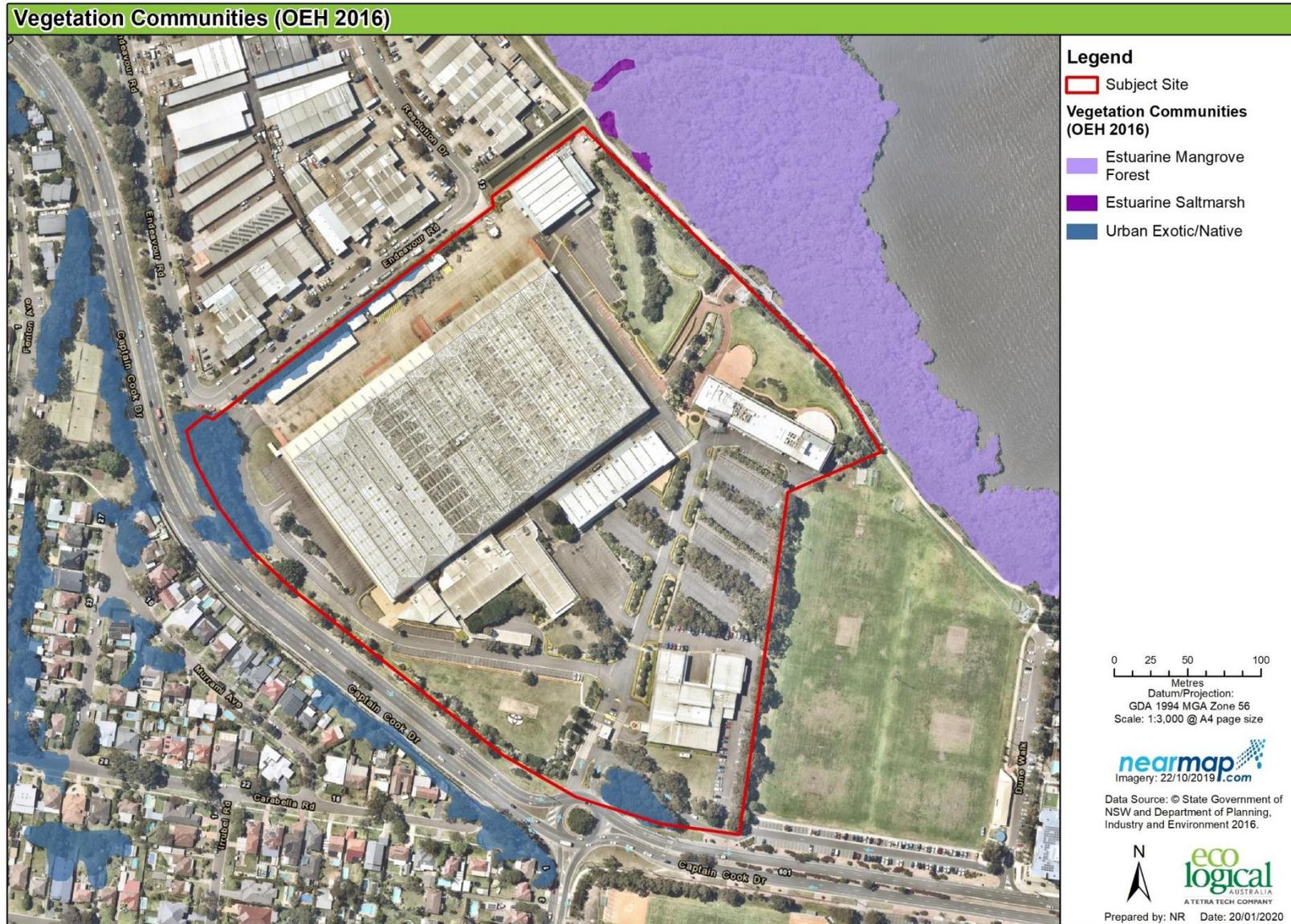


Figure 5: Previous vegetation mapping of the subject site and surrounding land (OEH 2016)

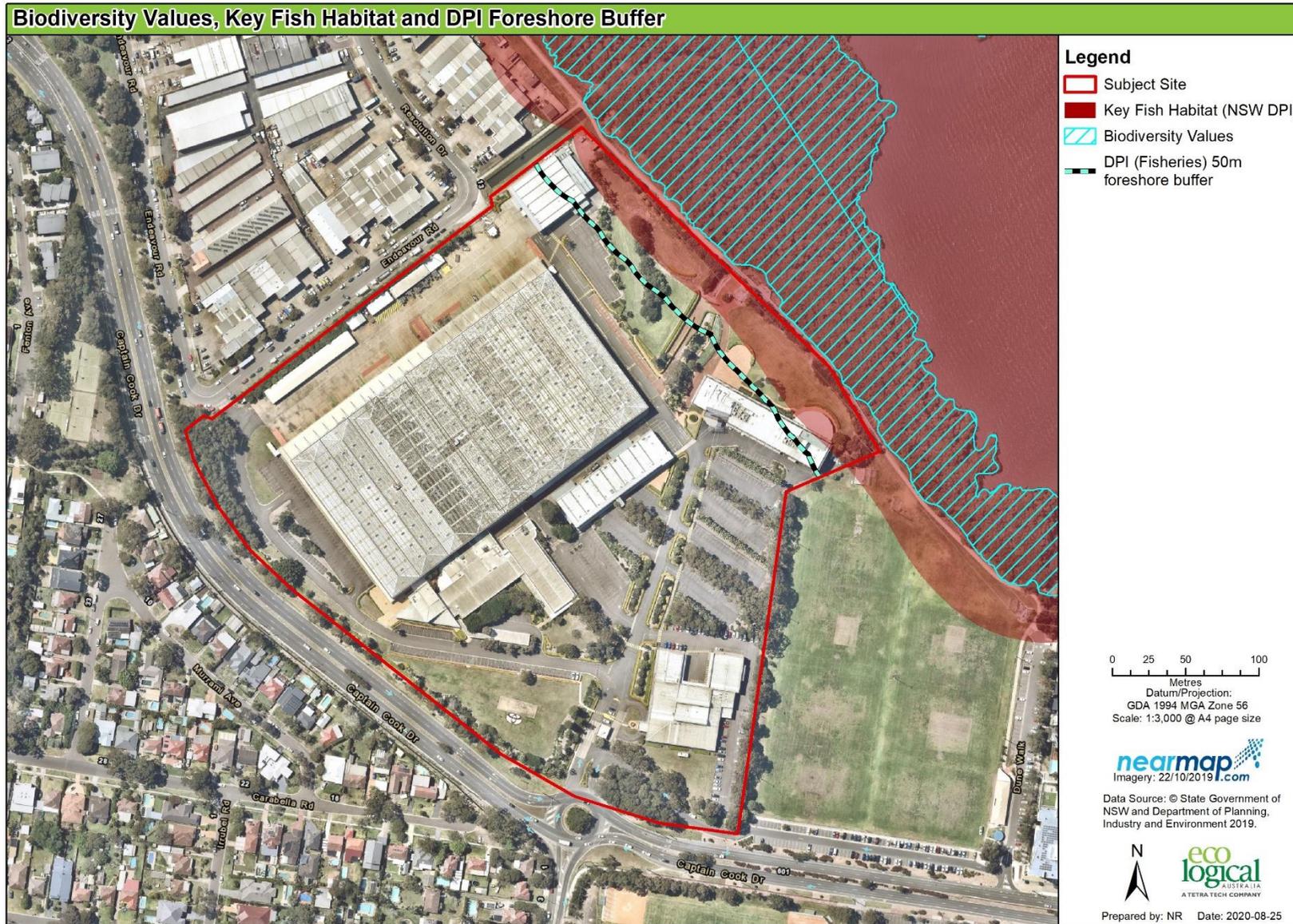


Figure 6: Biodiversity values map (OEH 2020), Key Fish Habitat and location of DPI (Fisheries) foreshore buffer

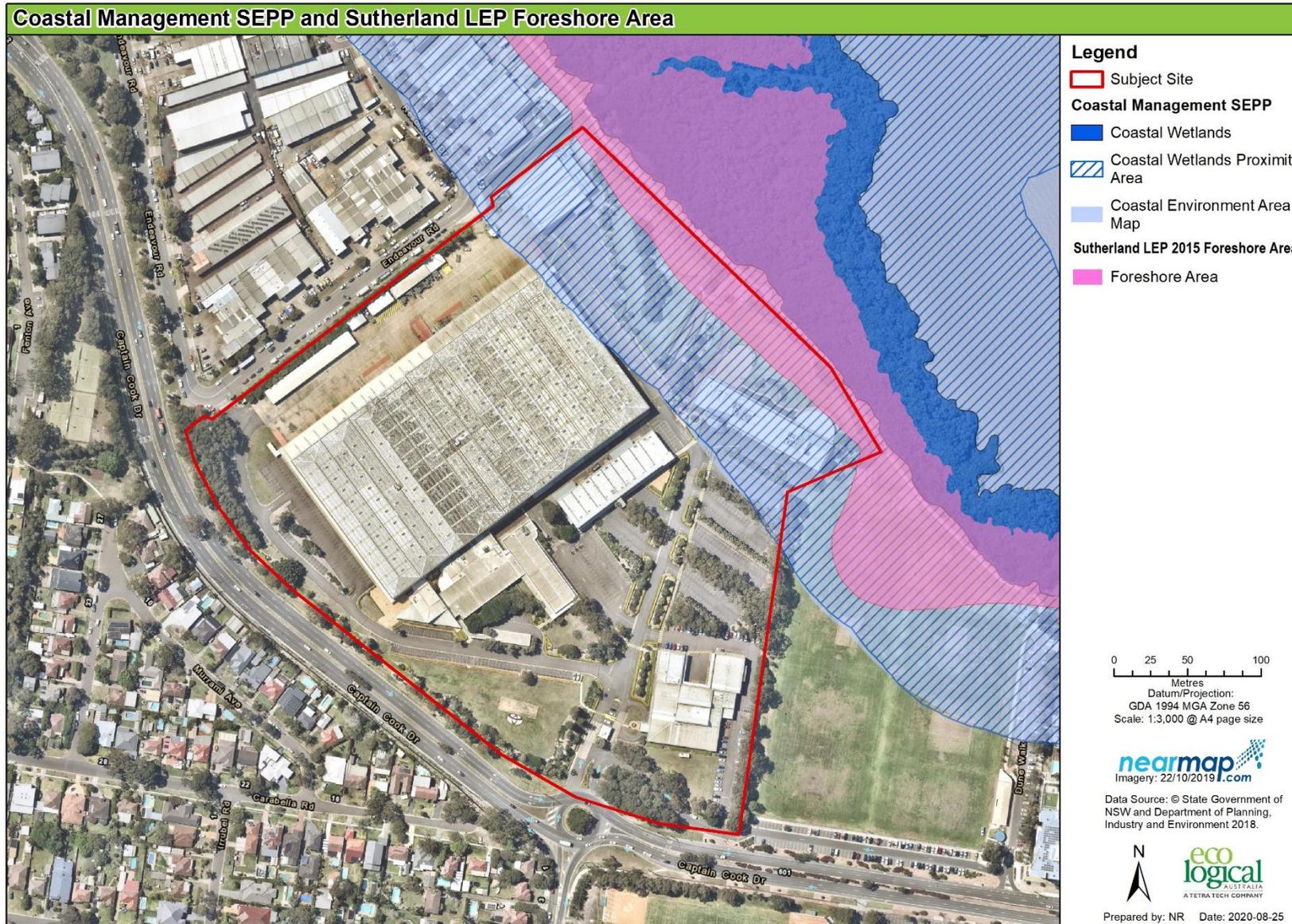


Figure 7: Coastal Management SEPP mapping and Sutherland Council foreshore area

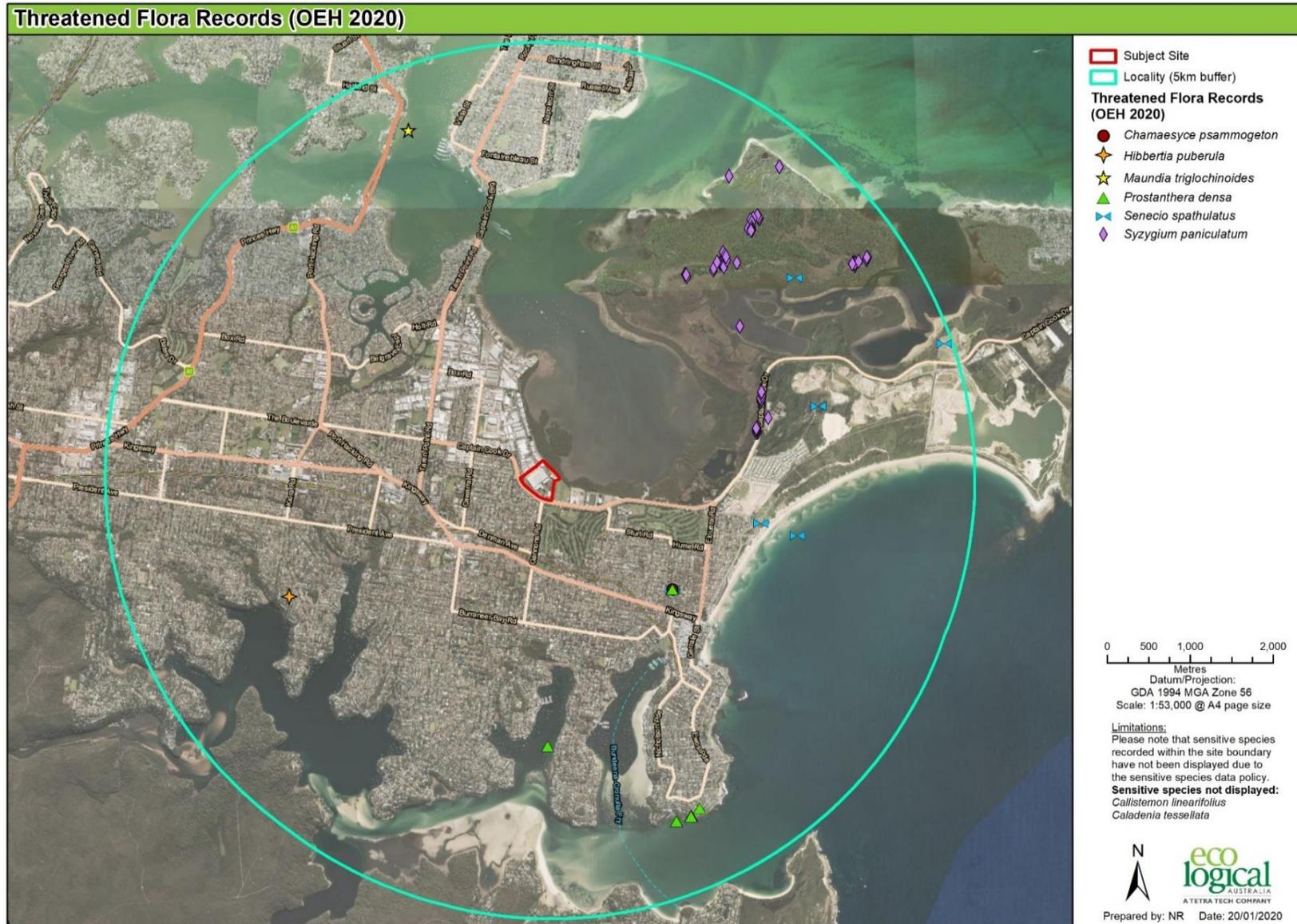


Figure 8: Threatened flora records (OEH 2020)



Figure 9: Threatened fauna records (OEH 2020)

3.2 Field survey

3.2.1 Vegetation communities

Vegetation must be assigned to the best-fit plant community types (PCT) under the BAM if it is dominated by species native to NSW, even if it is mainly planted vegetation such as on the study site. Approximately 1.08 ha of vegetation within the subject site was dominated by species native to NSW and were assigned to the following PCTs (condition is noted in brackets):

- **PCT 1232:** Swamp Oak - Prickly Tea-tree - Swamp Paperbark Swamp Forest on Coastal Floodplains, Sydney Basin and South East Corner (Planted)
- **PCT 1234:** Swamp Oak Swamp Forest Fringing Estuaries, Sydney Basin Bioregion and South East Corner Bioregion (Poor condition)
- **PCT 1832:** Tuckeroo – Lilly Pilly – Cheese Tree Littoral Rainforest on sand dunes in the Sydney basin (Planted)

The extent of each PCT is mapped in Figure 10. Planted vegetation dominated by exotic species or native species not naturally occurring with NSW was mapped as 'Urban/Exotic'. A description of each PCT can be found below, as well as a justification for each condition assigned.

3.2.1.1 PCT 1232: Swamp Oak - Prickly Tea-tree - Swamp Paperbark Swamp Forest on Coastal Floodplains, Sydney Basin and South East Corner – Planted

This PCT occurs across the majority of the study site, mainly being located within the numerous landscaped areas (Figure 12). This PCT is characterised by a canopy of *Livistona australis* (Cabbage tree palm) and *Corymbia maculata* (Spotted Gum) with *Callistemon viminalis* (Weeping Bottle brush) and *Melaleuca quinquenervia* (Broad-leaved paperbark) being less common. The midstorey was generally sparse where present. *Doryanthes excelsa* (Gynea Lilly) was the most common species within this stratum layer. The ground layer was dominated by species such as *Dianella caerulea var. producta*, *Ehrharta erecta* (Panic veltdgrass), *Lomandra longifolia* (Spiny-headed mat-rush) and *Digitaria sanguinalis* (Summer grass).

The PCT was assigned based on the combination of dominant species (listed above) being listed as occurring within PCT 1232. The PCT was assigned as 'Planted' condition as the vegetation was clearly planted as a series of garden beds and landscaped areas. As this plant community was planted, it is not considered to be part of the endangered ecological community *Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*.

3.2.1.2 PCT 1234: Swamp Oak Swamp Forest Fringing Estuaries, Sydney Basin Bioregion and South East Corner Bioregion – Poor condition

This PCT occurs as three small areas across the study site characterised by a canopy of *Casuarina glauca* (Swamp Oak) (Figure 13). The midstorey was very sparse with exotic *Duranta erecta* (Sky Flower) being planted in hedge rows around some of the PCT 1234 patches. Ground cover was predominantly exotic with *Ehrharta erecta* (Panic Veltdgrass) and *Araujia sericifera* (Moth Vine) being most common. The native vine *Cayratia clematidea* (Native Grape) was uncommon though present throughout this community.

Overall this PCT was in a poor condition, primarily due to the abundance of exotic species within the ground cover and the lack of native species diversity. Given the subject site's position fringing the

estuary, this PCT along with mangroves and saltmarsh, was likely part of the original vegetation prior to clearing and filling. As such, we assume this community has naturally regenerated where it occurs within the subject site. This PCT is consistent with the endangered ecological community *Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* as listed under the NSW BC Act.

3.2.1.3 PCT 1832: Tuckeroo – Lilly Pilly – Cheese Tree littoral rainforest on sand dunes in the Sydney basin – Planted

One patch within the study site was mapped as PCT 1832 (Figure 14). The main canopy species within this PCT consisted of *Cupaniopsis anacardioides* (Tuckeroo), *Syzygium paniculatum* (Magenta Lilly Pilly), *Glochidion ferdinandi* var. *ferdinandi* (Cheese Tree) and *Corymbia citriodora* (Lemon Scented Gum). Within the midstorey *Pittosporum undulatum* (Native Daphne) was present though sparse. *Duranta erecta* (Sky Flower) and *Murraya paniculata* (Orange Jessamine) were most abundant within the midstorey as planted hedge rows around the patch. Within the ground layer, *Dianella caerulea* var. *producta* and *Ehrharta erecta* (Panic veltdgrass) were the most abundant species with *Araujia sericifera* (Moth vine) and *Cayratia clematidea* (Native grape) also common. It was evident that this PCT was landscaped as a garden and thus given a condition of “Planted”.

3.2.1.4 Urban exotic

‘Urban Exotic’ was the most abundant vegetation zone within the study site (Figure 10), and included landscaped hedge rows of *Duranta erecta* (Sky flower), *Strelitzia spp.* (Bird of Paradise) and Magnolia trees. Common tree species included *Corymbia citriodora* (Lemon Scented Gum), *Phoenix canariensis* (Canary Island Date Palm) and *Jacaranda mimosifolia* (Jacaranda) (Figure 15).

3.2.2 Fauna habitat features and threatened species

No direct observations of microbats or signs of microbat occupancy was identified during this assessment. Potential entry/exit points that could lead to internal spaces, and consequently potential roost habitat were recorded during the external inspection. The entry and exit points included stormwater drain outlets, cracks and other small openings in awnings as well as the spaces between a shipping container. These potential habitats were of sub-optimal to low quality and therefore were considered unlikely to provide habitat to non-threatened or threatened bats.

However, this survey of potential microbat roosting habitat was undertaken in June, when microbats are less active. The survey requirements under the BAM, state that survey for *Myotis macropus* (Southern Myotis) needs to be undertaken in October – March when the species is more active. Southern Myotis is a ‘species credit species’, that has potential to occur within the subject site, given the presence of foraging habitat within Woollooware Bay. We recommend 2 nights of Anabat detector survey from October onwards to determine presence/absence of this species. If recorded, species credits will likely need to be purchased as part of the site development. This will be determined at the DA stage, when a BDAR and BAM credit calculations will be prepared.

No threatened flora or fauna species were observed during the site visit, although targeted ecological survey was not undertaken. There was no suitable breeding habitat for threatened species observed during the site inspection, in the form of hollow-bearing trees and raptor nests. This is consistent with the immature age of the vegetation, as there are no large emergent trees for nesting raptors and tree hollows have not had time to form.

To determine if threatened species are likely to utilise the site, the PMST and Bionet database search results were consolidated into a 'likelihood of occurrence' table (Appendix A), which was reviewed to determine which threatened species have been previously recorded in the locality and may occur within the subject site based on observed available habitat.

It was concluded that the subject site may provide foraging habitat for threatened species of microbats, and the Grey-headed Flying-fox (indicated in Appendix A as species that could forage in the site). The mobile nature of these species and widespread availability of foraging resources in the locality means that the foraging resources on-site (particularly the areas mapped as planted native vegetation communities) are a moderate ecological constraint to future redevelopment.

An existing freshwater feature within the northern part of the development site contains the pest species *Gambusia holbrooki* (Mosquito Fish or Plague Minnow). This species was introduced to Australia in the 1920s because of their reputation for mosquito control. However, their ability to control mosquito larvae is no greater than small native fish that feed on insects. *G. holbrooki* have been linked to the decline of frog species through the predation of tadpoles and adult frogs. There were no frogs calling during the site visit, despite the suitable weather (rain). The aquatic habitat may provide fresh water for birds and microbats.



Figure 10: Validated vegetation mapping and assigned PCTs across the study site, and location of vegetation integrity plots (ELA 2020)

4. Summary of ecological constraints and proposed redevelopment

Table 3 lists the ecological constraint classes and the ecological values/features within the subject site that apply to each constraint class. Figure 11 shows the extent of these constraints throughout the subject site, overlaid with the proposed concept masterplan.

Table 3: Ecological constraint classes

| Ecological Constraint | Ecological features/values |
|-----------------------|---|
| Low | Vegetation mapped as 'Urban/Exotic' |
| Moderate | Planted native vegetation communities (mapped as PCT 1232 and PCT 1832) as it provides foraging habitat for highly mobile microbats and the Grey-headed Flying Fox |
| High | Proximity to coastal wetland area positioned landward of the 50 m foreshore buffer Areas mapped as PCT 1234 (low condition), which is an endangered ecological community under the BC Act that appears to have naturally regenerated |
| Very high | 50 m foreshore buffer area |

The foreshore buffer is considered a very high constraint to development, as the current policy requires this area to be revegetated as part of a wider foreshore buffer to the aquatic reserve/wetlands. As such, a revegetated foreshore buffer of 50 m width from mean high water mark (MHW) may be required (Figure 6). This foreshore buffer may need to be revegetated with suitable estuarine species from the Swamp Oak Floodplain Forest endangered ecological community.

The applicant has adopted a foreshore buffer of 40 m for the proposed redevelopment of the subject site. Justification for adopting the 40 m buffer, includes:

- the precedence set by the recent Woollooware Bay development, where a 40 m foreshore buffer was accepted
- the presence of an existing council cycleway/walkway between the subject site and the wetlands, which fragments and separates the subject site from the wetlands
- the presence of existing buildings and other hardstand structures within the 50 m foreshore buffer
- constraints associated with the existing Ausgrid overhead power lines easement.

An area of Swamp Oak Floodplain Forest endangered ecological community (EEC) (as listed under the BC Act), occurs in the western corner of the site and at the entrance to the site, and is consistent with PCT 1234 *Swamp Oak Swamp Forest Fringing Estuaries*. As such, these areas have been assigned a high ecological constraint. The *Proximity to coastal wetlands* zone has also been assigned a high constraint, as development in this area will need to ensure no significant impacts to the adjacent coastal wetland.

Patches of native plantings across the remainder of the site are a moderate ecological constraint, based on the foraging habitat they provide for mobile threatened microbats and the Grey-headed Flying Fox. The remaining vegetation is assessed as a low ecological constraint, as it is dominated by exotic vegetation/and or vegetation not native to NSW.

Overall, the proposed urban design and landscaping positively responds to the site's ecological values through creation of a foreshore buffer, re-vegetation and retaining long standing attributes of the existing landscaping. Proposed positioning of buildings has strategically considered the ecological site opportunities and constraints.

The landscape plan (Figure 3), demonstrates that much of the existing planted native vegetation will be retained. This vegetation provides potential foraging habitat for native fauna, including the threatened Grey-headed Flying-fox and threatened species of microbats. All the mapped areas of PCT 1234, which is considered part of the endangered ecological community *Swamp Oak Floodplain Forest of the New South Wales North Coast*, will be retained. Within the foreshore buffer, the landscape plan proposes a diverse planting guide consistent with species from the Swamp Oak Floodplain EEC. The foreshore area will connect with the existing shared path and provide a sustainable transport option for users of the site, which is an environmental benefit.

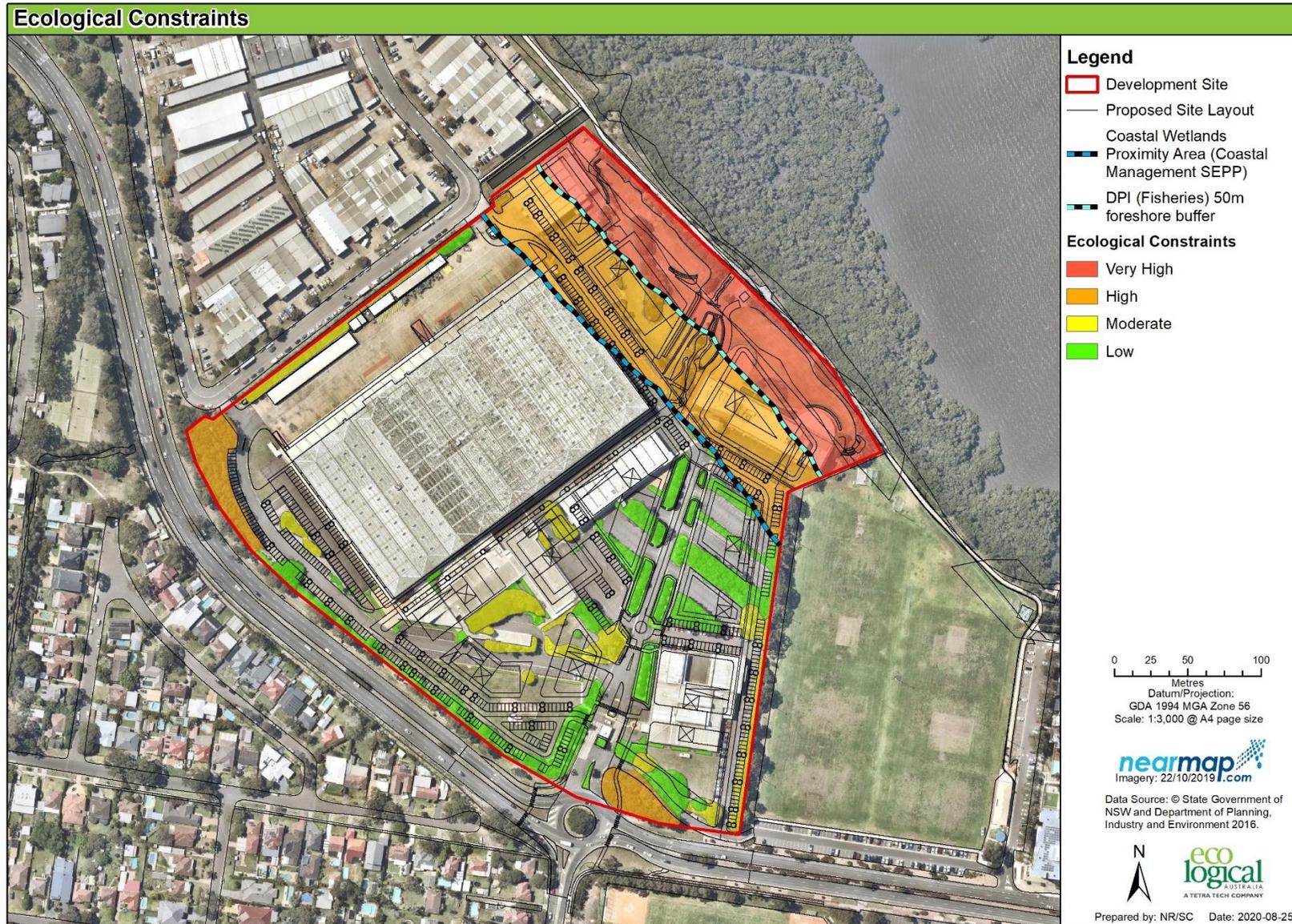


Figure 11: Ecological constraints throughout the subject site with the proposed masterplan overlaid

5. References

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Appendix A Likelihood of occurrence table for threatened and migratory species

| Scientific Name | Common Name | BC Act Status | EPBC Act Status | Distribution / Habitat | Likelihood of occurrence |
|---|-------------------------|---------------|-----------------|---|--------------------------|
| <i>Actitis hypoleucos</i> | Common Sandpiper | | M | Summer migrant. In NSW, widespread along coastline and also occurs in many areas inland. Coastal wetlands and some inland wetlands, especially muddy margins or rocky shores. Also estuaries and deltas, lakes, pools, billabongs, reservoirs, dams and claypans, mangroves. | Unlikely |
| <i>Anthochaera phrygia</i> | Regent Honeyeater | E4A | CE | Inland slopes of south-east Australia, and less frequently in coastal areas. In NSW, most records are from the North-West Plains, North-West and South-West Slopes, Northern Tablelands, Central Tablelands and Southern Tablelands regions; also recorded in the Central Coast and Hunter Valley regions. Eucalypt woodland and open forest, wooded farmland and urban areas with mature eucalypts, and riparian forests of <i>Casuarina cunninghamiana</i> (River Oak). | None |
| <i>Apus pacificus</i> | Fork-tailed Swift | | M | Recorded in all regions of NSW. Riparian woodland., swamps, low scrub, heathland, saltmarsh, grassland, Spinifex sandplains, open farmland and inland and coastal sand-dunes. | Unlikely |
| <i>Arctocephalus forsteri</i> | New Zealand Fur-seal | V | - | Reports of non-breeding animals along southern NSW coast particularly on Montague Island, but also at other isolated locations to north of Sydney. Prefers rocky parts of islands with jumbled terrain and boulders. | None |
| <i>Arctocephalus pusillus doriferus</i> | Australian Fur-seal | V | - | Reported to have bred at Seal Rocks, near Port Stephens and Montague Island in southern NSW. Haul outs are observed at isolated places along the NSW coast. Rocky parts of islands with flat, open terrain. | None |
| <i>Ardea ibis</i> | Cattle Egret | | | Widespread and common across NSW. Grasslands, wooded lands and terrestrial wetlands | Unlikely |
| <i>Ardenna carneipes</i> | Flesh-footed Shearwater | V | M | Recorded in NSW coastal waters. Breeds on Lord Howe Island. Marine. | Unlikely |
| <i>Ardenna grisea</i> | Sooty Shearwater | | M | Breeds on islands off NSW from Montague Island to Broughton Island. Present off eastern NSW mainly October-February. Islands, offshore. | Unlikely |
| <i>Ardenna pacificus</i> | Wedge-tailed Shearwater | | | On eastern coast of Australia, breeds on islands including Montague Island, Lord Howe Island and Norfolk Island. Observed coastal NSW. Islands, offshore. | None |

| Scientific Name | Common Name | BC Act Status | EPBC Act Status | Distribution / Habitat | Likelihood of occurrence |
|--------------------------------|-------------------------|---------------|-----------------|--|--------------------------|
| <i>Ardenna tenuirostris</i> | Short-tailed Shearwater | | M | Breeds on islands north to Broughton Island off NSW. Commonly observed south of coastal northern NSW during summer. Islands, offshore. | None |
| <i>Arenaria interpres</i> | Ruddy Turnstone | | M | Summer migrant to most coastal regions, with occasional records inland, including in NSW. Tidal reefs and pools; pebbly, shelly and sandy shores; mudflats; inland shallow waters; sewage ponds, saltfields; ploughed ground. | Unlikely |
| <i>Balaenoptera musculus</i> | Blue Whale | E1 | E, M | Between 20 degrees to 70 degrees South including NSW waters. Marine. | None |
| <i>Botaurus poiciloptilus</i> | Australasian Bittern | E1 | E | Found over most of NSW except for the far north-west. Permanent freshwater wetlands with tall, dense vegetation, particularly Typha spp. (bullrushes) and Eleocharis spp. (spikerushes). | Unlikely |
| <i>Burhinus grallarius</i> | Bush Stone-curlew | E1 | | In NSW, found sporadically in coastal areas, and west of the divide throughout the sheep-wheat belt. In NSW, it occurs in lowland grassy woodland and open forest. | Unlikely |
| <i>Calamanthus fuliginosus</i> | Striated Fieldwren | E1 | | South-eastern NSW into southern Victoria, south-east SA and Tasmania. Swampy coastal heaths, tussock grasslands and swamp margins. | Unlikely |
| <i>Calidris acuminata</i> | Sharp-tailed Sandpiper | | M | Summer migrant. Widespread in most regions of NSW, especially in coastal areas, but sparse in the south-central Western Plain and east Lower Western Regions. Shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. | Unlikely |
| <i>Calidris alba</i> | Sanderling | V | M | Occur along the NSW coast, with occasional inland sightings. Arrives from September and leaves by May (some may overwinter in Australia). Coastal areas on low beaches of firm sand, near reefs and inlets, along tidal mudflats and lagoons; rarely recorded in near-coastal wetlands. | None |
| <i>Calidris canutus</i> | Red Knot | | E, M | Summer migrant to Australia. In NSW, widespread in suitable habitat along the coast. Occasionally recorded inland in all regions. Intertidal mudflats, sandflats sheltered sandy beaches, estuaries, bays, inlets, lagoons, harbours, sandy ocean beaches, rock platforms, coral reefs, terrestrial saline wetlands near the coast, sewage ponds and saltworks. Rarely inland lakes or swamps. | Unlikely |

| Scientific Name | Common Name | BC Act Status | EPBC Act Status | Distribution / Habitat | Likelihood of occurrence |
|------------------------------|----------------------|---------------|-----------------|---|--------------------------|
| <i>Calidris ferruginea</i> | Curlew Sandpiper | E1 | CE, M | Occurs along the entire coast of NSW, and sometimes in freshwater wetlands in the Murray-Darling Basin. Littoral and estuarine habitats, including intertidal mudflats, non-tidal swamps, lakes and lagoons on the coast and sometimes inland. | Unlikely |
| <i>Calidris melanotos</i> | Pectoral Sandpiper | | M | Summer migrant to Australia. Widespread but scattered in NSW. East of the Great Divide, recorded from Casino and Ballina, south to Ulladulla. West of the Great Divide, widespread in the Riverina and Lower Western regions. Shallow fresh to saline wetlands, including coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. | Unlikely |
| <i>Calidris ruficollis</i> | Red-necked Stint | | M | Summer migrant to Australia, widespread coastal and inland NSW. Tidal mudflats, saltmarshes, sandy and shelly beaches, saline and freshwater wetlands, saltfields, sewage ponds. | Unlikely |
| <i>Calidris subminuta</i> | Long-toed Stint | | M | Summer migrant to Australia. Widely scattered irregular records in NSW: the estuary of the Richmond River, Kooragang Island, Pitts Town Lagoon, McGrath's Hill, Bushell's Lagoon, the Hawkesbury River, Shell Point, Botany Bay, Parkes, Fivebough Swamp, Tullakool Saltworks, Dareton, Mortanally Billabong, Wentworth and Cobar. Coastal and inland shallow wetlands, sewage ponds, tidelines, tidal mudflats. | Unlikely |
| <i>Calidris tenuirostris</i> | Great Knot | V | CE, M | In NSW, recorded at scattered sites along the coast down to about Narooma. It has also been observed inland at Tullakool, Armidale, Gilgandra and Griffith. Intertidal mudflats or sandflats, including inlets, bays, harbours, estuaries and lagoons. | Unlikely |
| <i>Caretta caretta</i> | Loggerhead Turtle | E1 | E, M | In NSW, seen in coastal waters as far south as Jervis Bay and have been recorded nesting on the NSW north coast and feeding around Sydney. Marine. Nesting occurs on beaches. | None |
| <i>Cercartetus nanus</i> | Eastern Pygmy-possum | V | - | In NSW its extent from the coast inland as far as the Pilliga, Dubbo, Parkes and Wagga Wagga on the western slopes. Rainforest, sclerophyll forest (including Box-Ironbark), woodland and heath. | None |
| <i>Chalinolobus dwyeri</i> | Large-eared Pied Bat | V | V | Recorded from Rockhampton in Qld south to Ulladulla in NSW. Largest concentrations of populations occur in the sandstone escarpments of the Sydney basin and the NSW north-west slopes. Wet and dry sclerophyll forests, Cyprus Pine dominated forest, woodland, sub-alpine woodland, edges of rainforests and sandstone outcrop country. | None |

| Scientific Name | Common Name | BC Act Status | EPBC Act Status | Distribution / Habitat | Likelihood of occurrence |
|----------------------------------|----------------------|---------------|-----------------|---|--------------------------|
| <i>Charadrius leschenaultii</i> | Greater Sand-plover | V | V, M | In NSW, recorded between the northern rivers and the Illawarra, with most records coming from the Clarence and Richmond estuaries. Almost entirely restricted to coastal areas in NSW, mainly on sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks. | Unlikely |
| <i>Charadrius mongolus</i> | Lesser Sand-plover | V | E, M | Summer migrant to Australia. Found around the entire coast but in NSW most common on north coast. Rarely recorded south of the Shoalhaven estuary, and there are few inland records. Almost entirely coastal in NSW, using sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats, sandy beaches, coral reefs and rock platforms. | Unlikely |
| <i>Chelonia mydas</i> | Green Turtle | V | V, M | Occurs in coastal waters of NSW, generally on the north or central coast, with occasional records from the south coast. Scattered nesting records along the NSW coast. Marine. Nesting occurs on beaches. | None |
| <i>Circus assimilis</i> | Spotted Harrier | V | - | Found throughout the Australian mainland, except in densely forested or wooded habitats, and rarely in Tasmania. Grassy open woodland, inland riparian woodland, grassland, shrub steppe, agricultural land and edges of inland wetlands. | Unlikely |
| <i>Daphoenositta chrysoptera</i> | Varied Sittella | V | - | Distribution in NSW is nearly continuous from the coast to the far west. Inhabits eucalypt forests and woodlands, mallee and Acacia woodland. | Unlikely |
| <i>Dasyornis brachypterus</i> | Eastern Bristlebird | E1 | E | There are three main populations: Northern - southern Qld/northern NSW, Central - Barren Ground NR, Budderoo NR, Woronora Plateau, Jervis Bay NP, Booderee NP and Beecroft Peninsula and Southern - Nadgee NR and Croajingalong NP in the vicinity of the NSW/Victorian border. Central and southern populations inhabit heath and open woodland with a heathy understorey. In northern NSW, habitat comprises open forest with dense tussocky grass understorey. | None |
| <i>Dasyurus maculatus</i> | Spotted-tailed Quoll | V | E | Found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Qld. Rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. | None |

| Scientific Name | Common Name | BC Status | Act | EPBC Status | Act | Distribution / Habitat | Likelihood of occurrence |
|------------------------------|----------------------|-----------|-----|-------------|-----|---|--------------------------|
| <i>Dermochelys coriacea</i> | Leatherback Turtle | E1 | | E, M | | All coastal waters of Australia. Large numbers feed in coastal waters south to the central coast of NSW. Occasional breeding records from NSW coast, including between Ballina and Lennox Head in northern NSW. Marine. Nesting occurs on beaches. | None |
| <i>Diomedea antipodensis</i> | Antipodean Albatross | V | | V | | Regularly occurs off the NSW south coast from Green Cape to Newcastle during winter. Marine. | None |
| <i>Diomedea exulans</i> | Wandering Albatross | E1 | | V, M | | Has been recorded along the length of the NSW coast. Marine. | None |
| <i>Diomedea gibsoni</i> | Gibson's Albatross | V | | V | | Regularly occurs off the NSW coast usually between Green Cape and Newcastle. Marine. | None |
| <i>Dugong dugon</i> | Dugong | E1 | | M | | Extends south to northern NSW, where its known from incidental records only. Wide shallow protected bays, wide shallow mangrove channels and in the lee of large inshore islands. Will also occupy deeper waters. | No |
| <i>Egretta sacra</i> | Eastern Reef Egret | | | | | Coast and islands of most of Australia, including NSW. Beaches, rocky shores, tidal rivers and inlets, mangroves, and exposed coral reefs. | Unlikely |
| <i>Epthianura albifrons</i> | White-fronted Chat | V | | | | Occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state. Saltmarsh vegetation, open grasslands and sometimes low shrubs bordering wetland areas. | No |
| <i>Esacus magnirostris</i> | Beach Stone-curlew | E4A | | - | | Across northern and north-eastern Australia, south to the Manning River in north-eastern NSW, with occasional vagrants to south-eastern NSW and Victoria. Exclusively along the coast, on beaches, islands, reefs and in estuaries, and edges of or near mangroves. | Unlikely |
| <i>Eubalaena australis</i> | Southern Right Whale | E1 | | E, M | | Migrate between summer feeding grounds in Antarctica and winter breeding grounds around the coasts of southern Australia. Marine. | No |
| <i>Falco subniger</i> | Black Falcon | V | | | | Sparsely distributed in NSW, occurring mostly in inland regions. Woodland, shrubland and grassland, especially riparian woodland and agricultural land. Often associated with streams or wetlands. | Unlikely |

| Scientific Name | Common Name | BC Act Status | EPBC Act Status | Distribution / Habitat | Likelihood of occurrence |
|-------------------------------------|----------------------------|---------------|-----------------|---|--|
| <i>Fregatta grallaria grallaria</i> | White-bellied Storm-Petrel | V | V | Vagrant birds occur in coastal NSW waters, particularly after storm events. Marine. | Unlikely |
| <i>Gallinago hardwickii</i> | Latham's Snipe | | M | Migrant to east coast of Australia, extending inland west of the Great Dividing Range in NSW. Freshwater, saline or brackish wetlands up to 2000 m above sea-level; usually freshwater swamps, flooded grasslands or heathlands. | Unlikely |
| <i>Glossopsitta pusilla</i> | Little Lorikeet | V | - | In NSW, found from the coast westward as far as Dubbo and Albury. Dry, open eucalypt forests and woodlands, including remnant woodland patches and roadside vegetation. | Unlikely |
| <i>Grantiella picta</i> | Painted Honeyeater | V | V | Widely distributed in NSW, predominantly on the inland side of the Great Dividing Range but avoiding arid areas. Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. | None |
| <i>Haematopus fuliginosus</i> | Sooty Oystercatcher | V | - | Distributed along the entire NSW coast. Rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries. | Unlikely |
| <i>Haematopus longirostris</i> | Pied Oystercatcher | E1 | - | Thinly scattered along the entire NSW coast. Intertidal flats of inlets and bays, open beaches and sandbanks. | Unlikely |
| <i>Haliaeetus leucogaster</i> | White-bellied Sea-Eagle | V | - | Distributed along the coastline of mainland Australia and Tasmania, extending inland along some of the larger waterways, especially in eastern Australia. Freshwater swamps, rivers, lakes, reservoirs, billabongs, saltmarsh and sewage ponds and coastal waters. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, forest and urban areas. | Unlikely given no large nests in trees were observed and no large emergent trees present |
| <i>Heleioporus australiacus</i> | Giant Burrowing Frog | V | V | South eastern NSW and Victoria, in two distinct populations: a northern population in the sandstone geology of the Sydney Basin as far south as Ulladulla, and a southern population occurring from north of Narooma through to Walhalla, Victoria. Heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. | None |
| <i>Hirundapus caudacutus</i> | White-throated Needletail | M | - | All coastal regions of NSW, inland to the western slopes and inland plains of the Great Divide. Occur most often over open forest and rainforest, as well as heathland, and remnant vegetation in farmland. | None |

| Scientific Name | Common Name | BC Act Status | EPBC Act Status | Distribution / Habitat | Likelihood of occurrence |
|----------------------------------|------------------------------------|---------------|-----------------|---|--------------------------|
| <i>Hoplocephalus bungaroides</i> | Broad-headed Snake | E1 | V | Largely confined to Triassic and Permian sandstones within the coast and ranges in an area within approximately 250 km of Sydney. Dry and wet sclerophyll forests, riverine forests, coastal heath swamps, rocky outcrops, heaths, grassy woodlands. | None |
| <i>Hydroprogne caspia</i> | Caspian Tern | | M | Widespread in coastal and inland NSW. Coastal offshore waters, beaches, mudflats, estuaries, rivers, lakes. | Unlikely |
| <i>Isoodon obesulus obesulus</i> | Southern Brown Bandicoot (eastern) | E1 | E | Found in south-eastern NSW, east of the Great Dividing Range south from the Hawkesbury River. Heath or open forest with a heathy understorey on sandy or friable soils. | None |
| <i>Ixobrychus flavicollis</i> | Black Bittern | V | - | In NSW, records are scattered along the east coast, with individuals rarely being recorded south of Sydney or inland. Terrestrial and estuarine wetlands. Also flooded grassland, forest, woodland, rainforest and mangroves where permanent water is present. | Unlikely |
| <i>Limicola falcinellus</i> | Broad-billed Sandpiper | V | M | Occur occasionally on the southern Australian coast. In NSW, mainly recorded in Hunter River estuary, with birds occasionally reaching the Shoalhaven estuary. There are few records for inland NSW. Sheltered parts of the coast such as estuarine sandflats and mudflats, harbours, embayments, lagoons, saltmarshes and reefs. | Unlikely |
| <i>Limosa lapponica</i> | Bar-tailed Godwit | | M | Summer migrant to Australia. Widespread along the coast of NSW, including the offshore islands. Also numerous scattered inland records. Intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons, bays, seagrass beds, saltmarsh, sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats. Rarely inland wetlands, paddocks and airstrips. | Unlikely |
| <i>Limosa limosa</i> | Black-tailed Godwit | V | M | Arrives in August and leaves in March. In NSW, most frequently recorded at Kooragang Island, with occasional records elsewhere along the coast, and inland in the Murray-Darling Basin, on the western slopes of the Northern Tablelands and in the far north-western corner of the state. Usually sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. Further inland, it can also be found around muddy lakes and swamps. | None |

| Scientific Name | Common Name | BC Act Status | EPBC Act Status | Distribution / Habitat | Likelihood of occurrence |
|-------------------------------|--|---------------|-----------------|--|---|
| <i>Litoria aurea</i> | Green and Golden Bell Frog | E1 | V | Since 1990, recorded from ~50 scattered sites within its former range in NSW, from the north coast near Brunswick Heads, south along the coast to Victoria. Records exist west to Bathurst, Tumut and the ACT region. Marshes, dams and stream-sides, particularly those containing <i>Typha</i> spp. (bullrushes) or <i>Eleocharis</i> spp. (spikerushes). Some populations occur in highly disturbed areas. | Unlikely |
| <i>Litoria littlejohni</i> | Littlejohn's Tree Frog | V | V | Plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest south to Buchan in Victoria. The species has not been recorded in southern NSW within the last decade. Breeding habitat is the upper reaches of permanent streams and perched swamps. Non-breeding habitat is heath-based forests and woodlands | None |
| <i>Litoria raniformis</i> | Southern Bell Frog | E1 | V | In NSW, only known to exist in isolated populations in the Coleambally Irrigation Area, the Lowbidgee floodplain and around Lake Victoria. A few recent unconfirmed records have also been made in the Murray Irrigation Area. Permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and river valleys. Also found in irrigated rice crops. | None |
| <i>Macronectes giganteus</i> | Southern Giant Petrel | E1 | E, M | Common visitor off the coast of NSW. Marine. | Unlikely |
| <i>Macronectes halli</i> | Northern Giant-Petrel | V | V, M | Common visitor in NSW waters, predominantly along the south-east coast during winter and autumn. Marine. | Unlikely |
| <i>Megaptera novaeangliae</i> | Humpback Whale | V | V, M | Regularly observed in NSW waters in June and July, on northward migration from Subantarctic waters, and in October and November, on southward migration. Marine. | None |
| <i>Menippus darcyi</i> | Menippus darcyi population in the Sutherland Shire | E2 | - | This population of beetles is confined to Grays Point Reserves, Grays Point, Sutherland Shire. Larvae graze on <i>Celtis paniculata</i> , which grow in littoral rainforest. | None |
| <i>Miniopterus australis</i> | Little Bentwing-bat | V | - | East coast and ranges south to Wollongong in NSW. Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. | Potential foraging habitat but roost in caves |

| Scientific Name | Common Name | BC Act Status | EPBC Act Status | Distribution / Habitat | Likelihood of occurrence |
|--|-----------------------|---------------|-----------------|--|--|
| <i>Miniopterus schreibersii oceanensis</i> | Eastern Bentwing-bat | V | - | In NSW it occurs on both sides of the Great Dividing Range, from the coast inland to Moree, Dubbo and Wagga Wagga. Rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland. | Potential foraging habitat but roost in caves |
| <i>Myotis macropus</i> | Southern Myotis | V | - | In NSW, found in the coastal band. It is rarely found more than 100 km inland, except along major rivers. Foraging habitat is waterbodies (including streams, or lakes or reservoirs) and fringing areas of vegetation up to 20m. | Potential foraging and roosting habitat |
| <i>Neophema chrysogaster</i> | Orange-bellied Parrot | E4A | CE | Breeds in Tasmania and migrates in autumn to spend the winter on the mainland coast of south-eastern SA and southern Victoria. Occasional reports from NSW, most recently Shellharbour and Maroubra in May 2003. Winter habitat is mostly within 3 km of the coast in sheltered bays, lagoons, estuaries, coastal dunes and saltmarshes. Also small islands and peninsulas, saltworks, golf courses, low samphire herbland and taller coastal shrubland. | None |
| <i>Ninox strenua</i> | Powerful Owl | V | - | In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains. Woodland, open sclerophyll forest, tall open wet forest and rainforest. | Potential foraging habitat. No hollows for roosting/breeding |
| <i>Numenius madagascariensis</i> | Eastern Curlew | | CE, M | Summer migrant to Australia. Primarily coastal distribution in NSW, with some scattered inland records. Estuaries, bays, harbours, inlets and coastal lagoons, intertidal mudflats or sandflats, ocean beaches, coral reefs, rock platforms, saltmarsh, mangroves, freshwater/brackish lakes, saltworks and sewage farms. | Unlikely |
| <i>Numenius minutus</i> | Little Curlew | | M | Summer migrant to Australia. In NSW, most records scattered east of the Great Dividing Range, from Casino, south to Greenwell Point with a few scattered records west of the Great Dividing Range. Dry grasslands, open woodlands, floodplains, margins of drying swamps, tidal mudflats, airfields, playing fields, crops, saltfields, sewage ponds. | Unlikely |
| <i>Numenius phaeopus</i> | Whimbrel | | M | Summer migrant to Australia. Found along almost the entire coast of NSW; scattered inland records. Estuaries, mangroves, tidal flats, coral cays, exposed reefs, flooded paddocks, sewage ponds, grasslands, sports fields, lawns. | Unlikely |

| Scientific Name | Common Name | BC Act Status | EPBC Act Status | Distribution / Habitat | Likelihood of occurrence |
|-------------------------------|--|---------------|-----------------|---|--------------------------|
| <i>Onychoprion fuscata</i> | Sooty Tern | V | - | In NSW only known to breed at Lord Howe Island. Occasionally seen along coastal NSW, especially after cyclones. Marine. | None |
| <i>Pandion cristatus</i> | Eastern Osprey | V | - | Common around the northern NSW coast, and uncommon to rare from coast further south. Some records from inland areas. Rocky shorelines, islands, reefs, mouths of large rivers, lagoons and lakes. | Unlikely |
| <i>Petauroides volans</i> | Greater Glider population in the Eurobodalla local government area | E2 | V | This population on the south coast of NSW is bounded by the Moruya River to the north, Coila Lake to the south and the Princes Highway and cleared land exceeding 700 m in width to the west. Eucalypt forests and woodlands. | None |
| <i>Petrogale penicillata</i> | Brush-tailed Rock-wallaby | E1 | V | In NSW they occur from the Qld border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges. | None |
| <i>Phascolarctos cinereus</i> | Koala, Hawks Nest and Tea Gardens population | E2,V | V | Known from, and in the immediate vicinity of, the towns of Hawks Nest and Tea Gardens in the Great Lakes Local Government Area. Eucalypt forest and woodland communities, including coastal forests, rainforest, riparian areas, swamp sclerophyll forests, heathland and shrubland. | None |
| <i>Plegadis falcinellus</i> | Glossy Ibis | | M | Recorded over much of NSW. Spring/summer breeding migrant to southern Murray-Darling region and Macquarie Marshes. Edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation. Occasionally estuaries, deltas, saltmarshes and coastal lagoons. | Unlikely |
| <i>Pluvialis fulva</i> | Pacific Golden Plover | | M | Regular widespread summer migrant to Australia, including coastal NSW, Lord Howe and Norfolk Island. Estuaries, mudflats, saltmarshes, mangroves, rocky reefs, inland swamps, ocean shores, paddocks, sewage ponds, ploughed land, airfields, playing fields. | Unlikely |

| Scientific Name | Common Name | BC Act Status | EPBC Act Status | Distribution / Habitat | Likelihood of occurrence |
|---|---|---------------|-----------------|--|---|
| <i>Pluvialis squatarola</i> | Grey Plover | | M | Regular summer migrant to coastal Australia, including NSW. Rarely inland, on passage. Mudflats, saltmarsh, tidal reefs and estuaries. | Unlikely |
| <i>Pseudophryne australis</i> | Red-crowned Toadlet | V | - | Confined to the Sydney Basin, from Pokolbin in the north, the Nowra area to the south, and west to Mt Victoria in the Blue Mountains. Open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings. | None |
| <i>Pterodroma leucoptera leucoptera</i> | Gould's Petrel | V | E | Recorded off NSW coast. Breeds on Cabbage Tree Island offshore from Port Stephens, and on nearby Boondelbah island. Marine. Nesting habitat is located within steeply sloping rock scree gullies with a canopy of Cabbage Tree Palms. | None |
| <i>Pterodroma neglecta neglecta</i> | Kermadec Petrel (west Pacific subspecies) | V | V | Vagrant birds occur in coastal NSW waters, particularly after storm events. Breeds on Balls Pyramid (near Lord Howe Island) and Phillip Island (near Norfolk Island). Marine. | None |
| <i>Pterodroma nigripennis</i> | Black-winged Petrel | V | | Recorded off NSW coast. Breeds on Lord Howe Island. Marine. | None |
| <i>Pteropus poliocephalus</i> | Grey-headed Flying-fox | V | V | Along the eastern coast of Australia, from Bundaberg in Qld to Melbourne in Victoria. Subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. | Potential foraging habitat. No breeding camps within the site |
| <i>Ptilinopus superbus</i> | Superb Fruit-Dove | V | | Principally from north-eastern Qld to north-eastern NSW. Further south, it is confined to pockets of suitable habitat, and occurs as far south as Moruya. Rainforest and closed forests. May also forage in eucalypt or acacia woodland where there are fruit-bearing trees. | Unlikely |
| <i>Rostratula australis</i> | Australian Painted Snipe | E1 | E | In NSW most records are from the Murray-Darling Basin. Other recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys. Swamps, dams and nearby marshy areas. | Unlikely |

| Scientific Name | Common Name | BC Act Status | EPBC Act Status | Distribution / Habitat | Likelihood of occurrence |
|--|-------------------------|---------------|-----------------|--|--------------------------|
| <i>Scoteanax rueppellii</i> | Greater Broad-nosed Bat | V | - | Both sides of the great divide, from the Atherton Tableland in Qld to north-eastern Victoria, mainly along river systems and gullies. In NSW it is widespread on the New England Tablelands. Woodland, moist and dry eucalypt forest and rainforest. | Unlikely |
| <i>Sterna hirundo</i> | Common Tern | | M | Regular summer migrant to northern and eastern coastal Australia, including coastal NSW. Also scattered inland records. Offshore waters, ocean beaches, estuaries, large lakes. Less commonly freshwater swamps, floodwaters, sewage farms and brackish and saline lakes. | Unlikely |
| <i>Sternula albifrons</i> | Little Tern | E1 | M | In NSW, it arrives from September to November, occurring mainly north of Sydney, with smaller numbers found south to Victoria. Sheltered coastal environments, harbours, inlets and rivers. | Unlikely |
| <i>Synemon plana</i> | Golden Sun Moth | E1 | CE | NSW populations are found in the area between Queanbeyan, Gunning, Young and Tumut. Natural Temperate Grasslands and grassy Box-Gum Woodlands in which groundlayer is dominated by <i>Austrodanthonia</i> spp. (wallaby grasses). | None |
| <i>Thalassarche cauta</i> | Shy Albatross | V | V | Occurs along the east coast south from Stradbroke Island and across the south coast to Carnarvon in WA. It is commonly recorded off southeast NSW, though rarely north of Sydney. Marine. | None |
| <i>Thalassarche cauta cauta</i> | Shy Albatross | V | V | Occurs along the east coast south from Stradbroke Island and across the south coast to Carnarvon in WA. It is commonly recorded off southeast NSW, though rarely north of Sydney. Marine. | None |
| <i>Thalassarche melanophris</i> | Black-browed Albatross | V | V | Regularly recorded off the NSW coast during May-November. Marine. | None |
| <i>Thinornis rubricollis rubricollis</i> | Hooded Plover | E4A | V | Occurs in coastal NSW north to Sussex Inlet. Occasional records from the Shoalhaven River, Comerong Beach and Lake Illawarra. Sandy ocean beaches, tidal bays and estuaries, rock platforms, rocky or sand-covered reefs, and small beaches in lines of cliffs. Also use near-coastal saline and freshwater lakes and lagoons. | None |

| Scientific Name | Common Name | BC Act Status | EPBC Act Status | Distribution / Habitat | Likelihood of occurrence |
|-----------------------------|---------------------|---------------|-----------------|---|--------------------------|
| <i>Tringa brevipes</i> | Grey-tailed Tattler | | M | Summer migrant to Australia. In NSW, distributed along most of the coast from the Qld border, south to Tilba Lake. More heavily distributed along coastal regions north of Sydney. Sheltered coasts with reefs and rock platforms or intertidal mudflats; intertidal rocky, coral or stony reefs; shores of rock, shingle, gravel or shells; embayments, estuaries and coastal lagoons; lagoons and lakes; and ponds in sewage farms and saltworks. | Unlikely |
| <i>Tringa nebularia</i> | Common Greenshank | | M | Summer migrant to Australia. Recorded in most coastal regions of NSW; also widespread west of the Great Dividing Range, especially between the Lachlan and Murray Rivers and the Darling River drainage basin, including the Macquarie Marshes, and north-west regions. Terrestrial wetlands (swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans, saltflats, sewage farms and saltworks dams, inundated rice crops and bores) and sheltered coastal habitats (mudflats, saltmarsh, mangroves, embayments, harbours, river estuaries, deltas, lagoons, tidal pools, rock-flats and rock platforms). | Unlikely |
| <i>Tyto novaehollandiae</i> | Masked Owl | V | - | Recorded over approximately 90% of NSW, excluding the most arid north-western corner. Most abundant on the coast but extends to the western plains. Dry eucalypt forests and woodlands from sea level to 1100 m. | Unlikely |
| <i>Varanus rosenbergi</i> | Rosenberg's Goanna | V | - | In NSW, found on the Sydney Sandstone in Wollemi National Park, in the Goulburn and ACT regions and near Cooma in the south. Also recorded from the South West Slopes near Khancoban and Tooma River. Heath, open forest and woodland. | None |
| <i>Xenus cinereus</i> | Terek Sandpiper | V | M | A rare migrant to the eastern and southern Australian coasts. The two main sites in NSW are the Richmond River estuary and the Hunter River estuary. Mudbanks and sandbanks near mangroves, rocky pools and reefs, and occasionally up to 10 km inland around brackish pools. | Unlikely |
| <i>Acacia bynoeana</i> | Bynoe's Wattle | E1 | V | Found in central eastern NSW, from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains. Heath or dry sclerophyll forest on sandy soils. | None |
| <i>Acacia pubescens</i> | Downy Wattle | V | V | Restricted to the Sydney region around the Bankstown-Fairfield-Rookwood and Pitt Town area, with outliers occurring at Barden Ridge, Oakdale and Mountain Lagoon. Open woodland and forest, including Cooks River/Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland. Occurs on alluviums, shales and at the intergrade between shales and sandstones. | None |

| Scientific Name | Common Name | BC Status | Act | EPBC Status | Act | Distribution / Habitat | Likelihood of occurrence |
|---|--------------------------|-----------|-----|-------------|-----|--|--------------------------|
| <i>Acacia terminalis</i> subsp. <i>terminalis</i> | Sunshine Wattle | E1 | | E | | Limited mainly to near-coastal areas from the northern shores of Sydney Harbour south to Botany Bay. Coastal scrub and dry sclerophyll woodland on sandy soils. | None |
| <i>Allocasuarina glareicola</i> | | E1 | | E | | Primarily restricted to the Richmond (NW Cumberland Plain) district, but with an outlier population found at Voyager Point, Liverpool. Castlereagh woodland on lateritic soil. Found in open woodland with <i>Eucalyptus parramattensis</i> , <i>Eucalyptus fibrosa</i> , <i>Angophora bakeri</i> , <i>Eucalyptus sclerophylla</i> and <i>Melaleuca decora</i> . | None |
| <i>Caladenia tessellata</i> | Thick Lip Spider Orchid | E1 | | V | | Currently known from two disjunct areas; one population near Braidwood on the Southern Tablelands and three populations in the Wyong area on the Central Coast. Grassy sclerophyll woodland on clay loam or sandy soils, or low woodland with stony soil. | None |
| <i>Callistemon linearifolius</i> | Netted Bottle Brush | V | | - | | Georges River to Hawkesbury River in the Sydney area (limited to the Hornsby Plateau area), and north to the Nelson Bay area of NSW. Also Coalcliff in the northern Illawarra. Dry sclerophyll forest. | None |
| <i>Chamaesyce psammogeton</i> | Sand Spurge | E1 | | | | Sparsely along the coast from south of Jervis Bay (at Currarong, Culburra and Seven Mile Beach National Park) to Qld (and Lord Howe Island). Fore-dunes, pebbly strandlines and exposed headlands, often with <i>Spinifex sericeus</i> (Spinifex) and <i>Zoysia macrantha</i> (Prickly Couch). | None |
| <i>Cryptostylis hunteriana</i> | Leafless Tongue Orchid | V | | V | | In NSW, recorded mainly on coastal and near coastal ranges north from Victoria to near Forster, with two isolated occurrences inland north-west of Grafton. Coastal heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodland, and lowland forest. | None |
| <i>Cynanchum elegans</i> | White-flowered Wax Plant | E1 | | E | | Restricted to eastern NSW, from Brunswick Heads on the north coast to Gerroa in the Illawarra region, and as far west as Merriwa in the upper Hunter River valley. Dry rainforest; littoral rainforest; <i>Leptospermum laevigatum</i> - <i>Banksia integrifolia</i> subsp. <i>integrifolia</i> (Coastal Tea-tree–Coastal Banksia) coastal scrub; <i>Eucalyptus tereticornis</i> (Forest Red Gum) or <i>Corymbia maculata</i> (Spotted Gum) open forest and woodland; and <i>Melaleuca armillaris</i> (Bracelet Honey Myrtle) scrub. | None |
| <i>Eucalyptus scoparia</i> | Wallangarra White Gum | E1 | | V | | In NSW it is known from only three locations near Tenterfield. Open eucalypt forest, woodland and heaths on well-drained granite/rhyolite hilltops, slopes and rocky outcrops, typically at high altitudes. | None |

| Scientific Name | Common Name | BC Act Status | EPBC Act Status | Distribution / Habitat | Likelihood of occurrence |
|--|----------------------|---------------|-----------------|--|--------------------------|
| <i>Genoplesium baueri</i> | Bauer's Midge Orchid | E1 | E | Has been recorded from locations between Nowra and Pittwater and may occur as far north as Port Stephens. Dry sclerophyll forest and moss gardens over sandstone. | None |
| <i>Hibbertia puberula</i> | | E1 | | Wollemi National Park south to Morton National Park and the south coast near Nowra. Low heath, dry sclerophyll woodland, upland swamps, on sandy soils or clay. | None |
| <i>Maundia triglochinosides</i> | | V | | Coastal NSW north from Wyong and extending into southern Qld. Swamps, lagoons, dams, channels, creeks or shallow freshwater 30 - 60 cm deep on heavy clay. | None |
| <i>Melaleuca biconvexa</i> | Biconvex Paperbark | V | V | Only found in NSW, populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north. Damp places, often near streams or low-lying areas on alluvial soils. | None |
| <i>Persicaria elatior</i> | Tall Knotweed | V | V | In south-eastern NSW recorded from Mt Dromedary, Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. In northern NSW known from Raymond Terrace (near Newcastle) and the Grafton area (Cherry Tree and Gibberagee State Forests). Beside streams and lakes, swamp forest or disturbed areas. | None |
| <i>Persoonia hirsuta</i> | Hairy Geebung | E1 | E | Scattered distribution around Sydney, from Singleton in the north, along the east coast to Bargo in the south and the Blue Mountains to the west. Sandy soils in dry sclerophyll open forest, woodland and heath on sandstone. | None |
| <i>Persoonia nutans</i> | Nodding Geebung | E1 | E | Restricted to the Cumberland Plain in western Sydney, between Richmond in the north and Macquarie Fields in the south. Northern populations: sclerophyll forest and woodland (Agnes Banks Woodland, Castlereagh Scribbly Gum Woodland and Cooks River / Castlereagh Ironbark Forest) on aeolian and alluvial sediments. Southern populations: tertiary alluvium, shale sandstone transition communities and Cooks River / Castlereagh Ironbark Forest. | None |
| <i>Pimelea curviflora</i> <i>curviflora</i> | - var. | V | V | Confined to the coastal area of the Sydney and Illawarra regions between northern Sydney and Maroota in the north-west and Croom Reserve near Albion Park in the south. Woodland, mostly on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes. | None |

| Scientific Name | Common Name | BC Act Status | EPBC Act Status | Distribution / Habitat | Likelihood of occurrence |
|--------------------------------|-------------------------|---------------|-----------------|--|---------------------------------|
| <i>Prostanthera densa</i> | Villous Mint-bush | V | V | Currarong area in Jervis Bay, Royal National Park, Cronulla, Garie Beach and Port Stephens (Gan Gan Hill, Nelson Bay). Sclerophyll forest and shrubland on coastal headlands and near-coastal ranges, chiefly on sandstone. | None |
| <i>Pterostylis saxicola</i> | Sydney Plains Greenhood | E1 | E | Restricted to western Sydney between Freemans Reach in the north and Picton in the south. Small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines, adjacent to sclerophyll forest or woodland on shale/sandstone transition soils or shale soils. | None |
| <i>Senecio spathulatus</i> | Coast Groundsel | E1 | - | Nadgee Nature Reserve (Cape Howe) and between Kurnell in Sydney and Myall Lakes National Park (with a possible occurrence at Cudmirrah). Scattered populations in Victoria from Wilsons Promontory to the NSW border. Frontal dunes in coastal areas. | None |
| <i>Syzygium paniculatum</i> | Magenta Lilly Pilly | E1 | V | Only in NSW, in a narrow, linear coastal strip from Upper Lansdowne to Conjola State Forest. Subtropical and littoral rainforest on gravels, sands, silts and clays. | Recorded as planted individuals |
| <i>Thelymitra kangaloonica</i> | Kangaloon Sun Orchid | E4A | CE | Only known to occur on the southern tablelands of NSW in the Moss Vale / Kangaloon / Fitzroy Falls area at 550-700 m above sea level. Swamps in sedgeland over grey silty grey loam soils. | None |
| <i>Thesium australe</i> | Austral Toadflax | V | V | In eastern NSW it is found in very small populations scattered along the coast, and from the Northern to Southern Tablelands. Grassland on coastal headlands or grassland and grassy woodland away from the coast. | None |

Appendix B Photos



Figure 12: PCT 1232 within the study site



Figure 13: PCT 1234 within the study site



Figure 14: PCT 1832 within the study site



Figure 15: *Corymbia citriodora* (Lemon-scented Gum) commonly occurs within the Urban Exotic vegetation zone and is not native to NSW