Ecological Constraints Assessment

Glenorie Village

GLN Planning Consulting Strategy

8 October 2024

Final

(02) 9868 1933 | PO Box 2474 Carlingford Court NSW 2118 | cumberlandecology.com.au

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The preparation of this report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or commendations contained within the report are based only on the aforementioned circumstances. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Cumberland Ecology.

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Approved by:	Mikael Peck
Position:	Principal Ecologist
Signed:	
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Glossary

Abbreviation	Definition
BAM	Biodiversity Assessment Method
BC Act	NSW *Biodiversity Conservation Act 2016*
BDAR	Biodiversity Development Assessment Report
BOS	Biodiversity Offset Scheme
BV Map	Biodiversity Values Map
CEEC	Critically Endangered Ecological Community
DA	Development Application
DCCEEW (Cwlth)	Commonwealth Department of Climate Change, Energy, the Environment and Water
DCCEEW (NSW)	NSW Department of Climate Change, Energy, the Environment and Water
DCP	Development Control Plan
ECA	Ecological Constraints Assessment
EEC	Endangered Ecological Community
EP&A Act	NSW *Environmental Planning & Assessment Act 1979*
EPBC Act	Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*
FM Act	NSW *Fisheries Management Act 1994*
GIS	Geographic Information Systems
ha	Hectare
LEP	Local Environment Plan
LGA	Local Government Area
mm	Millimetre
MNES	Matters of National Environmental Significance
NSW	New South Wales
NSW – Water	New South Wales Department of Climate Change, Energy, the Environment and Water
PCT	Plant Community Type
SAII	Serious And Irreversible Impacts
SEPP	State Environmental Planning Policy
Study Area	Glenorie Village and surrounds as identified in **Figure 1.**
Subject Land	Land within the Study Area that is within the Hornsby LGA as identified in **Figure 1**.
SVTM	State Vegetation Type Map
TEC	Threatened Ecological Community
WM Act	NSW *Water Management Act 2000*

1. Introduction

1.1. Background

Cumberland Ecology has been commissioned by GLN Planning Consulting Strategy on behalf of Hornsby Shire Council (the 'client') to provide an Ecological Constraints Assessment (ECA) for land surrounding Glenorie Village, Glenorie New South Wales (NSW). The land subject to this ECA comprises lands that are within both the Hills Shire Local Government Area (LGA) and the Hornsby Shire LGA (hereafter referred to collectively as the 'Study Area' (also referred to as the 'Approximate Indicative Broader Investigation Area') - see **Figure 1**). However, the primary focus of this ECA is for lands within the Study Area that are within the Hornsby LGA (hereafter referred to as the 'Subject Land', see **Figure 1**).

1.2. Purpose

The purpose of this ECA is to inform the client on the biodiversity values present within the Subject Land (and to a lesser extent the Study Area) to assist with identifying suitable areas that can be rezoned and developed in the future under separate development applications to facilitate housing diversity within the Subject Land in the form of E4 Environmental Living allotments of 5,000 – 10,000 m^2. Biodiversity values of particular relevance include threatened species and communities that are listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) and/or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The specific objectives of this report are to:

- Describe the biodiversity values of the Study Area with a particular focus on the Subject Land, including vegetation communities, flora species and fauna habitat;
- Identify potential impacts associated with future development of the Subject Land that future rezoning may facilitate;
- Summarise the ecological constraints associated with the Subject Land (and to a lesser extent the Study Area), including presence and extent of areas mapped under the Biodiversity Values Map (BV Map), Threatened Ecological Communities (TECs), and any Serious and Irreversible Impact (SAII) entities;
- Identify potential avoidance and mitigation measures for any future development; and
- Detail future ecological assessment requirements, including potential to trigger an offset liability under the Biodiversity Offsets Scheme (BOS) of the BC Act.

While this ECA is not sufficient to satisfy the legislative and statutory requirements of the Commonwealth EPBC Act, *Environmental Planning and Assessment Act 1979* (EP&A Act), BC Act and/or other relevant legislation (refer ***Section 1.3***), it nonetheless provides discussion of the legislative requirements for the future development of the Subject Land and identification of the likely assessment pathways under both Commonwealth and NSW legislation.

1.3. Relevant Legislation

1.3.1. Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Commonwealth Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places – defined in the EPBC Act as Matters of National Environmental Significance (MNES). Under the EPBC Act, any action (which includes a development, project or activity) that is considered likely to have a significant impact on MNES (including nationally listed threatened ecological communities and species and listed migratory species) must be referred to the Australian Government Minister for the Environment. The purpose of the referral is to allow a decision to be made about whether an action requires approval on a Commonwealth level. If an action is declared a "controlled action", then Commonwealth approval is required.

1.3.2. NSW Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is the overarching planning legislation in NSW. This Act provides for the creation of planning instruments that guide land use. The EP&A Act also provides for the protection of the environment, including the protection and conservation of native animals and plants. This includes threatened species, communities, habitat and processes as listed under the BC Act and *Fisheries Management Act 1994* (FM Act).

1.3.3. NSW Biodiversity Conservation Act 2016

The BC Act is the key piece of legislation in NSW relating to the protection and management of biodiversity and threatened species. The purpose of the BC Act is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development. The BC Act is supported by a number of regulations, including the *Biodiversity Conservation Regulation 2017*.

The BC Act requires consideration of whether a development or an activity is likely to significantly affect threatened species. For Part 4 local developments under the EP&A Act, projects that significantly affect threatened species or communities trigger the BOS. The BOS is intended to simplify biodiversity assessment and improve biodiversity outcomes by creating consistent assessment requirements to measure the likely biodiversity loss of development proposals and gains in biodiversity value achieved at offset sites through active management. Projects that trigger the BOS require an assessment following the Biodiversity Assessment Methodology (BAM) by an accredited BAM assessor and the preparation of a Biodiversity Development Assessment Report (BDAR). A discussion of BOS triggers and assessments that may be required in accordance with the BAM is provided in ***Section 4.3***.

1.3.4. Water Management Act 2000

The *Water Management Act 2000* (WM Act) is, together with the *Water Act 1912*, the key piece of legislation for the management of water in NSW. The objectives of the WM Act are to provide for the sustainable and integrated management of the water sources of the State, and the Act itself is based on the concept of ecologically sustainable development.

Controlled activities on waterfront land in NSW are regulated by the WM Act and require a controlled activity approval. Waterfront land is defined as the bed of any river, lake or estuary and includes any land within 40 m of the riverbanks, lake shore or estuary.

1.3.5. Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) protects threatened fish species and marine vegetation and identifies associated threatening processes and is administered by the NSW Department of Primary Industries (Fisheries).

The FM Act has the objective to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations. In particular, this Act includes measures to conserve fish stocks and key fish habitats, to conserve threatened species, populations and ecological communities of fish and marine vegetation, and to promote ecologically sustainable development, including the conservation of biological diversity.

Assessments under the FM Act are required to assess potential impacts to areas mapped as Key Fish Habitat and/or indicative distributions of threatened freshwater species.

2. Methodology

2.1. Desktop Assessment

2.1.1. Literature Review

A review of relevant ecological literature was undertaken as part of this ECA to evaluate the flora and fauna values associated with the Subject Land and Study Area. The information collected during the literature review guided the field surveys undertaken within the Subject Land for this ECA. Information within the literature reviewed was also utilised in determining the likelihood of threatened species occurring within the Subject Land and Study Area.

2.1.2. Database Analysis

Database analysis was conducted for the locality of Glenorie Village using the BioNet Atlas (DCCEEW (NSW) 2024b). The locality is defined as the area within a 10 km buffer from the boundary of Glenorie Village. The BioNet Atlas search facility was used to generate records of threatened flora and fauna species and populations listed under the BC Act and/or EPBC Act within the locality. The abundance, distribution and age of records generated within the search areas provided supplementary information for the assessment of occurrence of those threatened species within the Subject Land and Study Area.

The following databases and map tools were also interrogated:

- BioNet Vegetation Classification database (DCCEEW (NSW) 2024c);
- Threatened Biodiversity Data Collection (TBDC) (DCCEEW (NSW) 2024d);
- NSW Biodiversity Values Map (DCCEEW (NSW) 2024a);
- ePlanning Spatial Viewer – Land Zoning Maps (DPHI 2024);
- Hornsby Local Environment Plan (LEP) 2013 (Hornsby Shire Council 2013);
- The Hills LEP 2019 (The Hills Shire Council 2019);
- Hydrological datasets (DPIE 2021); and
- Fisheries NSW Spatial Data Portal (DPI 2024).

The information collected during the database analysis provided additional information on the ecological constraints associated with the Subject Land and Study Area.

2.1.3. Vegetation Mapping

Mapping layers from the NSW State Vegetation Type Map (SVTM) (DCCEEW (NSW) 2022) which covers the Study Area and wider locality were reviewed to determine the potential vegetation communities within the Subject Land and Study Area, including those that align to TECs listed under the BC Act and/or EPBC Act.

2.2. Field Surveys

2.2.1. Flora

A flora survey was conducted over three days by a botanist and ecologist from Cumberland Ecology on 24, 25 and 31 July 2024. The survey methods are described further below and survey locations are shown on **Figure 2**.

2.2.1.1. Vegetation Mapping

The vegetation within the Subject Land was ground-truthed to examine and verify the mapping of the condition and extent of the different vegetation communities present. Mapping of vegetation communities within the Subject Land was undertaken by traversing each patch of publicly accessible vegetation, or from a distance for any areas on private land that were inaccessible. A total of 16 rapid-point assessments were undertaken at various locations throughout the Subject Land where the dominant canopy, midstorey and groundcover species were recorded. The locations of the rapid-point assessments are shown on **Figure 2** and the species recorded at each point are provided in **Appendix A**. Where possible, key characteristics of areas in similar broad condition states were noted including areas with a similar tree cover, shrub cover, ground cover, weediness or a combination of these.

Records of vegetation community boundaries were made using ArcGIS Field Maps on a tablet pre-loaded with aerial photographs and SVTM broad-scale mapping (DCCEEW (NSW) 2022). Following the completion of the surveys, the resultant information was synthesised using Geographical Information Systems (GIS) to create a spatial database that was used to interpret and interpolate the data to produce a ground-truthed vegetation map of the Subject Land. Vegetation mapping of areas within the Hills LGA of the Study Area utilised SVTM broad-scale mapping only and were not subject to detailed surveys as part of this ECA. Vegetation communities recorded within the Subject Land were aligned with Plant Community Types (PCTs) as defined in the BioNet Vegetation Classification database (DCCEEW (NSW) 2024c). Photographs were taken of the vegetation present to provide a visual documentation of types and condition of PCTs occurring within the Subject Land.

2.2.1.2. BAM floristic plots

A total of four BAM floristic plots were completed within accessible vegetation of the Subject Land following the methodology outlined in the BAM. Their locations are shown in **Figure 2**. Each floristic plot included the establishment of a 20 m x 50 m plot within which data was collected to assess the vegetation integrity and habitat suitability of each vegetation zone surveyed, as well as assign to best-fit PCTs.

BAM plots include collection of the following data:

- Composition for each growth form group by counting the number of native plant species recorded for each growth form group within a 20 m x 20 m plot;
- Structure of each growth form group as the sum of all the individual projected foliage cover estimates of all native plant species recorded within each growth form group within a 20 m x 20m plot;
- Cover of High Threat Exotic weed species within a 20 m x 20 m plot;

- Assessment of function attributes within a 20 m x 50 m plot, including:
    - Count of number of large trees;
    - Tree stem size classes, measured as 'diameter at breast height over bark' (DBH);
    - Regeneration based on the presence of living trees with stems <5cm DBH; and
    - The total length in metres of fallen logs over 10 cm in diameter.
- Assessment of litter cover within five 1 m x 1 m plots evenly spread within the 20 m x 50 m plot; and
- Number of trees with hollows that are visible from the ground within the 20 m x 50 m plot.

It should be noted that additional BAM plots will be required in the future to inform future assessments and the BAM plots completed to date were undertaken only to inform this ECA. Flora species recorded within each BAM floristic plot are provided in **Appendix A.**

2.2.2. Habitat Assessment

A fauna habitat assessment was conducted by an ecologist concurrently during the vegetation surveys. The habitat assessment had a particular focus on the presence/absence of tree hollows as well as other habitat features such as bush rock, fallen trees and signs of fauna use such as scats, scratches and scrapings within separate areas. The nature and extent of fauna habitats in the Subject Land were assessed and areas where fauna species could reside, or forage were identified. This included consideration of important indicators of habitat condition and complexity including the occurrence of microhabitats such as tree hollows, fallen logs, bush rock and wetland areas such as dams, creeks and soaks.

During this habitat assessment any fauna seen or heard or otherwise determined to be present from signs of fauna use were recorded (see **Appendix B** for incidental fauna list).

2.3. Limitations

The results, conclusions and recommendations made within this ECA are preliminary only as a significant area of the Subject Land is within privately owned properties that could not be accessed or surveyed. As such, the mapping, conclusions and recommendations made within this ECA are preliminary only, and additional surveys are required to further refine vegetation and constraints mapping, as well as the conclusions and recommendations made within this ECA. In particular, assessment of TECs against condition thresholds for EPBC listings will require further analysis with floristic plots. Nevertheless, this ECA is considered to provide sufficient information to guide preliminary planning of the Subject Land for the purposes of rezoning and/or future development.

3. Results

3.1. Vegetation Communities

The majority of the Subject Land has been subject to a detailed mapping survey by Cumberland Ecology for the purpose of this ECA. The extent of native vegetation communities within the Hills LGA areas of the Study Area (i.e. areas outside the Subject Land) utilised SVTM broad-scale mapping (DCCEEW (NSW) 2022). This chapter focuses on the survey results for the Subject Land, but also presents the SVTM broad-scale mapping for areas of the Study Area that are outside of the Subject Land (i.e. the Hills Shire LGA areas - refer to ***Section 3.6***).

Naturally occurring remnant/regrowth vegetation recorded within the Subject Land was assigned to the best-fit NSW PCTs and condition class, and where relevant, TECs listed under the BC Act and/or EPBC Act. Planted Native Vegetation inconsistent with a naturally occurring PCT was also mapped, but not assigned to a best-fit PCT, consistent with the BAM. Areas of exotic vegetation were also recorded, but have not been mapped as such areas pose little to no constraint on future development. PCTs and Planted Native Vegetation recorded within the Subject Land are described in the subsections below and shown on **Figure 4**. SVTM broad-scale mapping of areas of the Study Area located outside of the Subject Land (i.e. Hills LGA areas within the Study Area) is also shown on **Figure 4.**

PCTs, Planted Native Vegetation and listing status under the BC Act/EPBC Act mapped within the Subject Land are provided in **Table 1**. No detailed descriptions of vegetation communities mapped outside of the Subject Land are provided as these area rely entirely on available broad-scale mapping. Instead, only TECs associated with broad-scale mapped PCTs within areas located outside of the Subject Land are provided in **Table 2**, within ***Section 3.6*.**

Table 1 PCTs, condition class, listing status under the BC and/or EPBC Act, and area of extent within the Subject Land

PCT	PCT Name	Condition Class	BC Act Status	EPBC Act Status	Subject Land Total Area (ha)
3136	Blue Gum High Forest	Canopy only	CEEC	-	0.95
3136	Blue Gum High Forest	Regrowth and weeds	-	-	0.16
3136	Blue Gum High Forest	Some native understorey	CEEC	-*	1.71
3262	Sydney Turpentine Ironbark Forest	Canopy only	CEEC	-	2.94
3262	Sydney Turpentine Ironbark Forest	Intact	CEEC	CEEC**	1.89
3262	Sydney Turpentine Ironbark Forest	Some native understorey	CEEC	-	1.79
3262	Sydney Turpentine Ironbark Forest	Weedy understorey	CEEC	-	0.17
3176	Sydney Enriched Sandstone Moist Forest	Intact	-	-	1.50

PCT	PCT Name	Condition Class	BC Act Status	EPBC Act Status	Subject Land Total Area (ha)
3586	Northern Sydney Scribbly Gum Woodland	Intact	-	-	0.36
3593	Sydney Coastal Sandstone Bloodwood Shrub Forest	Some native understorey	-	-	3.01
3593	Sydney Coastal Sandstone Bloodwood Shrub Forest	Intact	-	-	11.11
3593	Sydney Coastal Sandstone Bloodwood Shrub Forest	Canopy Only	-	-	0.06
3621	Sydney Hinterland Turpentine-Apple Gully Forest	Some native understorey	-	-	0.85
3621	Sydney Hinterland Turpentine-Apple Gully Forest	Intact	-	-	5.79
0	-	Planted Native Vegetation	-	-	1.53
Total					**33.82**

CEEC=Critically Endangered Ecological Community

**Some areas may meet EPBC Act listing. Further surveys required to confirm.*

***Only one patch in the north of the Subject Land is considered to meet EPBC Act criteria.*

3.2. Plant Community Types within the Subject Land

3.2.1. PCT 3136 Blue Gum High Forest

Vegetation Formation: Wet Sclerophyll Forests (Shrubby sub-formation)

Vegetation Class: North Coast Wet Sclerophyll Forests

Percentage cleared: 99.00

Within the Subject Land PCT 3136 occurs on gently sloped ridges comprising Wianamatta Shale in the east of the Subject Land, which have mostly been cleared for agriculture. Remnants comprise mostly small fragments, which have a sparse understorey due to vegetation maintenance, with all remnants persisting within highly maintained rural properties.

The PCT within the Subject Land is generally dominated by *Eucalyptus saligna* (Blue Gum High Forest) and *Syncarpia glomulifera* (Turpentine), with other species present including *Angophora costata* (Smooth-barked Apple), *Eucalyptus paniculata* (Grey Ironbark), *Eucalyptus globoidea* (White Stringybark) and *Eucalyptus resinifera* subsp. *resinifera* (Red Mahogany). Other native species present include *Pittosporum undulatum* (Sweet Pittosporum) and *Acacia parramattensis* (Sydney Green Wattle) in the sub-canopy and shrub layer, and the grass *Microlaena stipoides* var. *stipoides* (Weeping Grass) in the ground layer.

The PCT occurs as three condition zones within the Subject Land, which are described below.

3.2.1.1. PCT 3136 Some Native Understorey

This condition occurs mostly as the larger remaining patches within the Subject Land, and occur within rural properties where vegetation management of native vegetation has been less intensive allowing native understorey species to persist, often as scattered shrubs near the base of trees. Native grass and forb species persist in the ground layer, though the layer is not species rich due to management such as intermittent mowing. Some of the smaller patches that retain native species in the understorey are heavily dominated by exotic shrub species in the lower layers, so native understorey species consist of scattered shade tolerant species such as *Pittosporum undulatum*. Several patches of this condition persist in roadside remnants where maintenance is less intensive than the rural properties they occur adjacent to. An example of this condition is shown in **Photograph 1**.

Photograph 1 PCT 3136 – Some native understorey condition

3.2.1.2. PCT 3136 Regrowth and Weeds

This condition along the property borders and nature strips of two properties in the south of Harrisons Lane, where due to a lack of maintenance a screen of shrubby regrowth has grown along both sides of the road – on one of the properties the regrowth appears to have been maintained as a privacy screen, while the other property it appears to be a less managed strip of regrowth outside the border fence in an area where mowing appears to have ceased. The areas are highly dominated by exotic species, predominately *Ligustrum sinense* (Small-leaved Privet), though there are frequent occurrences of the sub-canopy species *Acacia parramattensis* and *Pittosporum undulatum*. Both species are associated with 3136 and due to these areas occurring on deep shale, these regrowth patches were assigned to PCT 3136. An example of this condition is shown in **Photograph 2**.

Photograph 2 PCT 3136 – Regrowth and weeds condition

3.2.1.3. PCT 3136 Canopy Only

This condition occurs as scattered remnants of canopy trees only within rural properties. They occur either as emergents over highly weedy patches of vegetation completely dominated by exotic species such *Ligustrum sinense,* or as sole trees within paddocks dominated almost exclusively by exotic grass species. An example of this condition is shown in **Photograph 3**.

Photograph 3 PCT 3136 - Canopy only condition

3.2.1.4. Justification of PCT Selection

PCT 3136 was selected due to comprising areas of tree and understorey species associated with the Blue Gum High Forest TEC and associated PCT 3136, and occurring on deep shales, on broad, rolling ridgetops of gentle to flat topography.

Alignment with Threatened Ecological Communities

PCT 3136 aligns with the TEC Blue Gum High Forest in the Sydney Basin Bioregion listed as Critically Endangered under the BC Act. It is also listed as Critically Endangered under the EPBC Act. Only the 'some native understorey' and 'canopy only' conditions conform to the BC Act Listed community, as the final determination (NSW Scientific Committee 2011) states the community can persist as highly modified relics comprising small clumps of remnant canopy trees without a native understorey.

The EPBC Act Listing Advice (DCCEEW (Cwlth) 2005b) states the following regarding condition of remnants that meet the condition criteria:

Remnants of the Blue Gum High Forest of the Sydney Basin Bioregion ecological community will typically have components representing the characteristic native species of all structural layers. The ecological community includes occurrences of the Blue Gum High Forest of the Sydney Basin Bioregion ecological community with a canopy cover greater than 10% and a size greater than one ha. These areas have the greatest conservation value. The high quality and size of these patches makes them most resilient to disturbance. Their total area covers approximately 136 ha.

Additionally, occurrences with less than 10% canopy cover are also considered part of the listed Blue Gum High Forest of the Sydney Basin Bioregion ecological community if the fragments are greater than one ha in size and occur in areas of native vegetation in excess of 5 ha. These areas enhance the potential for connectivity and viability of the ecological community. They support flora and fauna species through the facilitation of gene flow and act as buffer against disturbance. These areas total approximately 4 ha.

Within the east of the Subject Land, some of the larger areas of PCT 3136 'some native understorey' condition may meet listing criteria under the EPBC Act; however, most of these areas were surveyed 'over the fence' and additional surveys would be required to determine if native species are present within all structural layers throughout. Due to this condition being around existing dwellings, it is considered unlikely that these areas contain native species within all structural layers and therefore have been assumed to not conform to the EPBC Act listed TEC for the purposes of this ECA. Further surveys would be required to confirm this assumption.

3.2.2. PCT 3262 Sydney Turpentine Ironbark Forest

Vegetation Formation: Wet Sclerophyll Forests (Grassy sub-formation)

Vegetation Class: Northern Hinterland Wet Sclerophyll Forests

Percentage cleared: 95.91

Within the Subject Land this PCT occurs most extensively in the western half of the Subject Land, in an area roughly centred around Glenorie Public School. It occurs in areas at the periphery of the broad shale caps of

the gently sloped ridges throughout the locality, which have historically been cleared for agriculture. Shales are thinner in these areas than the areas further onto the ridges that support PCT 3136, and closer to the boundary with Hawkesbury Sandstone. A remnant at the Tekapo Road entrance to the large bushland reserve in the north, encompasses an area with shale clays in the east, and appears to transition through the hard setting soils of the Mittagong Formation into Hawkesbury Sandstone in the west where it is intersected by Glenorie Creek. The largest patch of the highest quality vegetation occurs within Glenorie Park, and there are patches of an array of sizes scattered through the residential areas surround Glenorie Public School, and within the school grounds. Elsewhere the community occurs within rural areas in the east of the Subject Land downstream along Glenorie Creek, where the creek has cut through deeper shale to the transition with Hawkesbury Sandstone, surrounding Cairnes Lane, and in the far north of the Subject Land along Old Northern Road.

The community within the Subject Land is dominated by *Syncarpia glomulifera*, with other common species including *Eucalyptus globoidea*, *Angophora costata* (Rough-barked Apple), *Eucalyptus punctata* (Grey Gum), *Angophora floribunda*, and *Eucalyptus resinifera subsp. resinifera*. Sub-canopy species include *Acacia parramattensis*, *Pittosporum undulatum*, *Acacia implexa* (Hickory Wattle) and *Allocasuarina littoralis* (Black She-oak).

Shrub species include *Breynia oblongifolia* (Coffee Bush), *Polyscias sambucifolia* (Elderberry Panax), and *Bursaria spinosa* (Native Blackthorn). The shrub layer often also includes the exotic species *Ligustrum sinense*.

The ground layer is generally dominated by *Microlaena stipoides* var. *stipoides* or *Imperata cylindrica* (Blady Grass), and a number of other grass, graminoid, and forb species are present including *Lomandra longifolia* (Spiny-headed Mat-rush), *Lomandra multiflora* subsp. *multiflora* (Many-flowered Mat-rush), *Aristida vagans* (Threeawn Speargrass), *Cyperus gracilis* (Slender Flat-sedge), *Goodenia hederacea* (Forest Goodenia), and *Dianella revoluta* (Blueberry Lily).

Climbers and twiners present include *Hardenbergia violacea* (False Sarsaparilla).

The PCT occurs as four condition within the Subject Land, which are described below.

3.2.2.1. PCT 3262 Intact

This condition occurs within Glenorie Park, and is dominated by native species in all strata. Weeds are present but not dominant in any stratum. The presence of higher levels of *Ligustrum sinense* in fringing areas of the park indicates the current high quality of the remnant within the park is likely due to bushland regeneration works having been undertaken. An example of this condition is shown in **Photograph 4**. A patch of this vegetation condition also occurs within a rural property in the central southern area of the Subject Land surrounding a dam, within the eastern reaches of Glenorie Creek. This area was not accessible and is likely to have higher weed levels than the Glenorie Park remnant, due to occurring within a rural property. This area of vegetation is shown in **Photograph 5**.

Photograph 4 PCT 3262- Intact condition

Photograph 5 PCT 3262- Intact condition (inaccessible area within rural property)

3.2.2.2. PCT 3262 Weedy Understorey

This condition occurs in the entrance to the bushland reserve off Tekapo Road. Due to occurring in an area of transitional soils, likely including some areas of Mittagong Formation derived soils, the canopy is diverse in this area, and along with canopy species present in the majority of remnants, includes some additional species with higher association to sandstone soils, or soils of moderate fertility, including *Eucalyptus racemosa* (Narrow-

leaved Scribbly Gum)*, Eucalyptus pilularis* (Blackbutt) and *Corymbia eximia* (Yellow Bloodwood). The PCT at this location is generally dominated by native species in all strata, but there are some dense patches of woody weeds, predominately *Ligustrum sinense*, along with trees of a *Pinus* species, and some areas appear to have historically been cleared/impacted regularly, before regrowing, due to encroachment from adjoining properties. The ground layer also contains moderate weed quantities in some areas of grass species such as *Ehrharta erecta* (Panic Veldtgrass). An example of this condition is shown in **Photograph 6**.

Photograph 6 PCT 3262 – Weedy understorey condition

3.2.2.3. PCT 3262 Some Native Understorey

This condition occurs as small, fragmented patches of canopy species, such as roadside fringes. Due to moderately intensive management regimes, such as understorey clearing, while leaving shrubs to regrow around the base of trees, and intermittent mowing, without historical laying of turf or attempts at pasture improvement, a reduced richness of native species is present in the shrub and ground layer. An example of this condition is shown in **Photograph 7**.

Photograph 7 PCT 3262 – Some native understorey condition

3.2.2.4. PCT 3262 Canopy Only

This condition occurs as scattered remnants of canopy trees only in areas such as residential yards and school grounds. An example of this condition is shown in **Photograph 8**.

Photograph 8 PCT 3262 - Canopy only condition

3.2.2.5. Justification of PCT Selection

PCT 3262 was selected due to comprising areas of species associated with the Sydney Turpentine Ironbark Forest TEC and associated PCT 3262, and occurring on areas of thin shales at the margins of the broad shale caps within the locality, at the interface with sandstone at the edge of ridge areas, or in areas where creek erosion has worn shale to a thin layer overlying sandstone.

3.2.2.6. Alignment with Threatened Ecological Communities

PCT 3262 aligns with the TEC Sydney Turpentine Ironbark Forest in the Sydney Basin Bioregion, listed as Critically Endangered under the BC Act. It is also listed as Critically Endangered under the EPBC Act.

Due to the lack of defined conditions in the final determination (NSW Scientific Committee 2019) for the BC Act listed TEC, all remnants within the Subject Land are considered to meet the definition of the CEEC under the BC Act.

The listing advice for the community (DCCEEW (Cwlth) 2005a) under the EPBC Act states the following regarding condition classes that conform to the listed TEC:

- The vegetation contains some characteristic components from all structural layers (tree canopy, small tree/shrub midstorey, and understorey); and
- Tree canopy cover > 10%, patch area > 1 ha, or
- Tree canopy cover < 10%, patch area > 1 ha and patch is located within native vegetation with an area > 5 ha.

Within the Subject Land, one area of PCT 3262 'intact condition' in the north of Glenorie Park has a tree canopy cover greater than 10%, is greater than 1 ha in area and contains native species in all structural layers. This area is considered to meet listing criteria for the EPBC Act listed CEEC and is identified in **Figure 4**.

3.2.3. PCT 3176 Sydney Enriched Sandstone Moist Forest

Vegetation Formation: Wet Sclerophyll Forests (Shrubby sub-formation)

Vegetation Class: North Coast Wet Sclerophyll Forests

Percentage cleared: 23.11

Within the Subject Land the PCT occurs in two sheltered locations, on sandstone slopes below Wianamatta Shale. The occurrences are on either side of an agricultural property at the end of Cairnes Lane. The largest occurrence is on a steep, southern aspect slope. The more northern occurrence, has a north to western aspect, however, is sheltered by location on the steep slopes of a small gully containing the headwaters of a tributary that feeds into Glenorie Creek to the north-west.

The canopy in these areas is dominated by *Syncarpia glomulifera*, in association with *Angophora costata*, although the more northern occurrence contains *Corymbia eximia* and *Angophora bakeri* (Narrow-leaved Apple), indicating a transition with the occurrence of PCT 3593 downslope.

Sub-canopy species present include *Acacia parramattensis*, *Pittosporum undulatum*, *Ceratopetalum gummiferum* (Christmas Bush) and *Banksia serrata* (Old-man Banksia).

The shrub layer is moderately dense, and includes *Persoonia linearis* (Narrow-leaved Geebung) and *Ozothamnus diosmifolius* (Rice Flower).

The ground layer is dominated by a combination of grasses and graminoids. Species include the grasses *Entolasia stricta* (Wiry Panic) and *Microlaena stipoides* var. *stipoides,* and the graminoid *Lomandra longifolia*. The forb *Dianella caerulea* var. *producta* is also present, and the fern *Pteridium esculentum* (Common Bracken) is common.

The PCT occurs as one condition zone within the Subject Land, which is described below.

3.2.3.1. PCT 3176 Intact

This condition is the only condition zone within the Subject Land. It is considered intact due to the dominance of native species in all strata, though as the patches occur within and adjacent to rural properties, exotic weed species such as *Ligustrum sinense* are common in the peripheries with upslope agricultural areas, and other past disturbances are evident, such as vegetation thinning, previous clearing, and fencing and other structures occurring at some locations. An example of this condition is shown in **Photograph 9**.

Photograph 9 PCT 3176 – Intact condition

3.2.3.2. Justification of PCT Selection

PCT 3176 was selected due being a wet sclerophyll forest dominated by *Syncarpia glomulifera* and *Angophora costata,* occurring on sheltered sandstone slopes below Wianamatta Shale.

A number of other species occur that are mentioned in the PCT description, and species recorded in plots assigned to the PCT in the BioNet vegetation Classification Database, including *Corymbia eximia, Acacia parramattensis*, *Pittosporum undulatum*, *Ceratopetalum gummiferum*, *Banksia serrata, Persoonia linearis, Ozothamnus diosmifolius, Entolasia stricta, Microlaena stipoides* var. *stipoides, Lomandra longifolia, Dianella caerulea* var. *producta and Pteridium esculentum*.

3.2.3.3. Alignment with Threatened Ecological Communities

PCT 3176 is aligned with the NSW TEC Hygrocybeae Community of Lane Cove Bushland Park in the Sydney Basin Bioregion. The occurrences within the Subject Land do not fit the description of this TEC in the final determination (NSW Scientific Committee 2014) as the community is limited to one location within the Gore Creek catchment in Lane Cove which is not within the Subject Land.

3.2.4. PCT 3593 Sydney Coastal Sandstone Bloodwood Shrub Forest

Vegetation Formation: Dry Sclerophyll Forests (Shrubby sub-formation)

Vegetation Class: Sydney Coastal Dry Sclerophyll Forests

Percentage cleared: 19.25

Within the Subject Land this PCT occurs extensively through the north of the Subject Land within a Bushland Reserve along Glenorie Creek and its tributaries. Smaller remnants consisting of scattered trees in backyards are also present in the suburban areas in the north-west of the Subject Land, within areas bound by Tecoma Road and Old Northern Road. The community occurs on ridgetops, upper slopes, and exposed slopes, and is generally associated with outcrops of Hawkesbury Sandstone and boulders. In two locations in the east however, it occurs in gently sloped valley floor areas without evident sandstone outcrops, on loose sand, which is evidently colluvial deposits from downslope weathering of sandstone.

The PCT within the Subject Land is generally dominated by *Corymbia eximia*, with other common species, some dominant in some areas, including *Corymbia gummifera* (Red Bloodwood), *Eucalyptus sparsifolia* (Narrow-leaved Stringybark), *Eucalyptus racemosa*, and *Eucalyptus punctata*. Other species which occur occasionally, generally in association with intergrade areas with adjoining communities include *Eucalyptus piperita* (Sydney Peppermint), *Eucalyptus resinifera* subsp. *resinifera* and *Eucalyptus pilularis*.

Sub-canopy species present include *Acacia parramattensis*, *Pittosporum undulatum*, *Allocasuarina littoralis*, *Persoonia levis*, and *Banksia serrata*. *Angophora bakeri* is common in the sub-canopy in areas in the north-east of the large bushland reserve in the north of the Subject Land.

The shrub layer is moderately dense and includes *Banksia spinulosa* (Hairpin Banksia), *Leptospermum polygalifolium* subsp. *cismontanum* (Tantoon), *Leucopogon muticus* (Blunt Beard-heath), and *Hakea sericea* (Needlebush). *Xanthorrhoea arborea* is common and occurs in the ground and shrub layer depending on trunk size.

The ground layer is dominated by a combination of grasses and graminoids. Species include the grasses *Imperata cylindrica* and *Entolasia stricta*, and graminoids *Cyathochaeta diandra* and *Lomandra longifolia*.

Climbers and twiners include *Smilax glyciphylla* (Native Sarsparilla) and the parasitic *Cassytha pubescens,* and the fern *Pteridium esculentum* is common.

The PCT occurs as three conditions within the Subject Land, which are described below.

3.2.4.1. PCT 3593 Intact

This condition zone occurs within the bushland reserve in the north of the Subject Land. The vegetation is intact, with native species dominant in all strata. Weed species are present in some areas, though are patchily distributed, and are generally associated with areas of creek likely to have been nutrient enriched with downstream movement of fertilisers, and areas in close proximity to residences and agricultural properties where there has been some level of disturbance such as small areas of clearing/encroachment, and dumping of garden waste. An example of this condition is shown in **Photograph 10**.

Photograph 10 PCT 3593 – Intact condition

3.2.4.2. PCT 3593 Some Native Understorey

This condition occurs in fringing areas of reserves predominately, in some semi-cleared areas of rural properties. The community is mostly characterised in these areas by canopy trees, though native species persist in the understorey, with reduced species richness due to past and current vegetation management. It includes areas where weed species are fairly dominant in the understorey, and areas where mowing precludes the full development of a native understorey. Shrub species persist, around the base of trees in mown areas, or as scattered remnants in weedy areas, and native species tolerant of either mowing or shading persist in the ground layer. An example of this condition is shown in **Photograph 11**.

Photograph 11 PCT 3593 – Some native understorey condition

3.2.4.3. PCT 3593 Canopy Only

This condition occurs as scattered remnants of canopy trees only in residential backyards which historically would have comprised exposed sandstone slopes. An example of this condition is shown in **Photograph 12**.

Photograph 12 PCT 3593 – Canopy only condition

3.2.4.4. Justification of PCT Selection

3593 was selected due to being a dry sclerophyll forest occurring on sandstone crests/ridges, and exposed upper slopes on a coastal plateau north of Sydney. It also includes a number of species in the canopy and understorey mentioned in the PCT description such as *Corymbia gummifera, Eucalyptus sparsifolia*, *Angophora costata, Banksia serrata, Leptospermum trinervium* (Flaky-barked Tea-tree)*, Lambertia Formosa* (Mountain Devil), *Persoonia levis, Entolasia stricta*, and *Cyathochaeta diandra*. The majority of other species recorded in rapid-point assessments have also previously been recorded within plots undertaken in the community, as reported in the BioNet Vegetation Classification Database.

3.2.4.5. Alignment with Threatened Ecological Communities

PCT 3593 is aligned with the NSW TEC Duffys Forest Ecological Community in the Sydney Basin. This TEC however occurs on thin shale remnants, and lateritic gravels at the interface between historically eroded shales and sandstone (Scientific Committee 2011). Occurrences within the Subject Land are not consistent with the final determination for the TEC, as they are all on Hawkesbury Sandstone derived soils, not on shale or lateritic gravels.

3.2.5. PCT 3586 Northern Sydney Scribbly Gum Woodland

Vegetation Formation: Dry Sclerophyll Forests (Shrubby sub-formation)

Vegetation Class: Sydney Coastal Dry Sclerophyll Forests

Percentage cleared: 14.99

Within the Subject Land, this PCT occurs in one location, in the bushland reserve area in the north, on a very mild, westerly exposed slope, with extensive sandstone outcropping, forming the character of a sandstone ridgetop area – with the canopy stunted and of a woodland formation due to availability of only shallow soils between rock outcrops.

The PCT within the Subject Land is dominated by *Eucalyptus racemosa*, with *Corymbia eximia*, and *Corymbia gummifera,* and a sub-canopy is present comprising *Angophora hispida* (Dwarf Apple) and *Banksia serrata.*

The shrub layer is moderately dense and species rich, and includes *Banksia spinulosa* (Hairpin Banksia), *Acacia ulicifolia* (Prickly Moses), *Lambertia formosa, Epacris pulchella* (Wallum Heath), *Banksia oblongifolia* (Fern-leaved Banksia) and *Boronia ledifolia* (Showy Boronia).

The ground layer is dominated by the grasses *Entolasia stricta* and *Anisopogon avenac*eus (Oat Speargrass), and graminoids *Lepyrodia scariosa*, *Cyathochaeta diandra* and *Ptilothrix deusta*.

Climbers and twiners include the parasitic *Cassytha glabella.*

The PCT occurs as one condition within the Subject Land, which is described below.

3.2.5.1. PCT 3586 Intact

This condition occurs within the bushland reserve in the north of the Subject Land. The vegetation is intact, with native species dominant in all strata. Weed species are absent from the community due to the infertile, sandstone derived soils. An example of this condition is shown in **Photograph 13**.

Photograph 13 PCT 3586- Intact condition

3.2.5.2. Justification of PCT Selection

PCT 3586 was selected due the woodland form of the vegetation which occurs on Hawkesbury Sandstone (unusual for related, locally present PCTs on Sandstone, which are generally forests), and presence of a number of species within rapid-point assessments consistent with the PCT description and reported in the BioNet Vegetation Classification Database as having been recorded within plots assigned to the PCT. Species include *Corymbia gummifera*, *Angophora hispida Banksia serrata*, *Banksia oblongifolia, Leptospermum trinervium, Grevillea buxifolia*, *Platysace linearifolia, Lambertia formosa, Cyathochaeta diandra, Lepyrodia scariosa,* and *Entolasia stricta*.

It should be noted that the occurrence within the Subject Land is dominated by *Eucalyptus racemosa,* which is inconsistent with the PCT description, which states the closely related *Eucalyptus haemastoma* generally dominates the canopy. The former *Eucalyptus sclerophylla,* which is now part of *Eucalyptus racemosa,* has been recorded very infrequently within plots assigned to the PCT as reported in the BioNet Vegetation Classification Database. *Eucalyptus racemosa* and *Eucalyptus haemastoma* are known to extensively intergrade, and fruit of recorded individuals, mostly at 5-6 mm diameter are at the larger end of the size scale for *Eucalyptus racemosa*, with *Eucalyptus haemastoma* fruit 7 mm diameter or larger. Vegetation descriptions for related communities under older broad scale mapping schemes for Sydney such as the Native Vegetation of the Sydney Metropolitan Area (OEH 2013) and Hornsby Shire Vegetation (Smith and Smith 2010) all describe *Eucalyptus*

haemastoma and *Eucalyptus racemosa* as both being associated with the communities. As described above, PCT 3586 is the best fit PCT for the woodland form of the vegetation within this area of the Subject Land, and it is likely that the lack of *Eucalyptus racemosa* being associated with the PCT, is due to less plot sampling of the more western occurrences of the PCT on the edge of the Hornsby Plateau, where *Eucalyptus racemosa* is more common than *Eucalyptus haemastoma*, noting that the PCT is known to extend as far west as Maroota. A review of the SVTM data via the SEED Portal shows that no plots have been undertaken in any of the locally mapped occurrences of PCT 3586 on the SVTM. Although PCT 3807 is known to have occurrences of *Eucalyptus racemosa*, and can present as a woodland form, the lack of *Banksia ericifolia* (Heath-leaved Banksia) and *Hakea teretifolia* (Needlebush) within the Subject Land occurrence is contraindicative, along with the fact that PCT 3807 most commonly presents as a dense, tall heath, rather than a low woodland.

3.2.5.3. Alignment with Threatened Ecological Communities

PCT 3586 is not aligned with any TECs.

3.2.6. PCT 3621 Sydney Hinterland Turpentine-Apple Gully Forest

Vegetation Formation: Dry Sclerophyll Forests (Shrubby sub-formation)

Vegetation Class: Sydney Hinterland Dry Sclerophyll Forests

Percentage cleared: 3.46

Within the Subject Land, this PCT's occurrence is mostly limited to the riparian areas of Glenorie Creek within the large bushland reserve in the north, and the steep, sheltered, eastern aspect slopes to the west of Glenorie Creek. Additionally, some small remnants occur further to the south within residential yards. Outcropping Hawkesbury Sandstone is common in most areas of the community and small cliffs are present in some areas.

The canopy of the community is dominated by *Eucalyptus piperita* and *Angophora costata*. Where the community adjoins areas of PCT 3593, *Corymbia eximia* is present in the canopy, and riparian areas in addition tended to have occurrences of *Syncarpia glomulifera* and *Eucalyptus punctata*. The sub-canopy includes occurrences of *Ceratopetalum gummiferum*, *Elaeocarpus reticulatus* (Blueberry Ash), *Acacia floribunda* (White Sally), and in several locations tall individuals of *Hakea sericea*.

The shrub layer is sparse to moderately dense and includes *Leptospermum trinervium*, *Persoonia linearis*, *Leptospermum polygalifolium* subsp. *cismontanum*, *Platysace linearifolia* and *Banksia spinulosa*.

The ground layer varies across the community, with the fern *Pteridium esculentum* common in drier areas, and *Calochlaena dubia* (Rainbow Fern) occurring densely in damper, shadier locations. Other common/dominant species include the graminoids *Lomandra longifolia* and *Anisopogon avenaceus*.

The PCT occurs as two condition within the Subject Land, which are described below.

3.2.6.1. PCT 3621 Intact

This condition zone occurs within the bushland reserve in the north of the Subject Land, in all areas not in close proximity to residential and rural properties. The vegetation is intact, with native species dominant in all strata.

Weed species are present in some areas, though are patchily distributed. An example of this condition is shown in **Photograph 14**.

Photograph 14 PCT 3621 – Intact condition

3.2.6.2. PCT 3621 Some Native Understorey

This condition occurs along the lower reaches of Glenorie Creek within the bushland reserve in the north, in association with close proximity to residential property, and also within a rural property at the northern end of Taupo Road. There are scattered remnants as well within some residential yards around Otago Close, and Timaru Street, where the steep rocky terrain, was unsuitable for development of lawn areas, and as such some understorey elements persist under canopy trees, such as occurrences of *Acacia implexa*. The community is mostly characterised in these areas by canopy trees, though native species persist in the understorey, with reduced species richness due to past and current vegetation management. It includes area where weed species are largely dominant in the understorey, and areas where removal and maintenance of the understorey, probably potentially for livestock grazing has resulted in a grassland ground layer with a high proportion of exotic species. An example of this condition is shown in **Photograph 15**.

Photograph 15 PCT 3621 – Some native understorey condition

3.2.6.3. Justification of PCT Selection

PCT 3621 was selected due being a dry sclerophyll forest, occurring on steep, sheltered, sandstone slopes. Vegetation also includes a number of species in the canopy and understorey mentioned in the PCT description such as *Eucalyptus piperita*, *Angophora costata, Syncarpia glomulifera, Ceratopetalum gummiferum*, *Elaeocarpus reticulatus*, *Persoonia linearis*, *Pteridium esculentum* and *Calochlaena dubia*.

The majority of other species recorded in rapid-point assessments have also previously been recorded within plots undertaken in the community, as reported in the BioNet Vegetation Classification Database.

3.2.6.4. Alignment with Threatened Ecological Communities

PCT 3621 is not aligned with any TECs.

3.3. Non-PCT Vegetation Communities within the Subject Land

3.3.1. Planted Native Vegetation

Throughout the residential and commercial areas of the Subject Land there are plantings of an array of native plant species that have been planted for aesthetic/landscaping purposes, and as such do not conform to a PCT. Species include some that naturally occur in Sydney, though are not associated with locally occurring PCTs, such as *Corymbia maculata* (Spotted Gum) and *Eucalyptus sideroxylon* (Mugga Ironbark), and species that do not have a natural range overlapping with the Subject Land such as *Lophostemon confertus* (Queensland Brushbox). An example of this community is shown in **Photograph 16**.

Photograph 16 Planted Native Vegetation within the Subject Land

3.3.2. Exotic Vegetation

Two general forms of exotic vegetation are present within the Subject Land. This includes exotic woody vegetation and exotic dominated grassland, which are described in detail below.

3.3.2.1. Exotic Woody Vegetation

Exotic Woody Vegetation is present throughout the Subject Land and comprises garden plantings of trees and shrubs such as *Jacaranda mimosifolia* (Jacaranda), and *Murraya paniculata* (Orange Jessamine). A number of areas of exotic agricultural plantations have also been mapped as this community, which occur within rural properties in the east of the Subject Land. An example of this community is shown in **Photograph 17**.

Photograph 17 Exotic Woody Vegetation within the Subject Land

3.3.2.2. Exotic Dominated Grassland

Occurring throughout the Subject Land are patches of Exotic Dominated Grassland. This vegetation community occurs as maintained lawns/open space throughout the Subject Land. No canopy trees or shrub layer are present in this vegetation community. It is dominated by exotic grass species. Species include *Cenchrus clandestinus* (Kikuyu Grass) and *Eragrostis curvula* (African Lovegrass). A number of exotic forbs are also common and include *Plantago lanceolata* (Lamb's Tongues), *Gamochaeta americana* (Cudweed) and *Modiola caroliniana* (Red-flowered Mallow). An example of this community is shown in **Photograph 18**.

Photograph 18 Exotic Dominated Grassland within the Subject Land

3.4. Flora Species

3.4.1. Threatened Flora

No naturally occurring threatened flora species were recorded within the Subject Land. Nevertheless, targeted threatened flora species surveys will likely be required for an ecological assessment accompanying a Development Application (DA) or Planning Proposal in the future for the Subject Land. **Table 2** below includes a list of threatened flora species previously recorded within the locality, as well as their listing status under the BC Act and EPBC Act. Threatened flora species that may require surveys in the future include those listed in **Table 2** below as well any predicted by the BAM calculator.

Table 2 Threatened flora species previously recorded in the locality

Scientific Name	Common Name	BC Act Status	EPBC Act Status
Acacia bynoeana	Bynoe's Wattle	E	V
Acacia gordonii		E	E
Callistemon linearifolius	Netted Bottle Brush	V	-
Darwinia biflora		V	V
Epacris purpurascens var. purpurascens		V	-
Eucalyptus sp. Cattai		E	CE
Grevillea parviflora subsp. supplicans		E	-
Hibbertia puberula		E	-
Hibbertia spanantha	Julian's Hibbertia	E	CE
Hibbertia superans		E	-
Lasiopetalum joyceae		V	V
Macadamia integrifolia	Macadamia Nut	-	V
Melaleuca deanei	Deane's Paperbark	V	V
Persoonia hirsuta	Hairy Geebung	E	E
Pimelea curviflora var. curviflora		V	V
Tetratheca glandulosa		V	-
Zieria involucrata		E	V

V=vulnerable, E=endangered, CE=critically endangered

3.5. Fauna Species

3.5.1. Fauna Habitat

The Subject Land generally comprises high density development in and around Glenorie Village that contains small, scattered patches of vegetation, with rural lots dominating further from Glenorie Village that include larger patches of vegetation that often adjoin larger patches of remnant vegetation along the steeper slopes of existing riparian areas.

Within highly developed areas in and around Glenorie Village, fauna habitat is primarily limited to small, isolated patches of vegetation that provide foraging resources for a range of highly mobile fauna species. These areas generally lack a high number of hollow-bearing trees, bush-rock and/or logs that would provide suitable refuge/breeding habitat for threatened fauna species. An exception to this is a relatively large area of PCT 3262 located to the north of Glenorie Park which contains remnant, intact vegetation with hollow-bearing trees and logs, and is considered to provide reasonably good habitat for threatened species.

Extending further from developed areas are larger lots containing larger areas of native vegetation that provide varied levels of connectivity to other areas of remnant bushland , which is primarily located along plateaus and steeper slopes of riparian areas. These areas contain a significantly higher number of older, larger trees that contain hollow-bearing trees, bush rock and logs that provide suitable refuge, breeding and or roosting habitat for threatened species, as well as foraging habitat. The best condition fauna habitat is considered to be areas of remnant, intact bushland with connectivity to larger areas located beyond the Study Area to the north and northeast. Notwithstanding, all areas of mature native vegetation (regardless of patch size) provide some degree of habitat for native species and are considered important within the larger landscape.

Habitat features recorded within the Subject Land that are considered to provide suitable habitat for threatened species previously recorded in the locality includes:

- Tree hollows – providing roosting and shelter for birds, arboreal mammals and microchiropteran bats. These are found throughout the mature native vegetation within the Subject Land;
- Decorticating bark – providing shelter for reptiles and microchiropteran bats. Decorticating bark is restricted to mature native trees found within the Subject Land;
- Nests – providing breeding habitat for native birds. Only small stick nests were recorded within dense native vegetation in remnant bushland;
- Nectar-producing trees - foraging habitat for insects, blossom-dependant birds, arboreal mammals and megachiropteran bats (flying-foxes). These are found throughout the Subject Land;
- Dense vegetation – provides potential habitat for birds, reptiles and arboreal and ground dwelling mammals;
- Watercourses - including dams and drainage lines provide potential shelter, roosting, and foraging habitat for amphibians, birds, and reptiles;
- Caves / Rocky Outcroppings – roosting habitat for cave dwelling bats as well as refuge habitat for reptiles and mammals. Caves and rocky outcroppings are restricted to steeper slopes along riparian areas that have not been previously cleared;
- Rock piles – scattered throughout the Subject Land, and border some of the dams and watercourses. These have the potential to provide shelter for reptiles and amphibians;

- Log / litter piles– scattered throughout the Subject Land, these provide temporary shelter for reptiles, amphibians and small mammals; and
- Roof cavities - provides potential roosting habitat for microchiropteran bats and birds. These are confined to the dwellings within Subject Land.

Examples of some of the habitat features recorded within the Subject Land are provided in **Photographs 19**-**21** below.

Photograph 19 Large hollow-bearing tree within intact bushland in the northeast of the Subject Land

Photograph 20 Riparian area within the centre of the Subject Land

Photograph 21 Rocky outcroppings in the northeast of the Subject Land

3.5.2. Threatened Fauna

One threatened fauna species was incidentally recorded during field surveys. This was the Flame Robin (*Petroica phoenicea*) which is listed as vulnerable under the BC Act. This individual was recorded within areas of PCT 3593 (intact condition) located within large tracts of intact bushland in the northeast of the Subject Land**.** A list of all fauna species recorded during field surveys of the Subject Land is provided in **Appendix B**.

A number of threatened fauna species have been recorded within the locality and nearly all are considered to have the potential occur within the Study Area; however, the most suitable habitat for threatened species is considered to be within the larger areas of intact bushland located further from previously cleared areas. Threatened species previously recorded in the locality are provided in **Table 3**, along with their listing status under the BC Act and EPBC Act.

Targeted threatened fauna species surveys will likely be required for an ecological assessment accompanying a DA or Planning Proposal in the future for the Subject Land. Threatened fauna species that may require surveys in the future include those listed in **Table 3** below as well any predicted by the BAM calculator.

Table 3 Threatened fauna species previously recorded in the locality

Scientific Name	Common Name	BC Act Status	EPBC Act Status
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	
Callocephalon fimbriatum	Gang-gang Cockatoo	E	E
Calyptorhynchus lathami lathami	South-eastern Glossy Black-Cockatoo	V	V
Cercartetus nanus	Eastern Pygmy-possum	V	
Chalinolobus dwyeri	Large-eared Pied Bat	E	E
Circus assimilis	Spotted Harrier	V	
Daphoenositta chrysoptera	Varied Sittella	V	
Dasyurus maculatus	Spotted-tailed Quoll	V	E
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	
Gallinago hardwickii	Latham's Snipe	V	V
Glossopsitta pusilla	Little Lorikeet	V	
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	
Heleioporus australiacus	Giant Burrowing Frog	V	V
Hieraaetus morphnoides	Little Eagle	V	
Hirundapus caudacutus	White-throated Needletail	V	V
Lophoictinia isura	Square-tailed Kite	V	
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V	
Miniopterus australis	Little Bent-winged Bat	V	
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	

Scientific Name	Common Name	BC Act Status	EPBC Act Status
Myotis macropus	Southern Myotis	V	
Ninox connivens	Barking Owl	V	
Ninox strenua	Powerful Owl	V	
Petauroides volans	Southern Greater Glider	E	E
Petaurus australis	Yellow-bellied Glider	V	V
Phascolarctos cinereus	Koala	E	E
Pommerhelix duralensis	Dural Land Snail	E	E
Pseudomys novaehollandiae	New Holland Mouse		V
Pseudophryne australis	Red-crowned Toadlet	V	
Pteropus poliocephalus	Grey-headed Flying-fox	V	V
Scoteanax rueppellii	Greater Broad-nosed Bat	V	
Tyto novaehollandiae	Masked Owl	V	
Tyto tenebricosa	Sooty Owl	V	
Vespadelus troughtoni	Eastern Cave Bat	V	

V=vulnerable, E=endangered

3.6. Vegetation Communities within Hills LGA Areas of the Study Area

Table 4 below presents the SVTM broad-scale vegetation mapping of areas of the Study Area located outside of the Subject Land (i.e. Hills LGA areas within the Study Area), their total area of extent, as well as associated TECs under the BC Act and EPBC Act. SVTM broad-scale mapping of the Hills LGA areas of the Study Area is shown in **Figure 4**. No further details of the vegetation within these areas are provided as these areas were not surveyed as part of this ECA. Targeted surveys of the Hills LGA areas of the Study Area would be required to ground-truth and refine existing mapping, and determine the ecological constraints present.

Table 4 SVTM mapping of Hills LGA areas of the Study Area

PCT	PCT Name	Associated TEC BC Act	Associated TEC EPBC Act	Total Area (ha)
0	Not classified	-	-	124.50
3321	Cumberland Shale-Sandstone Ironbark Forest	CEEC - Shale Sandstone Transition Forest in the Sydney Basin Bioregion	CEEC - Shale Sandstone Transition Forest in the Sydney Basin Bioregion	14.62
3136	Blue Gum High Forest	CEEC - Blue Gum High Forest in the Sydney Basin Bioregion; CEEC - Hygrocybeae Community of Lane Cove Bushland Park in the Sydney Basin Bioregion	CEEC - Blue Gum High Forest in the Sydney Basin Bioregion	13.74
3616	Sydney Hinterland Grey Gum Transition Forest	-	-	12.84
3448	Castlereagh Ironbark Forest	EEC - Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion; EEC - Shale Gravel Transition Forest in the Sydney Basin Bioregion	CEEC - Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion; CEEC - Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	8.34
3593	Sydney Coastal Sandstone Bloodwood Shrub Forest	EEC - Duffys Forest Ecological Community in the Sydney Basin Bioregion	-	7.60
3262	Sydney Turpentine Ironbark Forest	CEEC - Sydney Turpentine-Ironbark Forest in the Sydney Basin Bioregion	CEEC - Turpentine-Ironbark Forest of the Sydney Basin Bioregion	6.20
3176	Sydney Enriched Sandstone Moist Forest	CEEC - Hygrocybeae Community of Lane Cove Bushland Park in the Sydney Basin Bioregion	-	3.43

PCT	PCT Name	Associated TEC BC Act	Associated TEC EPBC Act	Total Area (ha)
3111	Sydney Hinterland Grey Myrtle Riparian Forest	-	-	1.44
3592	Sydney Coastal Enriched Sandstone Forest	-	-	0.19
3586	Northern Sydney Scribbly Gum Woodland	-	-	0.16
3621	Sydney Hinterland Turpentine-Apple Gully Forest	-	-	0.04
3622	Sydney Hinterland Yellow Bloodwood Woodland	-	-	0.02
Total				**193.12**

EEC=Endangered Ecological Community, CEEC=Critically Endangered Ecological Community

4. Discussion

4.1. Ecological Constraints

This section provides a discussion of the key potential ecological constraints to future rezoning and development within the Study Area, with particular reference to the Subject Land.

Key ecological constraints identified within the Subject Land include:

- Presence of native vegetation, including two PCTs (PCTs 3136 (some native understorey and canopy only conditions) and 3262 (all conditions)) that correspond to a CEEC listed under the BC Act;
- Potential habitat for threatened species;
- Areas mapped on the Biodiversity Values Map;
- Mapped watercourses and assessment requirements under the WM Act and/or FM Act; and
- Hornsby LEP and DCP considerations.

Each of these components is discussed further below.

4.1.1. Native Vegetation

A high level of conservation significance is attributed to patches of mapped PCTs, associated TECs, and to a lesser degree, Planted Native Vegetation within the Subject Land (**Figure 4**). As such, direct and indirect impacts on such areas should be avoided and mitigated where possible with any residual impacts potentially requiring offsetting. Constraints posed by mapped TECs, PCTs and Planted Native Vegetation are discussed in detail in ***Section 4.2***.

4.1.2. Potential Habitat for Threatened Species

A number of threatened flora and fauna species have been recorded in the locality of the Study Area as demonstrated in **Tables 2** and **3.** Areas considered most likely to provide habitat for threatened species (both flora and fauna) are the larger patches of native vegetation located furthest from previously cleared areas. Nevertheless, there is potential for highly mobile threatened fauna species to utilise all areas of the Study Area on occasion. Further to this, some threatened flora species prefer soil disturbance and could occur near previously developed/disturbed areas.

Any future ecological assessments required to support a DA or Planning Proposal would require consideration of threatened species, in particular species credit species under the BAM. In order to minimise impacts on species credit species, future development should focus on previously cleared areas devoid of native vegetation as these areas are unlikely to provide important habitat for species credit species. Where this is not possible, smaller patches of mapped Planted Native Vegetation and PCTs that do not conform to a TEC may be cleared, but may require offsetting. Any future assessment would need to consider the significance of impacts to any threatened species considered to have the potential to utilise the site through a 'Test of Significance'.

If impacts were deemed significant and thus triggered entry into the BOS, consideration of species credit species would be required under the BAM. The list of species that could require consideration is determined through inputs into the BAM Calculator, and is based on native vegetation extent, PCTs, and habitat features.

The list of potential species requiring consideration will be determined once a preliminary assessment according to the BAM is undertaken using the BAM calculator. According to the BAM, each species identified would need to be assessed and appropriately surveyed for. Surveys are required to be undertaken within a specified timeframe (provided as months of a year within the BAM calculator), which can impact project timeframes. If a species is determined to be present within the impact area, there would be a requirement to apply the avoid, mitigate and offset hierarchy outlined within the BC Act. Further details regarding potential future assessment requirements, including the BAM, can be found in ***Section 4.3.***

4.1.3. Areas Mapped on the Biodiversity Values Map

The Biodiversity Values Map (BV Map) identifies land with high biodiversity value that is especially sensitive to impacts from development and clearing. Under the BC Act, any development being assessed under Part 4 (Local Development) of the EP&A Act that occurs within areas mapped on the BV Map would automatically trigger entry into the BOS and require surveys and reporting in accordance with the BAM. A review of the BV Map identifies that parts of the Study Area containing larger patches of vegetation as well some riparian areas are mapped on the BV Map. Areas within the Study Area mapped under the BV Map are shown on **Figure 3**.

The BV Map is updated every 90 days. If any additional areas of the Study Area become mapped in the future, these areas would also need to be considered in future assessments.

4.1.4. Riparian Corridors, and WM Act FM Act Considerations

The Study Area includes 1st and 2nd order streams (see **Figure 3**) that constitute 'waterfront land'. Under the WM Act, approval is required for carrying out a 'controlled activity' that takes place on 'waterfront land' to ensure that the activity does not negatively impact upon waterfront land.

The relevant definition of waterfront land per the WM Act is as follows:

(a) the bed of any river, together with any land lying between the bed of the river and a line drawn parallel to, and the prescribed distance inland of, the highest bank of the river, or

(a1) the bed of any lake, together with any land lying between the bed of the lake and a line drawn parallel to, and the prescribed distance inland of, the shore of the lake, or

(a2) the bed of any estuary, together with any land lying between the bed of the estuary and a line drawn parallel to, and the prescribed distance inland of, the mean high water mark of the estuary, or

(b) if the regulations so provide, the bed of the coastal waters of the State, and any land lying between the shoreline of the coastal waters and a line drawn parallel to, and the prescribed distance inland of, the mean high water mark of the coastal waters, where the prescribed distance is 40 metres or (if the regulations prescribe a lesser distance, either generally or in relation to a particular location or class of locations) that lesser distance. Land that falls into 2 or more of the categories referred to in paragraphs (a), (a1) and (a2) may be waterfront land by virtue of any of the paragraphs relevant to that land.

Waterfront land within the Study Area comprises all areas within 40 m of the watercourse**.** If these areas were to be impacted in the context of a DA, a controlled activity approval would need to be sought.

The NSW Department of Climate Change, Energy, the Environment and Water (NSW – Water) guidelines state that the following vegetated riparian zone buffers should apply based on the watercourse order as classified under the Strahler System of ordering watercourses:

- 1st order watercourse: 10 m each side of watercourse (20 m + channel width);
- 2nd order watercourse: 20 m each side of watercourse (40 m + channel width);
- 3rd order watercourse: 30 m each side of watercourse (60 m + channel width); and
- 4th order watercourse and greater (including estuaries, coastal wetlands, and any parts of rivers influenced by tidal waters): 40 m (80 m + channel width).

Figure 3 identifies the indicative 10m and 20 m buffer applied to the mapped 1st and 2nd order watercourses within the Study Area. In accordance with the WM Act, non-riparian works may be authorised within the 50% outer area of the buffer in the event that an equivalent area connected to the riparian corridor be offset elsewhere on site (DPI 2018). Non-riparian works may include bushfire asset protection zones, recreational areas, roads and infrastructure. It is important to note that the buffers identified in **Figure 3** would need to be refined based on targeted surveys of each stream's top-of-bank and as such, actual buffers may be wider than what is presented in **Figure 3**.

Developments that encroach upon waterfront land generally requires revegetation and/or rehabilitation of riparian corridors along the mapped watercourses under a vegetation management plan prepared by a suitably experienced and qualified ecologist.

It is noted that sections of the first and second order watercourses mapped within the Study Area appear to be highly modified as a result of historic rural land uses, and include farm dams and existing culverts. It is therefore strongly recommended that prior to the undertaking of any DA or Planning Proposal within the Study Area that the client consults with the NSW – Water to determine the specific watercourse or wetland features within or adjacent to the site that a potential controlled activity approval would apply. Once determined, it would be suggested to engage a surveyor to determine highly accurate wetland and watercourse top of bank lines to base future buffer boundaries on, with consideration of any previously modified areas as these could may result in reduced constraints on future approvals and associated revegetation requirements.

In addition to the above, Key Fish Habitats are mapped along the northern boundary of the Subject Land. Any impacts to these mapped areas may require a separate approval under the FM Act. It is recommended that all areas mapped as Key Fish Habitats are entirely avoided by future development.

4.1.5. State Environmental Planning Policy (Biodiversity and Conservation) 2021

State Environmental Planning Policy (Biodiversity and Conservation) 2021 (Biodiversity and Conservation SEPP) came into force on 1 March 2022 and consolidates and repeals the provisions of the following SEPPs:

- State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017;
- State Environmental Planning Policy (Koala Habitat Protection) 2020;

- State Environmental Planning Policy (Koala Habitat Protection) 2021;
- Murray Regional Environmental Plan No 2—Riverine Land;
- State Environmental Planning Policy No 19—Bushland in Urban Areas;
- State Environmental Planning Policy No 50—Canal Estate Development;
- State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011;
- Sydney Regional Environmental Plan No 20—Hawkesbury-Nepean River (No 2—1997);
- Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005;
- Greater Metropolitan Regional Environmental Plan No 2—Georges River Catchment; and
- Willandra Lakes Regional Environmental Plan No 1—World Heritage Property.

The Biodiversity and Conservation SEPP consolidation is administrative, and no policy changes have been made i.e. the SEPP consolidation does not change the legal effect of the existing SEPPs, with section 30A of the *Interpretation Act 1987* applying to the transferred provisions. Further details on the relevant chapters of the Biodiversity and Conservation SEPP to the Study Area are provided below.

4.1.5.1. Chapter 2 - Vegetation in Non-Rural Areas

This chapter applies to multiple non-rural areas of the state of NSW, including the Hornsby and Hills LGAs. However, it is assumed that any proposed future DA within the Study Area involving vegetation impacts will comprise a Part 4 DA that requires development consent, permits for clearing of vegetation are not relevant to the proposed works.

4.1.5.2. Chapter 4 – Koala Habitat Protection 2021

This chapter applies to the Hornsby and Hills LGAs as they are both listed in Schedule 2 of the Biodiversity and Conservation SEPP. As there is no approved Koala Plan of Management for either LGA, any DA impacting an area of greater than 1 ha will need to demonstrate that the DA will not impact on the Koala or Koala habitat, to the satisfaction of Council. If the DA is impacting greater than 1 ha of land and is determined to impact on the Koala or Koala habitat, then a Koala Plan of Management will likely be required.

4.1.6. Hornsby LEP and DCP

4.1.6.1. Hornsby LEP

The Subject Land includes areas mapped as 'Terrestrial Biodiversity' under the Hornsby LEP as shown on **Figure 3**. **Figure 3** also shows areas mapped as 'Terrestrial Biodiversity' under the Hills LEP within the Study Area. DAs withing the Subject Land encroaching upon areas mapped as 'Terrestrial Biodiversity' under the Hornsby LEP must demonstrate the following to Council's satisfaction taken from Section 6.4 (4) of the LEP:

(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.

4.1.6.2. Hornsby DCP

The DCP contains several general controls that relate to the natural environment. Of particular relevance to biodiversity are the general controls for biodiversity and watercourses. The DCP includes the following prescriptive measures for biodiversity and watercourses.

Biodiversity

- Development should seek to avoid potential adverse impact on biodiversity, if that impact cannot be avoided, minimise that impact, or if the impact cannot be minimised, to mitigate the impact;
- A flora and fauna assessment is required for development that may impact on land mapped as Biodiversity on the Terrestrial Biodiversity Map, or native vegetation which is habitat for species listed in Schedule 1 and 2 of the Biodiversity Conservation Act 2016;
- Development should avoid the fragmentation of existing native vegetation; and
- Development should seek to retain unique environmental features of the site including: rock outcrops, wetlands and the like, watercourses, drainage lines and riparian land, groups of significant trees and vegetation, and mature hollow trees and other fauna habitat features on the site.

In addition to the above, the DCP identifies the following minimum buffers from significant vegetation to future developments:

- 20 m from TECs and areas mapped as Biodiversity under the Terrestrial Biodiversity Map;
- 20 m from wetland or saltmarsh plant communities; and
- 10 m from threatened flora/fauna species habitat/populations, locally significant bushland and groups of remnant indigenous trees.

Watercourses

- Existing natural drainage lines and water bodies on a site should be utilised as part of the major drainage network rather than piping stormwater flows;
- All work should not cause bed and bank instability and any bank stabilisation measures should preferably use soft engineering techniques. Watercourses should be linked with other areas of indigenous vegetation, wildlife corridors and/or natural or visually important site features;
- Watercourses should not be piped, filled, excavated, or relocated. In some instances, Council will permit these works to occur;

- The design and location of any development should seek to maintain an effective riparian area and comply with best practice guidelines, that may require: core riparian zone that is the land within and adjacent to the channel. The width of the core riparian zone from the banks of the stream is determined by assessing the importance and riparian function of the watercourse, and a vegetated buffer that protects the environmental integrity of the core riparian zone, with a minimum width of 10 metres; and
- The riparian area should be fully vegetated with local native vegetation (trees, shrubs and groundcover species) at a density that would occur naturally. Species should be consistent with the existing native species present and Council's Riparian Species List. A permanent physical barrier should be placed at the landward extent of the riparian area to prevent inadvertent damage to riparian vegetation where vehicle access to the riparian land, or mowing or slashing of vegetation may otherwise occur.

4.2. Summary and Classification of Ecological Constraints

This analysis has identified three levels of ecological constraints: High, Moderate and Low. **Table 5** below includes the total area of extent of each ecological constraint category within the Subject Land, as shown in **Figure 5**. The rationale for each level of constraint within the Subject Land is provided below.

Table 5 Extent (area in ha) of ecological constraint categories mapped within the study area

Ecological Constraints Category	Subject Land (ha)
High	14.32
Moderate	28.86
Low	80.32

4.2.1. 'High' Constraint

Areas mapped as 'High' constraint are shown in **Figure 5** and include the following:

- PCT 3136 (some native understorey and canopy only conditions) listed as a CEEC under the BC Act;
- PCT 3262 (all conditions) listed as a CEEC under the BC Act;
- Inner 50% of riparian buffers protected under the WM Act;
- Key Fish Habitat protected under the FM Act; and
- Terrestrial Biodiversity under the Hornsby LEP.

The following sub-sections provide a rational for assigning the above to the 'High' constraint category.

4.2.1.1. Serious and Irreversible Impact Entities

PCT 3136 (some native understorey and canopy only conditions) and PCT 3262 (all conditions) have been identified as occurring within the Subject Land, which both conform to a separate CEEC listed under the BC Act. Further to this, an intact area of PCT 3262 also conforms to a CEEC listed under the EPBC Act. A higher

level of conservation significance is attributed to these TECs and impacts, both direct and indirect, should be avoided and mitigated where possible as:

- They may present higher offsetting obligations; and/or
- Trigger a serious and irreversible impact (SAII) (as outlined below); and/or
- May require approval from the Commonwealth.

If any future development had unavoidable impacts on these CEECs, the BDAR would need to consider whether the impacts result in an SAII to either community, both of which have been identified as a candidate SAII entity. Under the BOS, a consent authority (i.e. Council) is required to reject a Part 4 development that is considered to have an impact that is serious and irreversible on an SAII entity. Principles for determining whether or not an impact is considered to be serious and irreversible include the following four principles (clause 6.7 of the BC Act Regulation):

- Will cause a further decline of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline, or
- Will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size, or
- Impact on the habitat of a species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution, or
- Impact on a species or ecological community that is unlikely to respond to measures to improve habitat and vegetation integrity and is therefore irreplaceable.

The consent authority (i.e. Council) has the ability to determine that a proposed development is not considered to be an SAII. In order for this to occur, an assessment would be required that demonstrates that the development is not in conflict with any of the four principles (clause 6.7 of the BC Act Regulation) provided above. In the case of the Subject Land, this would imply a strong requirement to avoid clearing any of these CEECs that are listed under the BC Act.

4.2.1.2. Inner 50% of Riparian Buffers

In accordance with the WM Act, the Inner 50% of applicable vegetated riparian zones (i.e. riparian buffers) must remain vegetated and must not be subject to impacts. Impacting these areas as part of a DA may result in a risk of rejection from Council or not receiving Controlled Activity Approval under the WM Act to carry out the actual works. It is noted that some activities are allowed to occur within the Inner 50% of applicable vegetated riparian zones (subject to approval), which includes stormwater outlet structures and essential services.

4.2.1.3. Key Fish Habitat

Areas mapped as Key Fish Habitat occur within the Subject Land (albeit only along the northern boundary). Any impacts to these mapped areas may constitute an integrated development if the impacts are considered to obstruct the free passage of fish. In such a case, a separate approval under the FM Act would be required.

4.2.1.4. Areas mapped as 'Terrestrial Biodiversity' under the Hornsby LEP

Areas mapped as 'Terrestrial Biodiversity' under the Hornsby LEP occur within the Subject Land. Any impacts to these mapped areas must demonstrate that the development is designed, sited and will be managed to avoid/minimise any significant adverse environmental impact to the mapped area to the satisfaction of Council. If this cannot be demonstrated to Council's satisfaction, the future development is unlikely to be approved by Council.

4.2.2. 'Moderate' Constraint

Areas mapped as 'Moderate' constraint are shown in **Figure 5** and include the following:

- PCT 3136 (regrowth and weeds condition) not listed as a TEC under the BC Act;
- PCT 3176 (intact condition) not listed as a TEC under the BC Act;
- PCT 3586 (intact condition) not listed as a TEC under the BC Act;
- PCT 3593 (all conditions) not listed as a TEC under the BC Act;
- PCT 3621 (all conditions) not listed as a TEC under the BC Act;
- Planted Native Vegetation not conforming to a PCT or TEC listed under the BC Act;
- Outer 50% of riparian buffers;
- Dams; and
- BV mapped areas.

The following sub-sections provide a rational for assigning the above to the 'Moderate' constraint category.

4.2.2.1. Native Vegetation Communities (non-TECs)

Areas of native vegetation of PCTs 3136 (regrowth and weeds condition), 3176, 3593, 3586, 3621 and Planted Native Vegetation have been included in the 'moderate' constraint category. These areas of vegetation contain potential habitat for native flora and fauna species, including threatened species, especially in areas that have connectivity to larger areas of native vegetation, as well as areas within or adjacent to the riparian corridors. Areas of non-TEC native vegetation that do not have connectivity to larger aeras of native vegetation and/or are outside of riparian corridors also contribute to the movement of aerial or highly mobile fauna through their contribution to habitat corridors and "stepping stone habitat", allowing fauna to move throughout the otherwise largely cleared surrounding landscape.

Although non-TEC native vegetation is not listed under the BC Act and/or EPBC Act, these areas still represent areas of moderate conservation significance throughout the Subject Land and broad-scale impacts may result in opposition from consent authorities and community groups and may reduce the likelihood of DA approval. Impacts to these areas of vegetation will need to be well justified and the application of the avoid, minimise, and offset hierarchy must be demonstrated if the DA triggers entry into the BOS. However, none of these non-TECs within the Subject Land are listed as SAII entities in accordance with the BAM, meaning that they are not

considered to be at most risk of extinction from potential development and will not offer consent authorities grounds for automatic refusal of a DA via an SAII argument.

Impacts within these areas may contribute to triggering entry into the BOS through one or more of the thresholds detailed in ***Section 4.3.1.1i.*** If the BOS is triggered by a DA, development activities in these areas will likely require offsetting and associated costs in accordance with the BC Act.

4.2.2.2. Areas Mapped as Dams

Areas identified as Dams within the Subject Land provide habitat for aquatic, terrestrial and aerial fauna species including fish, amphibians, reptiles, waterbirds and microchiropteran bats. Resident terrestrial fauna species would be expected to regularly utilise these dams as a water source. Complete removal of dams within the Subject Land may result in consent authorities requesting additional reports such as dam decommissioning plans as a condition of consent. Additionally, if a DA within the Subject Land were to trigger the BOS, targeted threatened fauna surveys may need to be undertaken throughout the dams to determine the potential presence of threatened species known to the locality such as the Southern Myotis (*Myotis macropus*).

4.2.2.3. Outer 50% of Riparian Buffers

The outer 50% of a riparian buffers shown on **Figure 5** also comprise the area defined as 'Waterfront Land' and impacts to this land in the context of a DA will trigger the requirement for a controlled activity approval under the WM Act. Non- riparian works or DA activity can be undertaken within the outer 50% as long as the offset rules as described in ***Section 4.1.4*** are utilised.

4.2.2.4. BV mapped areas

Any DA that impacts on areas mapped under the BV Map will automatically trigger entry into the BOS and required the preparation of a BDAR. While impacting areas mapped on the BV Map do not necessarily pose a risk to future development (as long as they do not include areas of TECs or are not within the inner 50% of the riparian buffer), they will require targeted surveys under the BAM and potential offsetting.

4.2.3. 'Low' Constraint

Areas mapped as 'Low' constraint are shown in **Figure 5** and include areas of exotic vegetation and previously cleared areas (i.e. unmapped areas in **Figure 4**). Areas mapped as 'Low' constraint are considered unlikely to comprise areas of significant biodiversity value. Whilst areas of exotic vegetation may contribute to the native vegetation clearance threshold under the BAM (***Section 4.3.1.1***) due to containing commonly cultivated native species, entry into the BOS is more likely to be driven by other factors such as the 'High' or 'Moderate' constraint category entities. If a potential DA within the Subject Land were to trigger the BOS, these areas would be highly unlikely to incur offset costs.

4.3. Future Assessment Requirements

Future development of the Subject Land (and Study Area) that proposes impacts to vegetation is anticipated to directly and indirectly impact existing biodiversity values present. Potential impacts include:

- Removal of native vegetation;

- Removal of fauna habitat features such as hollow-bearing trees, decorticating bark, logs, man-made structures and blossom-producing trees and shrubs;
- Removal of potential habitat for threatened flora and fauna species;
- Modification of microhabitats through edge effects;
- Modification of habitat connectivity;
- Runoff, sedimentation and erosion;
- Weed invasion; and
- Injury or mortality to fauna species.

Such impacts would need to be assessed as part of the future DA process. Future assessment requirements are discussed below. These sections provide a discussion of the likely assessment requirements for any future development of the Subject Land. This includes a brief overview of the current NSW and Commonwealth assessment requirements.

4.3.1. NSW Assessment Requirements (BC Act)

4.3.1.1. Biodiversity Offset Scheme and Biodiversity Development Assessment Report

i. Entry into the BOS

Assessment of ecological impacts for future DAs within the Subject Land are required to be in accordance with the BC Act. For developments under Part 4 (Local Development) of the EP&A Act, it is necessary to determine whether the project triggers the BOS. For a project to trigger the BOS, it would need to be considered as likely to significantly affect threatened species, which can occur as follows:

- It is likely to significantly affect threatened species or ecological communities, or their habitats, according to the Test of Significance in Section 7.3 of the BC Act; or
- It exceeds the BOS native vegetation clearing threshold; or
- It is carried out in an area mapped on the Biodiversity Values Map; or
- It is carried out in a declared Area of Outstanding Biodiversity Value (AOBV)

If any of these criteria are triggered, the project triggers entry into the BOS. Assessment under the BOS requires an assessment following the BAM by an accredited BAM assessor and the preparation of a BDAR. Each criterion is considered separately below.

a. Test of Significance

If a proposed development is likely to significantly affect threatened species or ecological communities, or their habitats, according to the Test of Significance in Section 7.3 of the BC Act, then it triggers entry to the BOS and associated offset requirements. In the case of the Subject Land, this could occur through clearing areas of PCT 3136 (some native understorey and canopy only conditions) or PCT 3262 (all conditions) that are both listed as

a CEEC under the BC Act. Further targeted surveys, conducted during appropriate survey periods, would be required to confirm whether or not a significant impact on threatened species would be likely to occur, once a development footprint was confirmed.

b. Clearing Threshold

Any development being assessed under Part 4 of the EP&A Act that clears native vegetation above a threshold specified based on minimum lot size would automatically enter into the BOS and may require offsetting. The threshold levels of clearing for each minimum lot size are shown in **Table 6**. For lots without a minimum lot size, the actual lot size of areas subject to impacts is used in place of the minimum lot size when determining the area clearing threshold.

Any clearing of native vegetation would require application of the avoid, mitigate and offset hierarchy outlined within the BC Act. Therefore, unless future DAs involve limited impacts to native vegetation, future development may exceed the native vegetation clearance threshold which would trigger entry into the offsets scheme.

Table 6 Area of clearing thresholds

Minimum Lot Size of Land	Area of Clearing
Less than 1 hectare	0.25 hectares or more
Less than 40 hectares but not less than 1 hectare	0.5 hectares or more
Less than 1,000 hectares but not less than 40 hectares	1 hectare or more
1,000 hectares or more	2 hectares or more

c. BV Map

Under the BC Act, any DA being assessed under Part 4 (Local Development) of the EP&A Act that occurs within areas mapped on the BV Map will automatically enter into the BOS. Sections of the Subject Land (and Study Area) are mapped on the BV Map (**Figure 2**), and impacting these areas as part of a DA will trigger entry into the BOS and will require assessment in accordance with the BAM. Note that the BV Map is updated every 90 days. Any future development will need to take this into account should additional areas within the Subject Land become mapped in the future.

d. Areas of Outstanding Biodiversity Value

No AOBV have been mapped as occurring in the Subject Land. Therefore, the project will not trigger entry into the BOS via this criterion.

ii. Biodiversity Development Assessment Report

If the entry into the BOS is triggered for a future DA, a BDAR would need to be prepared and associated offsetting calculated. A few key concepts of the BDAR process relevant to the Subject Land are discussed below.

a. Serious and Irreversible Impacts

The BOS recognises that there are some types of serious and irreversible impacts (SAII) that cannot be addressed through offsetting. For a Part 4 Development under the EP&A Act the approval authority (i.e.

Council) is responsible for deciding whether an impact is serious and irreversible. The approval authority must not grant approval if they determine that a proposal is likely to have a serious and irreversible impact on biodiversity values.

An impact is to be regarded as serious and irreversible if it is likely to contribute significantly to the risk of a threatened species or ecological community becoming extinct because:

- It will cause a further decline of a species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline;
- It will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size;
- It is an impact on the habitat of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution; and
- The impacted species or ecological community is unlikely to respond to measures to improve its habitat and vegetation integrity and therefore its members are not replaceable.

These principles are set out in clause 6.7 of the *Biodiversity Conservation Regulation 2017*.

The entities at risk of SAII are listed in the BioNet Threatened Biodiversity Data Collection, however the approval authority may include additional candidate SAII entities. If Council considers the development would result in an impact that is serious and irreversible, the DA must be refused.

Based on this initial assessment, two candidate SAII entities have been identified within the Subject Land. These include PCT 3136 (some native understorey and canopy only conditions) listed as a CEEC under the BC Act and PCT 3262 (all conditions) listed as a CEEC under the BC Act. Additional SAII candidate species may be identified during the preparation of a BDAR during threatened species surveys. Although an SAII candidate species may be identified as potentially occurring through the online BAM calculator, it does not mean that an SAII will be determined to take place. However, any future BDAR would need to provide a detailed assessment of why an SAII would not take place as a result of the project for any candidate SAII entities identified.

iii. Offsetting Liability

Should future development trigger entry into the BOS based on any of the mechanisms described in ***Section 4.3.1.1.i***, development is highly like to trigger some level of offset liability. The BOS provides a framework to avoid, minimise and offset impacts on biodiversity from development and clearing, and to ensure land that is used to offset impacts is secured in-perpetuity. Any development that involves clearing of native vegetation and associated habitat generates a credit obligation based on site specific conditions that must be retired to offset their impact following approval by the consent authority.

Under the BAM, there are two types of credits:

- Ecosystem Credits – these credits relate to PCT as well as specific threatened fauna species whose occurrence can generally be predicted by vegetation surrogates and/or landscape features, or that have a low probability of detection using targeted surveys; and

- Species credit species are threatened species for which vegetation surrogates and/or landscape features cannot reliably predict the likelihood of their occurrence or components of their habitat. A targeted survey or an expert report is required to confirm the presence of these species on the Subject Land. Alternatively, for a development, activity, clearing or biodiversity certification proposal only, the proponent may elect to assume the species is present.

Once the consent authority has issued the approval or consent that includes the final credit obligation of ecosystem and/or species credits, the obligation can be satisfied as follows:

- The retirement of the required number and class of like-for-like biodiversity credits;
- The retirement of the required biodiversity credits in accordance with the variation rules;
- The funding of a biodiversity conservation action that would benefit the relevant threatened species or ecological community and that is equivalent to the cost of acquiring the required like-for-like biodiversity credits as determined by the offsets payment calculator referred to in Section 6.32 of the BC Act; or
- The payment under Section 6.30 of the BC Act of an amount into the Biodiversity Conservation Fund determined in accordance with the offsets payment calculator to satisfy the requirement to retire biodiversity credits.

It should be noted that any proposed tree planting in accordance with a DCP or riparian revegetation under the WM Act constitutes legal obligations under separate legislation and therefore do not comprise an offset under the BC Act. These actions also cannot be utilised as grounds for a reduction in credits which must be calculated via the BAM calculator in accordance with the BC Act.

4.3.1.2. Flora and Fauna Assessment

If a future DA does not trigger entry into the BOS via the mechanisms described above, the DA may be able to be assessed utilising a lower level of assessment known as a Flora and Fauna Assessment (FFA). FFAs generally feature less rigorous floristic and threatened species surveys requirements, a smaller scope regarding reporting, desktop studies and GIS mapping and do not involve credit calculations or mandatory biodiversity offsets. However, the consent authority may negotiate the provision of informal on-site replanting at a set ratio in lieu of offsets as a mitigation or compensatory measure, as well as the implementation of a vegetation management plan or similar.

4.3.2. Commonwealth Assessment Requirements

Threatened species, populations and communities listed under the EPBC Act that are considered to be directly or indirectly impacted by the project should be assessed in accordance with the *Matters of National Environmental Significance (MNES) Significant Impact Guidelines 1.1* (DoE 2013). If a development is considered to significantly impact any MNES, then a referral would be required to be submitted to the Commonwealth Minister for the Environment. Should the Minister determine the project to be a controlled action, approval under the EPBC Act would be required.

As discussed in ***Section 3.2***, one patch of PCT 3262 (intact condition - see **Figure 4**) is considered to meet the relevant EPBC Act TEC listing criteria. However, other MNES may be identified in the future following additional

surveys including threatened fauna species known to the locality. Should future development be deemed likely to have a significant impact to threatened species or TECs listed under the EBPC Act, a referral to the Commonwealth may be required.

4.4. Recommended Avoidance and Mitigation Measures

This section outlines recommended avoidance and mitigation measures to be implemented in the future.

4.4.1. Recommended Avoidance Measures

Taking the ecological constraints into consideration, suitable recommended avoidance measures for the Subject Land include:

- Avoidance of areas mapped as 'High' constraint in **Figure 5**;
- Minimise impacts on areas mapped as 'Moderate' constraint in **Figure 5**;
- Maximise development within areas mapped as 'Low' constraint in **Figure 5.**

In addition to the above, the following should occur:

- Locating a majority of the clearing areas outside of areas comprising TECs;
- Prioritising avoidance of impacts to candidate SAII entities (PCT 3136 and PCT 3262);
- Prioritising tree retention based on the following hierarchy:
    a. Native trees associated with mapped PCTs;
    b. Planted native trees endemic to the Sydney region;
    c. Planted native trees that are not endemic to the Sydney region (e.g. *Eucalyptus microcorys*);
    d. Australian native trees that are not endemic to NSW (e.g. *Corymbia citriodora*).
    e. Exotic trees.
- Locating the majority of the clearing as far as possible from riparian corridors within the Subject Land;
- Locating the impact footprints in cleared areas or areas previously subject to disturbance;
- Locating the clearing areas to avoid direct impacts to habitat features, such as hollow-bearing trees, bush-rock and logs/log piles;
- Use of alternative means to provide associated infrastructure (e.g. shared driveways);
- Including provision for ecological restoration within retained areas of the Subject Land, particularly if the outer 50% of an applicable riparian buffer is impacted (**Figure 4**), or if the consent authority negotiates a requirement for revegetation within the Subject Land.

4.4.2. Recommended Mitigation Measures

Mitigation measures recommended to be included as conditions of consent for future DAs within the Subject Land include:

- Demarcating clearing areas to avoid inadvertent damage to retained vegetation;
- Installation of temporary fencing and sediment/erosion controls around retained vegetation and significant environmental features, such as dams and hollow-bearing trees;
- Timing clearing works to minimise harm to fauna species;
- Undertake pre-clearing surveys and clearance supervision to manage impacts to fauna species;
- Relocation of fauna habitat features within retained areas;
- Installation of nest boxes and/or artificial hollows to replace impacted habitat features;
- Tree replanting in accordance with the DCP if required;
- Preparation of vegetation management plans, dam dewatering plans or fauna management plans as required; and
- Hygiene protocols to prevent the spread of weeds and pathogens.

4.5. Conclusion and Recommendations

This ECA has assumed that a portion of the Subject Land will be subject to land clearing facilitated by a Planning Proposal and subsequent DAs. As such, this ECA details the potential ecological constraints present that may complicate or add risk of refusal to future works. The key ecological constraints identified are summarised below:

- Presence of native vegetation, including two TECs: clearing of native vegetation that exceeds any of the BOS thresholds will trigger entry into the BOS. If the BOS is triggered, clearing of native vegetation mapped as PCTs will likely require the provision of offsets (i.e. ecosystem credits) under the BOS. The offset liability required will need to be determined utilising the BAM calculator. Regardless as to whether the BOS is triggered, impacts to TECs may result in a lower likelihood of project approval if not justified and adequately avoided or mitigated. In particular, any potential impacts to PCT 3136 (some native understorey and canopy only conditions) and PCT 3262 (all conditions) are of the highest risk as these PCTs comprise candidate SAII entities;
- Potential habitat for threatened species: The areas of highest habitat value for threatened species comprises the larger patches of mapped PCTs that have connectivity to larger areas of bushland as well as areas along riparian corridors within the Subject Land. These areas are considered to represent the best habitat connectivity for resident threatened and non-threatened fauna species, and contain the highest abundance of hollow-bearing trees that can provide roosting and breeding habitat for a number of threatened mammals and birds. If a DA triggered entry into the offsets scheme, clearing of such habitat may require the provision of offsets (i.e. species credits in addition to ecosystem credits) to compensate

for the loss of habitat. The offset liability required will need to be determined utilising the BAM calculator; and

- Watercourses/dams: The Subject Land has been mapped as containing watercourses and dams that constitute 'waterfront land' in accordance with the WM Act. DAs encroaching on waterfront land will require a controlled activity approval and potentially the preparation of a vegetation management plan, Encroachments on the inner 50% riparian buffer may increase risk of DA rejection by the consent authority.

In order to minimise the impact to these ecological constraints, it is recommended that areas of native vegetation, in particular the mapped PCTs and TEC's, and areas associated with watercourses be entirely avoided, where possible. It is also recommended that all areas mapped as PCT 3136 (some native understorey and canopy only conditions) and PCT 3262 (all conditions) be avoided to the maximum extent feasible, as any impacts on these communities (direct and indirect) may result in an SAII if determined by Council, which increases the risk of development proposals being rejected. Although all clearance of native vegetation will need to be offset under the BOS, avoidance of PCT 3136 (some native understorey and canopy only conditions) and PCT 3262 (all conditions) will likely reduce offsetting costs. Instead, the project layout should focus on areas of low biodiversity value such as the cleared areas and exotic vegetation ('Low' constraint areas mapped on **Figure 5**) if this can be accommodated within future project designs.

If a future DA surpasses the entry thresholds for the BOS, ecological assessment will need to take the form of a BDAR and will most likely involve costs associated with biodiversity offsets. If a DA does not surpass the entry thresholds for the BOS, an ecological assessment can take the form of a smaller scope FFA. If NSW – Water determines that a future DA will require a controlled activity approval, a vegetation management plan will likely be required to be prepared to facilitate the management of any applicable vegetated riparian zones.

Depending on the extent of the final rezoning area, biodiversity certification of the rezoning area may also be an option under the BC Act, rather than preparing a BDAR. Biodiversity certification of land may be done by a planning authority or by all land owners of the land proposed to be 'biocertified'. Once a final footprint/rezoning area is identified, this option can be further investigated and discussed with Council.

5. References

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APPENDIX A :
Flora Species Lists

Table 7 BAM floristic plot species list

Scientific Name	Common Name	Exotic	HTW	BAM Growth Form Group	Plot 1		Plot 2		Plot 3		Plot 4	
					C	A	C	A	C	A	C	A
Acacia floribunda	White Sally			Shrub (SG)					10	5		
Acacia parramattensis	Parramatta Wattle			Tree (TG)	15	50						
Acacia terminalis	Sunshine Wattle			Shrub (SG)			0.1	1				
Acacia ulicifolia	Prickly Moses			Shrub (SG)			0.2	4				
Acianthus fornicatus	Pixie Caps			Forb (FG)					0.1	50		
Actinotus minor	Lesser Flannel Flower			Forb (FG)			0.2	30				
Allocasuarina littoralis	Black She-Oak			Tree (TG)	2	4					10	3
Angophora bakeri	Narrow-leaved Apple			Tree (TG)							15	10
Angophora costata	Sydney Red Gum			Tree (TG)					20	5		
Angophora hispida	Dwarf Apple			Tree (TG)			25	15				
Anisopogon avenaceus	Oat Speargrass			Grass & grasslike (GG)			15	700	10	1000		
Aristida vagans	Threeawn Speargrass			Grass & grasslike (GG)	1	100						
Austrostipa pubescens				Grass & grasslike (GG)			5	200	5	500	2	100

Scientific Name	Common Name	Exotic	HTW	BAM Growth Form Group	Plot 1		Plot 2		Plot 3		Plot 4	
					C	A	C	A	C	A	C	A
Baeckea diosmifolia	Fringed Baeckea			Shrub (SG)							0.1	1
Banksia oblongifolia	Fern-leaved Banksia			Shrub (SG)			0.5	1	1	3		
Banksia serrata	Old-man Banksia			Tree (TG)			5	3				
Banksia spinulosa	Hairpin Banksia			Shrub (SG)			1	5	1	5	0.5	1
Blechnum cartilagineum	Gristle Fern			Fern (EG)					0.3	10		
Boronia ledifolia	Sydney Boronia			Shrub (SG)			0.2	2				
Breynia oblongifolia	Coffee Bush			Shrub (SG)	0.3	1						
Bursaria spinosa	Native Blackthorn			Shrub (SG)	0.7	3						
Callicoma serratifolia	Black Wattle			Shrub (SG)					5	2		
Calochlaena dubia	Rainbow Fern			Other (OG)					10	200		
Cassytha glabella				Other (OG)			0.5	500			0.1	30
Cayratia clematidea	Native Grape			Other (OG)	0.1	3						
Centella asiatica	Indian Pennywort			Forb (FG)	0.1	20						
Ceratopetalum gummiferum	Christmas Bush			Tree (TG)					10	15		
Cheilanthes sieberi	Rock Fern			Fern (EG)	0.2	50						

Scientific Name	Common Name	Exotic	HTW	BAM Growth Form Group	Plot 1		Plot 2		Plot 3		Plot 4	
					C	A	C	A	C	A	C	A
Commelina cyanea	Native Wandering Jew			Forb (FG)	0.1	4						
Corymbia eximia	Yellow Bloodwood			Tree (TG)			0.7	1	5	2	15	3
Corymbia gummifera	Red Bloodwood			Tree (TG)	1	1					10	4
Cryptostylis subulata	Large Tongue Orchid			Forb (FG)			0.1	4				
Cyathochaeta diandra				Grass & grasslike (GG)	5	500	10	500			5	300
Dampiera stricta				Forb (FG)			0.1	5				
Dianella caerulea var. producta				Forb (FG)	1	40	0.2	5			0.2	5
Dianella revoluta	Blueberry Lily			Forb (FG)	5	200						
Dichondra repens	Kidney Weed			Forb (FG)	0.2	200						
Dillwynia floribunda				Shrub (SG)			0.1	1				
Dodonaea camfieldii				Shrub (SG)			0.3	20				
Echinopogon caespitosus	Bushy Hedgehog-grass			Grass & grasslike (GG)	0.5	50						
Entolasia stricta	Wiry Panic			Grass & grasslike (GG)	2	200	15	1500	10	1000	10	1000
Epacris pulchella	Wallum Heath			Shrub (SG)			0.2	10				
Eragrostis brownii	Brown's Lovegrass			Grass & grasslike (GG)			0.2	20			5	500

Scientific Name	Common Name	Exotic	HTW	BAM Growth Form Group	Plot 1		Plot 2		Plot 3		Plot 4	
					C	A	C	A	C	A	C	A
Eucalyptus piperita	Sydney Peppermint			Tree (TG)					25	5		
Eucalyptus punctata	Grey Gum			Tree (TG)			4	1			20	2
Eucalyptus racemosa	Narrow-leaved Scribbly Gum			Tree (TG)			15	5			5	1
Eucalyptus resinifera subsp. resinifera				Tree (TG)	25	4						
Eucalyptus sparsifolia	Narrow-leaved Stringybark			Tree (TG)							10	3
Euchiton sphaericus	Star Cudweed			Forb (FG)	0.1	20						
Gahnia clarkei	Tall Saw-sedge			Grass & grasslike (GG)			0.4	3				
Glycine clandestina	Twining glycine			Other (OG)	0.1	2						
Glycine microphylla	Small-leaf Glycine			Other (OG)	0.1	20						
Glycine tabacina	Variable Glycine			Other (OG)	0.1	10						
Goodenia hederacea	Ivy Goodenia			Forb (FG)							0.1	10
Hakea sericea	Needlebush			Shrub (SG)					5	10	20	35
Hardenbergia violacea	False Sarsaparilla			Other (OG)	0.1	3						
Hibbertia aspera	Rough Guinea Flower			Shrub (SG)	1	40						
Hovea linearis				Forb (FG)			0.1	1				

Scientific Name	Common Name	Exotic	HTW	BAM Growth Form Group	Plot 1		Plot 2		Plot 3		Plot 4	
					C	A	C	A	C	A	C	A
Hypolepis muelleri	Harsh Ground Fern			Fern (EG)					10	200		
Imperata cylindrica	Blady Grass			Grass & grasslike (GG)	5	500					15	1500
Lagenophora stipitata	Common Lagenophora			Forb (FG)							0.1	10
Lambertia formosa	Mountain Devil			Shrub (SG)			1	5	0.5	3		
Lepidosperma gunnii				Grass & grasslike (GG)	5	500	1	50				
Lepidosperma laterale	Variable Sword-sedge			Grass & grasslike (GG)	0.3	10			1	50	1	50
Leptospermum polygalifolium subsp. polygalifolium				Shrub (SG)					0.2	1		
Leptospermum trinervium narrow-leaved form	Slender Tea-tree (narrow-leaved form)			Shrub (SG)			10	10				
Lepyrodia scariosa				Grass & grasslike (GG)			20	1000			5	300
Leucopogon lanceolatus				Shrub (SG)					0.5	4		
Leucopogon muticus	Blunt Beard-heath			Shrub (SG)			0.1	2				
Lobelia purpurascens	Whiteroot			Forb (FG)	0.2	50						

Scientific Name	Common Name	Exotic	HTW	BAM Growth Form Group	Plot 1		Plot 2		Plot 3		Plot 4	
					C	A	C	A	C	A	C	A
Lomandra cylindrica				Grass & grasslike (GG)			0.1	10			1	100
Lomandra filiformis subsp. filiformis				Grass & grasslike (GG)	0.2	30					0.1	3
Lomandra glauca	Pale Mat-rush			Grass & grasslike (GG)			0.3	40			0.2	30
Lomandra longifolia	Spiny-headed Mat-rush			Grass & grasslike (GG)	3	40	1	10	35	300	5	20
Lomandra multiflora subsp. multiflora	Many-flowered Mat-rush			Grass & grasslike (GG)	0.5	10	0.2	10			0.2	5
Lomandra obliqua				Grass & grasslike (GG)			0.3	40	0.1	2	0.1	5
Lomatia silaifolia	Crinkle Bush			Shrub (SG)					0.5	4		
Micrantheum ericoides				Shrub (SG)			0.5	30				
Microlaena stipoides var. stipoides	Weeping Grass			Grass & grasslike (GG)	50	5000			5	500	3	300
Opercularia diphylla	Stinkweed			Forb (FG)	0.1	30						
Oplismenus aemulus				Grass & grasslike (GG)	0.1	10			2	200	0.1	1

Scientific Name	Common Name	Exotic	HTW	BAM Growth Form Group	Plot 1		Plot 2		Plot 3		Plot 4	
					C	A	C	A	C	A	C	A
Panicum simile	Two-colour Panic			Grass & grasslike (GG)	0.1	5						
Paspalidium distans				Grass & grasslike (GG)	1	100						
Patersonia sericea	Silky Purple-Flag			Forb (FG)			0.1	2				
Persoonia linearis	Narrow-leaved Geebung			Shrub (SG)			0.3	5	3	10	0.2	2
Phyllanthus hirtellus	Thyme Spurge			Shrub (SG)			0.3	30				
Pimelea linifolia	Slender Rice Flower			Shrub (SG)			0.1	2				
Pittosporum undulatum	Sweet Pittosporum			Shrub (SG)	10	40	0.1	5	3	4	0.1	3
Platysace linearifolia				Shrub (SG)					0.3	5		
Poa affinis				Grass & grasslike (GG)					10	1000		
Polyscias sambucifolia	Elderberry Panax			Shrub (SG)	1	5			1	3		
Pomaderris intermedia				Shrub (SG)					2	15		
Pomax umbellata	Pomax			Forb (FG)	0.1	3						
Pseuderanthemum variabile	Pastel Flower			Forb (FG)					0.1	10		
Pteridium esculentum	Bracken			Fern (EG)					3	40		
Pterostylis nutans	Nodding Greenhood			Forb (FG)					0.2	50		

Scientific Name	Common Name	Exotic	HTW	BAM Growth Form Group	Plot 1		Plot 2		Plot 3		Plot 4	
					C	A	C	A	C	A	C	A
Ptilothrix deusta				Grass & grasslike (GG)			15	1500			10	1000
Pultenaea flexilis				Shrub (SG)					0.2	10		
Scaevola ramosissima	Purple Fan-flower			Forb (FG)			0.1	1				
Schoenus apogon	Fluke Bogrush			Grass & grasslike (GG)			0.1	3				
Schoenus melanostachys				Grass & grasslike (GG)			2	50	10	300		
Senecio hispidulus	Hill Fireweed			Forb (FG)	0.2	4						
Smilax australis	Lawyer Vine			Other (OG)					0.2	10		
Stylidium lineare	Narrow-leaved Triggerplant			Forb (FG)					25	4		
Syncarpia glomulifera	Turpentine			Tree (TG)	35	13						
Themeda triandra				Grass & grasslike (GG)	15	1500			10	1000		
Veronica plebeia	Trailing Speedwell			Forb (FG)	0.1	5					0.1	5
Xanthorrhoea media				Other (OG)			1	10				
Xanthosia tridentata	Rock Xanthosia			Forb (FG)			0.2	10				
Andropogon virginicus	Whisky Grass	*	Yes				0.5	30			0.5	30
Araujia sericifera	Moth Vine	*	Yes		0.1	1						
Bidens pilosa	Cobbler's Pegs	*	Yes									
Billardiera heterophylla	Purple Appleberry	*					0.1	5	0.1	10	0.1	5

Scientific Name	Common Name	Exotic	HTW	BAM Growth Form Group	Plot 1		Plot 2		Plot 3		Plot 4	
					C	A	C	A	C	A	C	A
Cinnamomum camphora	Camphor Laurel	*	Yes		0.1	1						
Conyza sumatrensis	Tall fleabane	*									0.1	2
Ehrharta erecta	Panic Veldtgrass	*	Yes		0.2	30			0.1	2		
Facelis retusa		*			0.1	4						
Gamochaeta americana	Purple Cudweed	*									0.1	1
Hypochaeris radicata	Catsear	*			0.1	3						
Ligustrum sinense	Small-leaved Privet	*	Yes		0.2	20			0.1	2		
Murraya paniculata		*			0.1	1						
Senecio madagascariensis	Fireweed	*	Yes		0.1	2					0.1	3
Setaria parviflora		*			1	100						

C=% cover, A=abundance, HTW=High Threat Weed under BAM

Table 8 Flora species list from rapid-point assessments S01-S09

	Site								
Stratum	**S01**	**S02**	**S03**	**S04**	**S05**	**S06**	**S07**	**S08**	**S09**
Canopy/ Midstorey	*Syncarpia glomulifera*	*Eucalyptus globoidea*	*Eucalyptus racemosa*	*Eucalyptus globoidea*	*Syncarpia glomulifera*	*Angophora costata*	*Melaleuca linariifolia*	*Eucalyptus racemosa*	*Melaleuca bracteata*
	Eucalyptus punctata	*Eucalyptus punctata*	*Eucalyptus resinifera*	*Syncarpia glomulifera*	*Eucalyptus racemosa*	*Syncarpia glomulifera*	*Eucalyptus globoidea*	*Corymbia eximia*	*Acacia decurrens*
	Jacaranda mimosifolia	*Angophora costata*			*Eucalyptus globoidea*		*Syncarpia glomulifera*	*Corymbia gummifera*	*Casuarina glauca*
	Allocasuarina littoralis	*Corymbia gummifera*			*Eucalyptus punctata*			*Eucalyptus sparsifolia*	*Callistemon viminalis*
	Acacia parramattensis	*Angophora bakeri*	*Acacia parramattensis*	*Acacia parramattensis*	*Pittosporum undulatum*	*Allocasuarina littoralis*		*Pittosporum undulatum*	*Kunzea ambigua*
	Pittosporum undulatum	*Acacia parramattensis*		*Allocasuarina littoralis*	*Acacia parramattensis*	*Pittosporum undulatum*		*Acacia implexa*	
	Acacia implexa			*Pittosporum undulatum*	*Allocasuarina littoralis*	*Allocasuarina torulosa*		*Persoonia levis*	
						Acacia implexa		*Elaeocarpus reticulatus*	
	Olea europaea subsp. cuspidata			*Bursaria spinosa*	*Breynia oblongifolia*			*Banksia oblongifolia*	*Callistemon citrinus*
					Bursaria spinosa			*Lambertia formosa*	*Cyathea cooperi*
					Polyscias sambucifolia			*Polyscias sambucifolia*	*Breynia oblongifolia*

	Site								
Stratum	**S01**	**S02**	**S03**	**S04**	**S05**	**S06**	**S07**	**S08**	**S09**
								Acacia longifolia subsp. longifolia	*Pittosporum undulatum*
Ground Covers	*Eragrostis curvula*	*Themeda triandra*		*Aristida vagans*	*Themeda triandra*			*Cyathochaeta diandra*	*Lomandra longifolia*
	Einadia hastata	*Microlaena stipoides var. stipoides*		*Microlaena stipoides var. stipoides*	*Lepidosperma laterale*			*Pteridium esculentum*	*Carex appressa*
		Lomandra longifolia		*Rytidosperma racemosum*	*Imperata cylindrica*			*Lomandra longifolia*	*Geranium homeanum*
		Dianella caerulea var. producta		*Cyperus gracilis*	*Microlaena stipoides var. stipoides*			*Microlaena stipoides var. stipoides*	*Ficinia nodosa*
		Hardenbergia violacea		*Hardenbergia violacea*	*Cheilanthes sieberi*				
		Glycine tabacina		*Lomandra multiflora subsp. multiflora*	*Lomandra longifolia*				
				Goodenia hederacea	*Dianella revoluta*				

	Site								
Stratum	**S01**	**S02**	**S03**	**S04**	**S05**	**S06**	**S07**	**S08**	**S09**
					Dianella caerulea var. producta				

Table 9 Flora species list from rapid-point assessments S10-S17 (no S14)

	Site						
Stratum	**S10**	**S11**	**S12**	**S13**	**S15**	**S16**	**S17**
Canopy/ Midstorey	*Eucalyptus racemosa*	*Corymbia gummifera*	*Corymbia gummifera*	*Syncarpia glomulifera*	*Eucalyptus piperita*	*Eucalyptus racemosa*	*Eucalyptus saligna*
	Eucalyptus resinifera	*Eucalyptus sparsifolia*	*Corymbia eximia*	*Angophora costata*	*Angophora costata*	*Angophora hispida*	*Eucalyptus pilularis*
	Corymbia eximia	*Corymbia eximia*	*Eucalyptus racemosa*		*Corymbia eximia*	*Banksia serrata*	*Eucalyptus eximia*
	Acacia elata	*Eucalyptus punctata*	*Eucalyptus punctata*		*Syncarpia glomulifera*	*Corymbia gummifera*	*Eucalyptus racemosa*
	Eucalyptus punctata		*Acacia parramattensis*	*Pittosporum undulatum*	*Ceratopetalum gummiferum*	*Corymbia eximia*	*Pittosporum undulatum*
	Acacia implexa		*Banksia serrata*	*Ceratopetalum gummiferum*	*Hakea sericea*	*Leptospermum trinervium*	*Acacia parramattensis*
	Banksia serrata		*Pittosporum undulatum*	*Acacia parramattensis*	*Acacia floribunda*		*Trema aspera*
	Pittosporum undulatum			*Banksia serrata*			*Eucalyptus piperita*
	Banksia spinulosa		*Hakea sericea*	*Persoonia linearis*	*Leptospermum trinervium*	*Acacia ulicifolia*	*Ozothamnus diosmifolius*
			Leucopogon muticus	*Ozothamnus diosmifolius*	*Persoonia linearis*	*Boronia ledifolia*	*Solanum prinophyllum*
			Banksia spinulosa		*Leptospermum polygalifolium subsp. cismontanum*	*Lambertia formosa*	*Polyscias sambucifolia*

	Site						
Stratum	**S10**	**S11**	**S12**	**S13**	**S15**	**S16**	**S17**
			Leptospermum polygalifolium		*Banksia spinulosa*	*Epacris pulchella*	*Breynia oblongifolia*
					Platysace linearifolia	*Banksia oblongifolia*	
Ground Covers	*Imperata cylindrica*		*Lomandra longifolia*	*Lomandra longifolia*	*Lomandra longifolia*	*Cyathochaeta diandra*	*Microlaena stipoides var. stipoides*
	Lomandra longifolia		*Imperata cylindrica*	*Pteridium esculentum*	*Anisopogon avenaceus*	*Anisopogon avenaceus*	*Lomandra longifolia*
	Dianella caerulea var. producta		*Entolasia stricta*	*Entolasia stricta*	*Lomandra obliqua*	*Actinotus minor*	*Oplismenus aemulus*
			Cyathochaeta diandra	*Microlaena stipoides var. stipoides*		*Lepyrodia scariosa*	*Dianella caerulea var. producta*
	Smilax glyciphylla		*Smilax glyciphylla*	*Dianella caerulea var. producta*	*Xanthorrhoea arborea*	*Cassytha glabella*	*Glycine microphylla*
			Cassytha pubescens		*Pteridium esculentum*	*Lomandra obliqua*	
			Xanthorrhoea arborea		*Calochlaena dubia*		
			Pteridium esculentum			*Ptilothrix deusta*	

APPENDIX B :

Fauna Species List

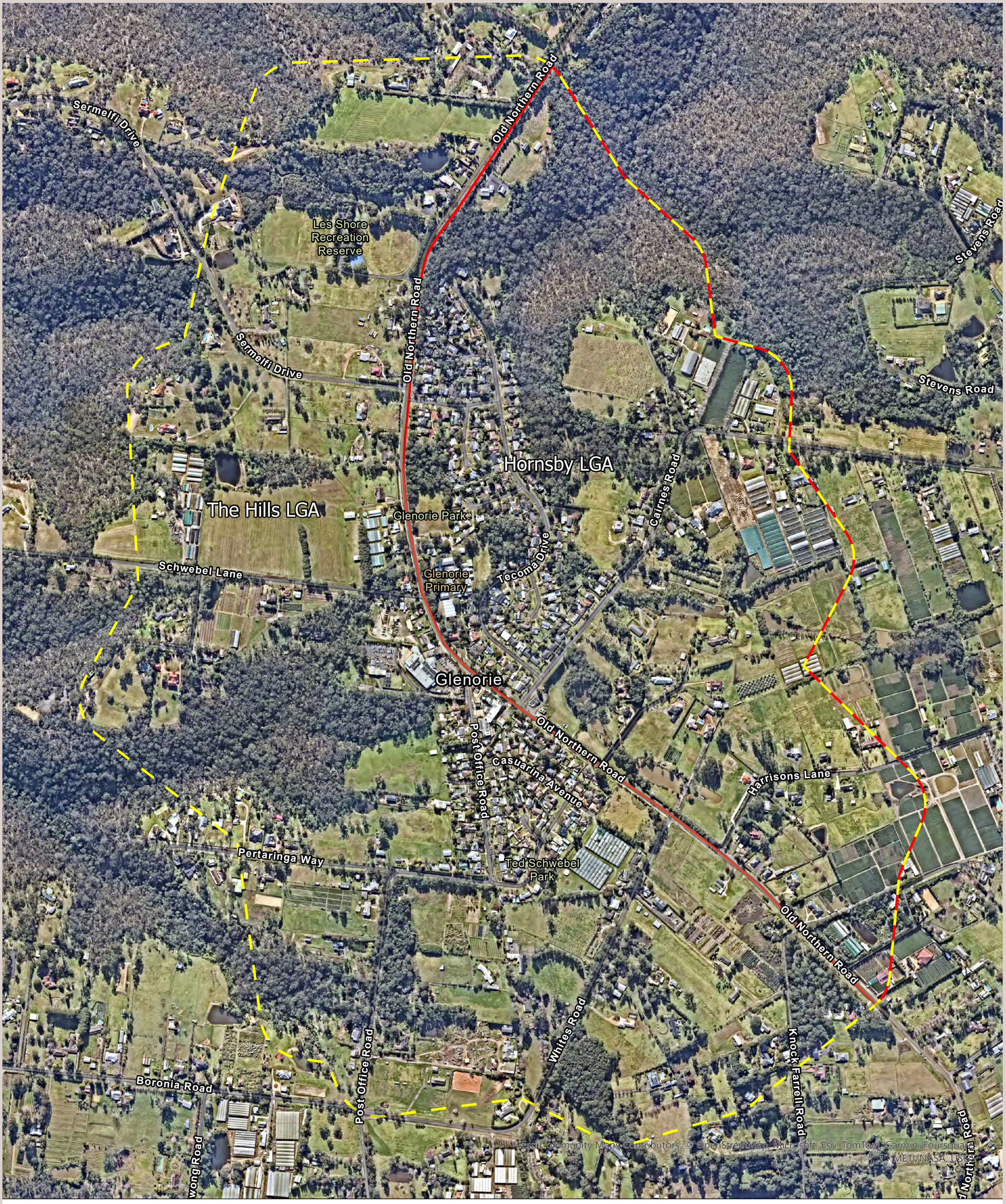
Table 10 Fauna species recorded

Common Name	Scientific Name	Introduced	BC Act Status	EPBC Act Status
Amphibians				
Common Eastern Froglet	*Crinia Signifera*			
Aves				
Australian Brush-turkey	*Alectura lathami*			
Australian Magpie	*Cracticus tibicen*			
Australian Magpie-lark	*Grallina cyanoleuca*			
Australian Raven	*Corvus coronoides*			
Australian Wood Duck	*Chenonetta jubata*			
Brown Cuckoo Dove	*Macropygia amboinensis*			
Brown Thornbill	*Acanthiza pusilla*			
Common Bronzewing	*Phaps chalcoptera*			
Common Starling	*Sturnus vulgaris*	*		
Crested Pigeon	*Ocyphaps lophotes*			
Crimson Rosella	*Platycercus elegans*			
Eastern Rosella	*Platycercus eximius*			
Eastern Spinebill	*Acanthorhynchus tenuirostris*			
Eastern Whipbird	*Psophodes olivaceus*			
Flame Robin	*Petroica phoenicea*		V	
Galah	*Eolophus roseicapillus*			
Grey Butcherbird	*Cracticus torquatus*			
Grey Fantail	*Rhipidura albiscapa*			
Grey Shrike-thrush	*Colluricincla harmonica*			
Indian Myna	*Sturnus tristis*	*		
Laughing Kookaburra	*Dacelo novaeguineae*			
Lewins Honeyeater	*Meliphaga lewinii*			
Little Corella	*Cacatua sanguinea*			
Little Wattlebird	*Anthochaera chrysoptera*			
Masked Lapwing	*Vanellus miles*			
Noisy Miner	*Manorina melanocephala*			
Pacific Black Duck	*Anas superciliosa*			
Pied Currawong	*Strepera graculina*			
Rainbow Lorikeet	*Trichoglossus haematodus*			
Red-browed Finch	*Neochmia temporalis*			

Common Name	Scientific Name	Introduced	BC Act Status	EPBC Act Status
Spotted Pardalote	*Pardalotus punctatus*			
Striated Pardalote	*Pardalotus striatus*			
Sulphur-crested Cockatoo	*Cacatua galerita*			
Superb Fairy-wren	*Malurus cyaneus*			
Welcome Swallow	*Hirundo neoxena*			
White-throated Treecreeper	*Cormobates leucophaea*			
Willie Wagtail	*Rhipidura leucophrys*			
Yellow Thornbill	*Acanthiza nana*			
Yellow-tailed Black Cockatoo	*Calyptorhynchus funereus*			
Mammals				
European Rabbit	*Oryctolagus cuniculus*	*		
Swamp Wallaby	*Wallabia bicolor*			

V=Vulnerable

FIGURES



Legend

- Subject Land
- Study Area (Approximate Indicative Broader Investigation Area)

Image Source: Nearmap © (2024) Dated: 26/6/2024
Data Source: Sixmaps Clip & Ship, DCS Spatial Services
NSW Department of Customer Services

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Spatial Reference: GDA 1994 MGA Zone 56

0 50 100 200 300 400 m

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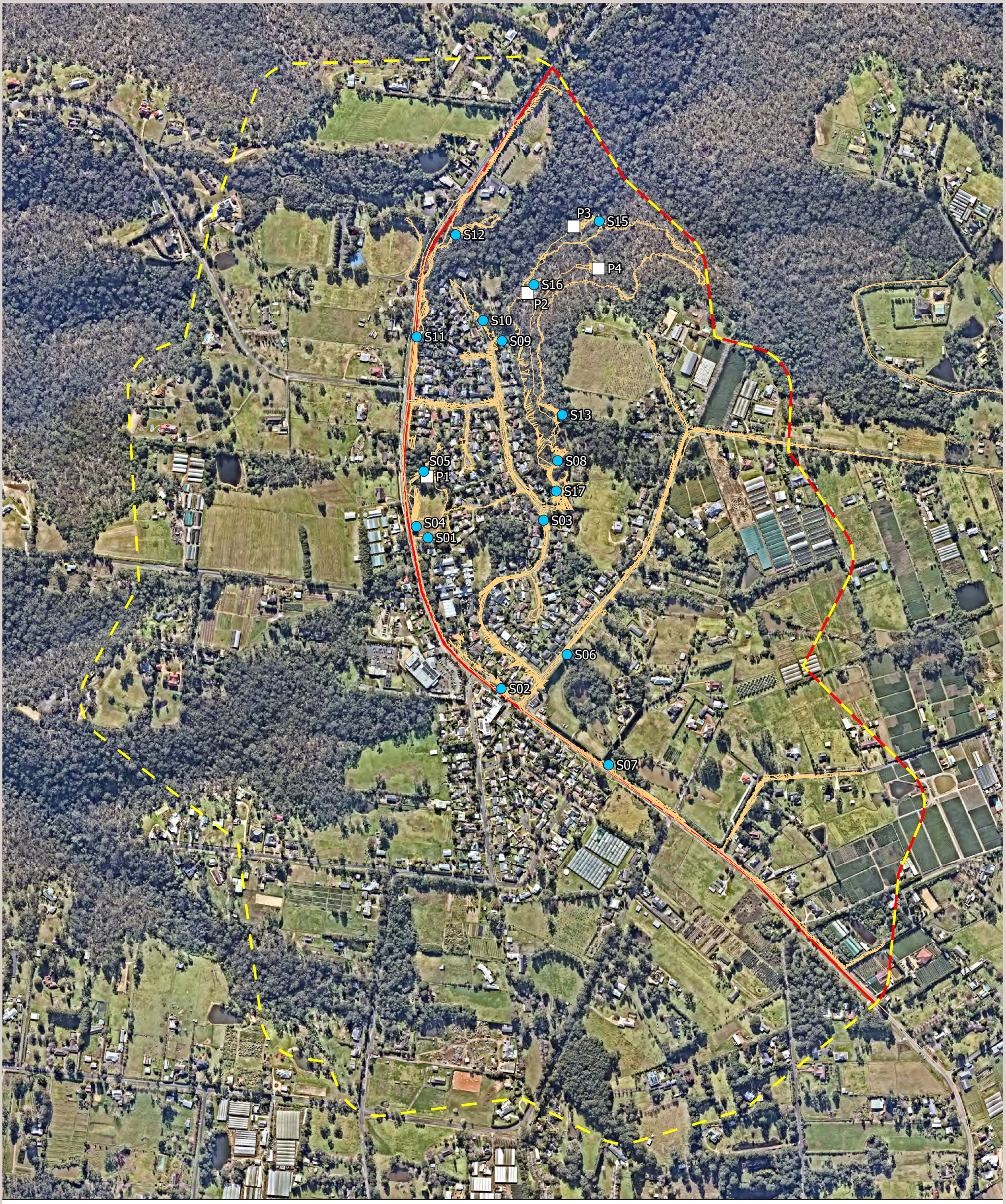
Figure 1. Location of the Subject Land and Study Area



Legend

- Subject Land
- Study Area (Approximate Indicative Broader Investigation Area)
- Survey Tracks
- BAM 20 x 20m Floristic Plots
- Rapid-point Assessments

Image Source: Nearmap © (2024) Dated: 26/6/2024
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Figure 2. Survey locations

Legend

- Subject Land
- Study Area (Approximate Indicative Broader Investigation Area)
- Biodiversity Values Mapping
- Terrestrial Biodiversity
- Key Fish Habitat

Stream Order

- 1st Order Stream
- 2nd Order Stream
- Watercourse Buffers

Image Source: Nearmap © (2024) Dated: 26/6/2024
Data Source:
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0 50 100 200 300 400 m

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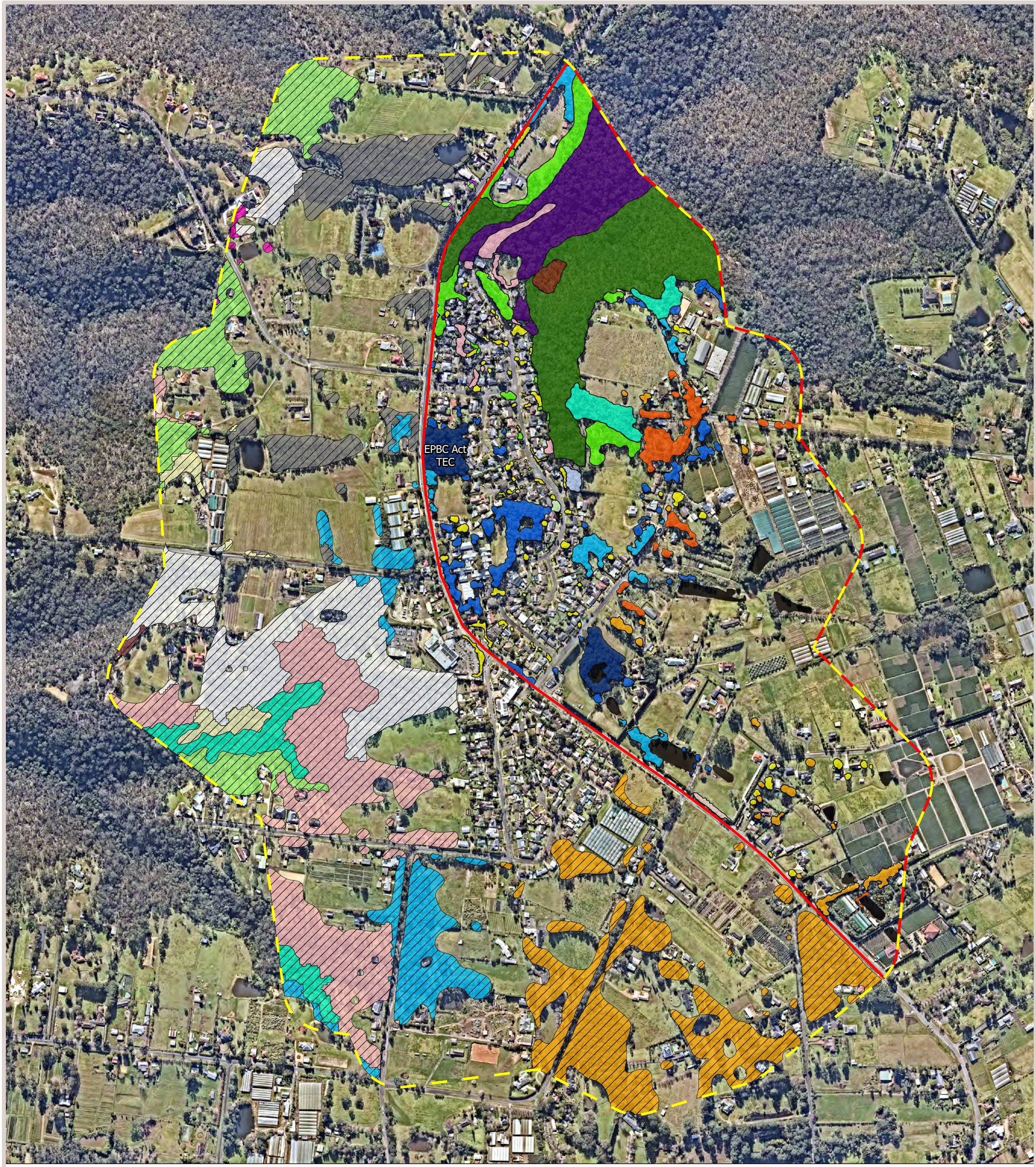
Figure 3. BV mapping, watercourses and associated buffers, key fish habitat and LEP terrestrial biodiversity mapping



Legend

- Subject Land
- Study Area (Approximate Indicative Broader Investigation Area)

Plant Community Type (CE)

- PCT 3136 (Canopy Only) (CEEC BC Act)
- PCT 3136 (Some native understorey) (CEEC BC Act)
- PCT 3136 (Regrowth and weeds)
- PCT 3176 (Intact)
- PCT 3262 (Intact) (CEEC BC Act)
- PCT 3262 (Canopy Only) (CEEC BC Act)
- PCT 3262 (Some native understorey) (CEEC BC Act)
- PCT 3262 (Weedy understorey) (CEEC BC Act)
- PCT 3586 (Intact)
- PCT 3593 (Intact)
- PCT 3593 (Canopy Only)
- PCT 3593 (Some native understorey)
- PCT 3621 (Intact)
- PCT 3621 (Some native understorey)
- Planted Native
- Dams

Plant Community Type (DCCEEW)

- PCT 3111
- PCT 3136
- PCT 3176
- PCT 3262
- PCT 3321
- PCT 3448
- PCT 3586
- PCT 3592
- PCT 3593
- PCT 3616
- PCT 3621
- PCT 3622

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Spatial Reference: GDA 1994 MGA Zone 56

0 50 100 200 300 400 m

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Figure 4. Vegetation mapping of the Subject Land and Study Area

Legend

Subject Land

Study Area (Approximate Indicative Broader Investigation Area)

Constraint Category

High

Moderate

Low

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Data Source:
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Council (2024)

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Spatial Reference: GDA 1994 MGA Zone 56

0 50 100 200 300 400 m

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Figure 5. Ecological constraints mapping (High, Moderate, Low)