# Kiama West Planning Proposal Biodiversity Technical Study

## Ocean Farm Property Trust

ecological AUSTRALIA
A TETRA TECH COMPANY

1300 646 131
www.ecoaus.com.au

## DOCUMENT TRACKING

| | |
|---|---|
| **Project Name** | Kiama West Planning Proposal Biodiversity Technical Study |
| **Project Number** | 22WOL_2840 |
| **Project Manager** | Bethany Lavers |
| **Prepared by** | Joseph Gleeson |
| **Reviewed by** | Meredith Henderson / Ian Dixon |
| **Approved by** | Meredith Henderson / Deanne Hickey |
| **Status** | **Final** |
| **Version Number** | **1** |
| **Last saved on** | **8 December 2023** |

This report should be cited as 'Eco Logical Australia 2022. *Kiama West Planning Proposal Biodiversity Technical Study*. Prepared for Ocean Farm Property Trust.'

### ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from Traders In Purple Pty Ltd.



Template 2.8.1

# Contents

# List of Figures



# List of Tables



# Abbreviations

| Abbreviation | Description |
|---|---|
| BAM | Biodiversity Assessment Method |
| BC Act | *Biodiversity Conservation Act 2016* (NSW) |
| BDAR | Biodiversity Development Assessment Report |
| BOS | Biodiversity Offset Scheme |
| BV Map | Biodiversity Values Map |
| CEEC | Critically Endangered Ecological Community |

| Abbreviation | Description |
|---|---|
| DCP | Development Control Plan |
| DBH | Diameter at Breast Height |
| DPI | Department of Industries |
| DDP | Dam De-watering Plan |
| DPE | Department of Planning and Environment |
| EEC | Endangered Ecological Community |
| ELA | Eco Logical Australia Pty Ltd |
| EP&A Act | *Environmental Planning and Assessment Act 1979* (NSW) |
| EPBC Act | *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) |
| FM Act | *Fisheries Management Act 1994* |
| HBT | Hollow-bearing Tree |
| LEP | Local Environmental Plan |
| LGA | Local Government Area |
| MNES | Matters of National Environmental Significance |
| NRAR | Natural Resources Access Regulator |
| PCT | Plant Community Type |
| RSWMP | Regional Strategic Weed Management Plans |
| SAII | Serious and Irreversible Impacts |
| SEPP | State Environmental Planning Policy |
| TEC | Threatened Ecological Community |
| VMP | Vegetation Management Plan |
| WM Act | *Water Management Act 2000* |

# Executive Summary

Eco Logical Australia Pty Ltd (ELA) was engaged by Ocean Farm Property Trust to prepare a Biodiversity Technical Study to support a Planning Proposal for an area of land approximately 121 hectares in area, immediately west of Kiama.

Ocean Farm Property Trust are proposing to submit a planning proposal to rezone the land at the following properties west of Kiama NSW: 103 Jamberoo Road Kiama, 33 Greyleigh Drive Kiama and 177 Long Brush Road Jerrara (the study area). The proposal is to rezone the site from RU2 Rural Landscape to a variety of new land use zones including residential (R2, R3 and R5), recreational (RE1), special purpose (SP4) and conservation (C2). This biodiversity constraints assessment was prepared to support the planning proposal and identify the constraints for future development.

This report outlines the terrestrial and riparian ecological constraints across the study area. This includes information relating to relevant environmental planning instruments, threatened species and ecological communities, entry requirements into the Biodiversity Offset Scheme (BOS) and implications this scheme could have for future development.

A desktop review and field survey were undertaken of the study area to identify ecological constraints. The desktop review identified applicable planning instruments, past land use, previous vegetation mapping and records of threatened species previously recorded within and surrounding the study area.

The field survey included validation of previous vegetation mapping, identification of Plant Community Types (PCTs) and vegetation condition zones, as well as fauna habitat assessments.

The study area is a mix of cleared land and remnant subtropical rainforest and Melaleuca Forest. Two Plant Community Types (PCTs) occur within the study area which both correspond to threatened ecological communities (TECs):

- PCT 3013 *Illawarra Lowland Subtropical Rainforest* which corresponds with *Illawarra Subtropical Rainforest in the Sydney Basin Bioregion*, listed as an Endangered Ecological Community (EEC) under the *Biodiversity Conservation Act 2016* (BC Act), as described in the Final Determination (DPE 2020). PCT 3013 also corresponds to a critically endangered ecological community listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), known as *Illawarra–Shoalhaven subtropical rainforest of the Sydney Basin Bioregion*.
- PCT 3872 *Illawarra Basalt Melaleuca Scrub* which corresponds with *Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion*, listed as critically endangered under the BC Act.

PCT 3013 in moderate and good condition within the study area meets the minimum requirements for a vegetation patch to correspond with the EPBC Act definition and is therefore *Illawarra-Shoalhaven Subtropical Rainforest in the Sydney Basin Bioregion* as listed under the EPBC Act.

The field survey also found an abundance of *Zieria granulata* throughout the study area which is listed as endangered under the BC Act and EPBC Act.

While no threatened fauna species were identified during the field survey, several habitat features were identified that would provide habitat for a number of threatened species.

Based off the current layout, the Planning Proposal would result in the removal of 3.44 ha of remnant native vegetation (PCTs). The proposal will retain 16.08 ha of native remnant vegetation within the study area. The study area included several high constraints that would need to be considered for any future development with approval of the rezoning application. High constraints within the study area include threatened ecological communities, threatened flora species (*Zieria granulata*), potential habitat for threatened fauna, Serious and Irreversible Impact (SAII) entities and areas mapped on the NSW Department of Planning and Environment's (DPE) Biodiversity Values (BV) Map. Impacts on these features may trigger the NSW Biodiversity Offsets Scheme (BOS), for which assessment using the Biodiversity Assessment Method (BAM) and preparation of a Biodiversity Development Assessment Report (BDAR) would be required. Any residual unavoidable impacts would be required to be offset.

Illawarra Subtropical Rainforest and *Melaleuca armillaris* Tall Shrubland within the study area are listed as SAII entities. Thus, Council at the DA stage must form an opinion as to whether the proposed impacts (direct and indirect) to the community would constitute SAII. If Council determines the impacts to be SAII, it must refuse the DA.

There are areas mapped to have low and moderate constraints that could achieve a better outcome. These areas comprise exotic vegetation and cleared land and existing dwellings and infrastructure.

Spring Creek and 11 of its tributaries traverse the length of the study area, with Strahler Stream Orders ranging from 1-4. Any future development on waterfront land (within 40 m of a watercourse) would require a Controlled Activity Approval and Vegetation Management Plan (VMP) to improve riparian vegetation as much as practical, as prescribed by the Department of Planning and Environment - Water (DPE). Based on the current layout, it is likely a Controlled Activity Approval would be required along Spring Creek and its tributaries, and a VMP (or a number of VMPs) would need to be prepared to guide the restoration of native vegetation within the corridor.

# 1. Introduction

## 1.1. Background

Eco Logical Australia Pty Ltd (ELA) was engaged by Ocean Farm Property Trust to prepare a Biodiversity Constraints Assessment to support a Planning Proposal for an area of land approximately 121 hectares in area, immediately west of Kiama (study area) (Figure 1). The objective of the Planning Proposal is to rezone the study area from RU2 Rural Landscape to a variety of new land use zones including residential (R2, R3 and R5), recreational (RE1), special purpose (SP4) and conservation (C2). The following properties are included in the study area:

103 Jamberoo Road, Kiama:

- Lot 187 DP751279
- Lot 102 DP1176643

33 Greyleigh Drive Kiama:

- Lots 156, 183, 185, 186, 188 and 189 DP 751279
- Lot 1 DP 995058
- Lot 1 DP 1003719
- Lot 1320 DP 1060995
- Lot 2 DP 1135218
- Lot 1 DP 1178500

177 Long Brush Road, Jerrara:

- Lot 201 DP 1148007.

The study area currently has a range of land uses including rural industry, rural living and a small hospitality business. The current land use zoning within the study area is RU2 Rural Landscape within the cleared paddocks and C2 Environmental Conservation and C3 Environmental management along Spring Creek consistent with the Kiama Local Environment Plan (LEP) (Figure 2). The land surrounding the study area to the north, west and south is a mix of rural industry and rural living. Kiama residential land is present along the eastern boundary. Jamberoo Road traverses the northern boundary of the study area (Figure 1).

Key spatial terms used in this report are:

- *Subject site*: the area proposed to be directly affected by the proposal.
- *Study area*: the area proposed for rezoning as provided by Ocean Farm Property Trust (the lot boundaries of the properties listed above).

Areas outside of the subject site will retain their current land zoning under the Kiama LEP.

## 1.2. Purpose

This report outlines the terrestrial and riparian ecological constraints across the study area. This includes information relating to relevant environmental planning instruments, threatened species and ecological

communities, entry requirements into the Biodiversity Offset Scheme (BOS) and implications of the scheme on future development.

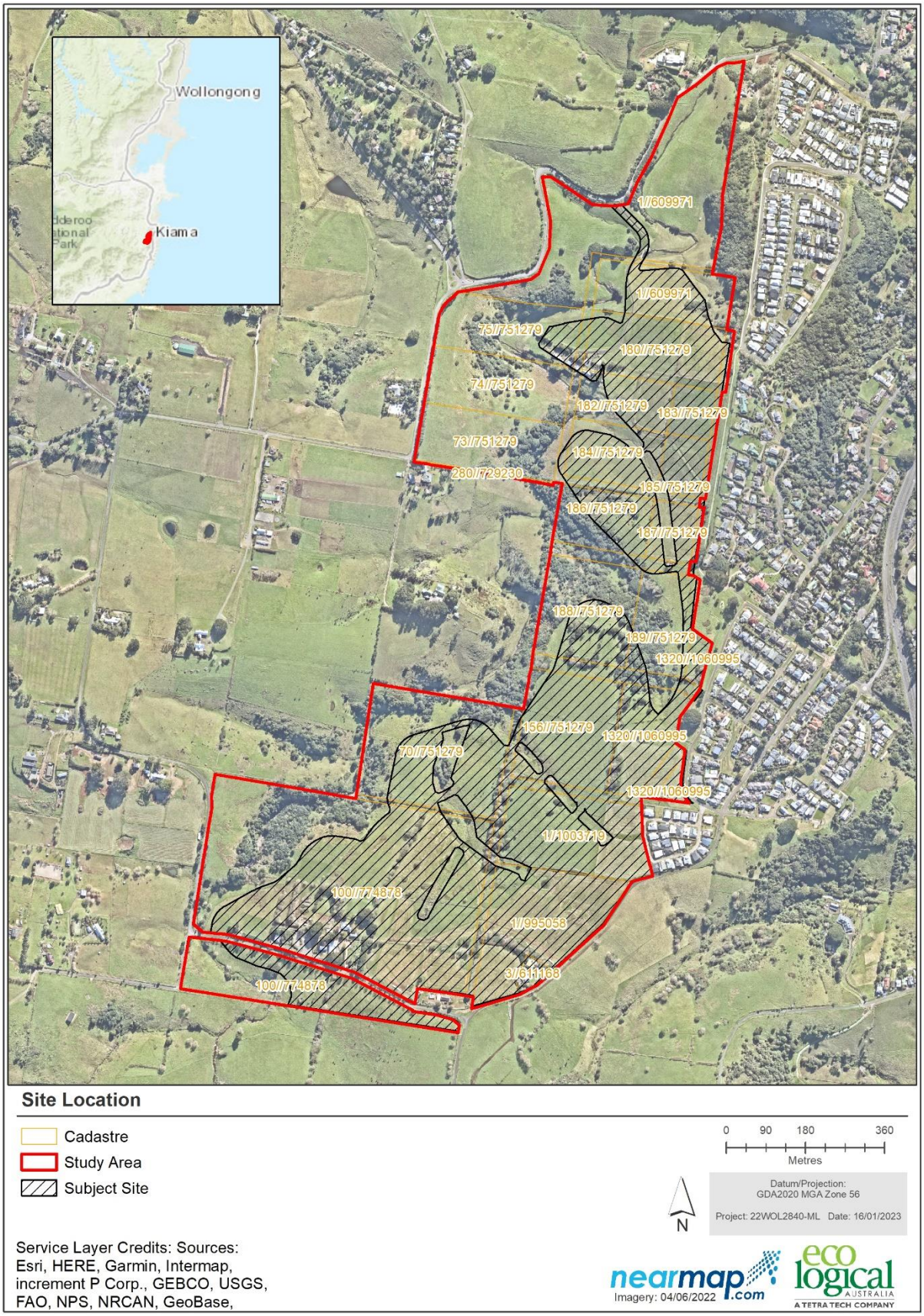



**Figure 1: Location of the study area**

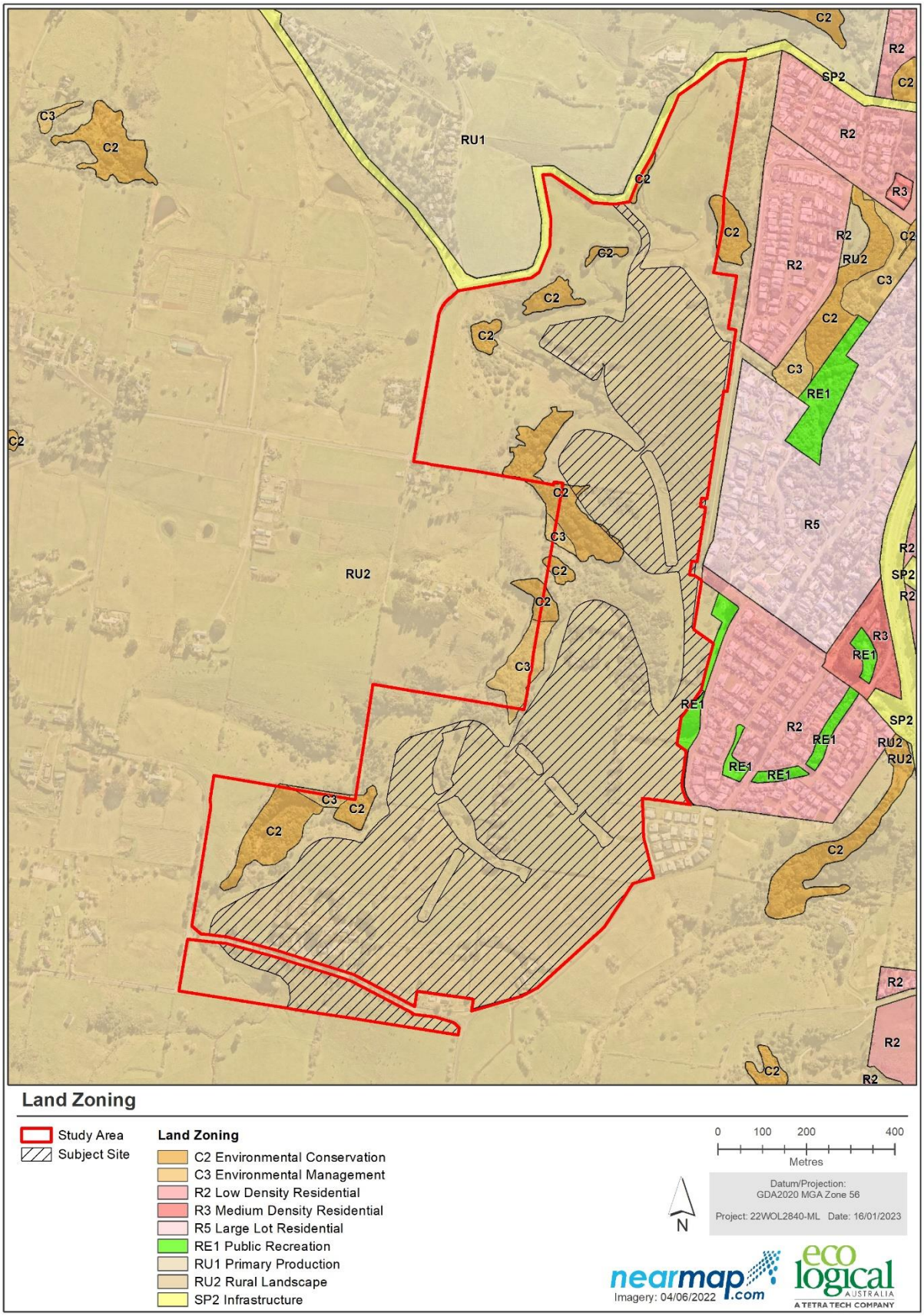



**Figure 2: Current land use zoning**

# 2. Legislative context

**Table 1: Legislation relevant to the study area**

| Name | Relevance to the project |
|---|---|
| **Commonwealth** | |
| ***Environment Protection and Biodiversity Conservation Act 1999*** **(EPBC Act)** | The EPBC Act aims to protect Matters of National Environmental Significance (MNES) including wetlands of international importance, threatened species and communities and listed migratory species. An action that may or is likely to have a significant impact on MNES should be referred to the Commonwealth to determine whether it is a Controlled Action that requires approval from the Commonwealth.<br>The MNES that have been considered during this assessment are:<br>• Listed threatened species and communities<br>• Listed migratory species.<br>Depending on the scale of impacts to MNES listed under the EPBC Act, future development may require a referral under the EPBC Act. MNES of particular relevance include Illawarra-Shoalhaven Subtropical Rainforest TEC and *Zieria granulata* within the study area. |
| **State** | |
| ***Environmental Planning and Assessment Act 1979*** **(EP&A Act)** | The *Environmental Planning and Assessment Act 1979* (EP&A Act) is the principal planning legislation for NSW. It provides a framework for the overall environmental planning and assessment of development proposals. This Act provides for the creation of State Environmental Planning Policies (SEPPs), Local Environmental Plans (LEPs) and Development Control Plans (DCPs).<br>If an LEP is to be amended (e.g., to change the zoning of land), the change is made through the preparation of a planning proposal. The planning proposal explains the intent of the proposed changes and the justification for the LEP amendments. This is required, for example, when a council has endorsed and seeks to implement and give effect to its local housing or employment land strategy.<br>Planning proposals are assessed under Part 3 of the EP&A Act. It is typical for planning proposals to consider whether the future development would require entry into the Biodiversity Offset Scheme (BOS). More information on this is discussed below. |
| ***Biodiversity Conservation Act 2016*** **(BC Act)** | The BC Act outlines the assessment requirements to determine whether a proposed development (under Part 4 of the EP&A Act) is likely to significantly affect threatened species or ecological communities, or their habitats under section 7.3, and whether the Biodiversity Offsets Scheme (BOS) will be triggered.<br>It is an expectation of many local Councils that these impacts be considered in planning proposals (under Part 3 of the EP&A Act) so that the decision maker can be adequately informed of the proposed impacts of the change in land use.<br>For future development, works that exceed the BOS thresholds as set out in Part 7 of the Act and Part 7 of the *Biodiversity Conservation Regulation 2017* (BC Regulation), are required to undertake the ecological assessment in accordance with the Biodiversity Assessment Method (BAM), including the preparation of a Biodiversity Development Assessment Report (BDAR).<br>The triggers to enter the BOS include:<br>• Clearing of native vegetation above the area threshold permitted for the minimum lot size<br>i. <0.25 clearing threshold (for a minimum lot size of less than 1 ha)<br>ii. <0.5 ha clearing threshold (for a minimum lot size of 1 ha to less than 40 ha)<br>• Affecting land that is mapped as having high biodiversity value on the Biodiversity Values (BV) map |

| Name | Relevance to the project |
|---|---|
| | • If the development is determined to have a significant impact on any threatened flora, fauna or ecological communities determined through the application of s7.3 of the Act. |
| ***Biodiversity Conservation Regulation 2017*** | The Biodiversity Values Map (BV Map) identifies land with high biodiversity value, as defined by the *Biodiversity Conservation Regulation 2017*. The subject site intersects land identified on the BV Map however this intersection includes existing roads and therefore, the land has been previously disturbed and paved. Development outside of the existing disturbance footprint would trigger the BOS. |
| ***Fisheries Management Act 1994*** | The *Fisheries Management Act 1994* (FM Act) governs the management of fish and their habitat in NSW. The schedules of the Act list key threatening processes and threatened species which must be addressed at the DA stage. Development constraints for the study area in association with the FM Act are outlined in this report to identify potential aquatic biodiversity considerations for the proposed LEP change.<br>The FM Act regulates the provision of permits required in relation to harm of protected marine vegetation (seagrass, macroalgae, mangroves and saltmarsh), dredging, reclamation or obstruction of fish passage on or adjacent to Key Fish Habitat (KFH). This includes direct and indirect impacts, whether temporary or permanent.<br>The subject site crosses Spring Creek (KFH) at two locations at the northern and southern end of the study area for the purpose of road infrastructure. However, these creek crossings are existing. Therefore, these areas would not be considered new impacts within KFH. However, any proposed works that extend beyond the footprint of the existing roads (for example, road widening works) within KFH mapped areas would likely require consultation with Department of Primary Industries (DPI) Fisheries under s.199 of the FM Act. |
| ***Biosecurity Act 2015* (BS Act)** | The *Biosecurity Act 2015* provides a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers. Implementation of the Act for weeds is supported by Regional Strategic Weed Management Plans (RSWMP) developed for each region in NSW. Priority weeds and Weeds of National Significance (WoNS) within the study area are identified in this assessment to highlight potential weed management issues for the proposed LEP change. |
| ***Local Land Services Act 2013*** | The *Local Land Services Act 2013* (LLS Act) regulates the clearing of native vegetation on rural land but only when the activity is permitted without Council consent. Under Section 60o of the LLS Act, the clearing of vegetation is authorised by other legislation if it requires development consent under Part 4 of the EP&A Act. Furthermore, this report assesses the biodiversity constraints for a proposed LEP change and not for proposed development Thus, the LLS Act is not applicable to this proposal. |
| ***Water Management Act 2000*** | The main objective of the *Water Management Act 2000* (WM Act) is to manage NSW water in a sustainable and integrated manner that will benefit current generations without compromising future generations' ability to meet their needs. The WM Act is administered by the Natural Resources Access Regulator (NRAR) and establishes an approval regime for activities within waterfront land, defined as the land 40 m from the highest bank of a river, lake or estuary. A Controlled Activity Approval (CAA) is typically required for work within waterfront land. Development constraints for the study area in association with the WM Act are outlined in this report to identify potential riparian considerations for the proposed LEP change.<br>The study area contains waterfront land, as shown in Figure 7.<br>Any proposed development within waterfront land will require a Controlled Activity Approval (CAA) and integrated approval under the WM Act. Note that in some cases, 1st order watercourses can be treated as 'not waterfront land', following consultation with NRAR, particularly if there are no formed creeks banks and no creek bed. Watercourse validation has been conducted as part of this project. |

| Name | Relevance to the project |
|---|---|
| | At DA stage, any riparian areas that need to be retained will also require vegetated riparian zones (VRZ) either side of the stream, of widths according to their Strahler stream order:<br>• 1st order = 10m<br>• 2nd order = 20m<br>• 3rd order = 30m<br>• 4th order = 40m<br>The width of these VRZs is illustrated in Figure 7, in order for these to be considered in future development. |
| **Environmental Planning Instruments** | |
| **State Environmental Planning Policy (Biodiversity and Conservation) 2021** | This new State Environmental Planning Policy (SEPP) came into effect on March 1 2022 and among others has consolidated the following SEPPs:<br>• Sydney Drinking Water Catchment SEPP 2011 (now chapter 8)<br>• The Vegetation in Non-Rural Areas SEPP 2017 (now chapter 2)<br>• Koala Habitat Protection SEPP 2021 (SEPP KHP) (now chapter 4).<br>The study area is not mapped within the Sydney drinking water catchment and therefore this chapter of the SEPP does not apply.<br>The Vegetation in Non-Rural Areas SEPP 2017 aimed to protect the biodiversity values of trees and other vegetation in non-rural areas of the State, and to preserve the amenity of non-rural areas of the State through the preservation of trees and other vegetation. The provisions of this SEPP have been included in the Biodiversity and Conservation SEPP in Chapter 2. Chapter 2 applies to development that does not require consent. As any proposed future development would require consent from Kiama Municipal Council, the Vegetation SEPP is not relevant to the proposal.<br>Chapter 4: Koala Habitat Protection 2021 (SEPP KHP) contains the land-use planning and assessment framework for Koala habitat within the Metropolitan Sydney and Central Coast.<br>Chapter 4 aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline.<br>Kiama LGA is not listed in Schedule 2 of the Biodiversity and Conservation SEPP. Furthermore, this report assesses the biodiversity constraints for a proposed LEP change and not for proposed development. Therefore the Chapter 4 does not apply to the study area. |
| **State Environmental Planning Policy (Resilience and Hazards) *2021*** | The subject site is not located within land to which this SEPP applies. |
| **Kiama Local Environment Plan 2011 (LEP)** | The objective of the Planning Proposal is to rezone the study area from RU2 Rural Landscape to a variety of new land use zones including residential (R2, R3 and R5), recreational (RE1), special purpose (SP4) and conservation (C2). The future use of the land will need to adhere to the planning objectives for each land zone in accordance with the LEP.<br>Vegetation mapped as Terrestrial Biodiversity under Kiama LEP is located within the study area (Figure 3). Impacts to any vegetation mapped under this layer would need to address Clause 6.4 of the *Kiama Local Environmental Plan (LEP) 2011*. However, these areas are not within the subject site and will not be directly affected by the proposed land use change. |
| **Kiama Development Control Plan 2020 (DCP)** | The Kiama DCP contains provisions relating to native vegetation and riparian values under Chapter 3. |

# 3. Methodology

## 3.1. Desktop Assessment

A desktop assessment was undertaken to inform the field assessment. The following resources were consulted to inform this assessment:

- BioNet (Atlas of NSW Wildlife) database search (5 km) for threatened species, endangered populations listed under the BC Act (date)
- EPBC Act Protected Matters Search Tool (PMST) (5km) for Matters of Environmental Significance (MNES) listed under the EPBC Act (date)
- Collation of database results into a 'Likelihood of Occurrence Table'
- Review of applicable SEPPs
- NSW Government Biodiversity Values Mapping (date)
- State-wide Hydroline map of riparian corridors
- DPI Fisheries Spatial Portal for threatened species listed under the FM Act and Key Fish Habitat map
- Aerial photographs, topographical maps and GIS data systems
- NSW State Vegetation Type Map (DPE 2022)
- Kiama LEP 2011 and Kiama DCP 2020.

## 3.2. Field survey

The field survey was conducted on the 16, 18, 23, 24 and 30 August by ELA ecologists, Michael Gregor and Joseph Gleeson and Principal Ecologist Dr Meredith Henderson. The site inspection was conducted to:

- Validate existing vegetation mapping (OEH 2013), assign vegetation mapping to Plant Community Types (PCTs), determine the condition of PCTs present and assess whether they conform to any Threatened Ecological Communities (TECs).
- Identify habitat features for potential threatened flora and fauna species within the study area, including hollow bearing trees, woody debris, wetland areas or creek lines.
- Identify areas of potential aquatic habitat in watercourses and dams identified in the study area.

To assist in validating / determining the PCTs, boundaries and condition of the existing vegetation, a series of rapid assessments were conducted across the study area. These rapid assessments involved recording vegetation structure detail (stratum heights and covers) along with compositional detail, including dominant and indicative flora species within an approximate 20 m radius of a survey site chosen randomly within the vegetation zone. Other site detail was collected such as landscape position, slope, aspect, and soils, where relevant. These rapid assessment points, along with boundaries between different vegetation communities and conditions, were recorded in the field using the ArcGIS Field Maps app on a smart phone.

A total of eight full-floristic vegetation and vegetation integrity plots and were also surveyed to identify PCTs and to assess the composition, structure and function components of each vegetation zone in

accordance with the Biodiversity Assessment Method (BAM). The location of each plot is shown in Figure 7. All field data collected at full-floristic and vegetation integrity plots is included in Appendix B.

Important habitat features were also recorded using Field Maps, including detail on the type of feature (e.g. hollow bearing tree), extent / abundance of habitat feature, and other important details (e.g. tree species, height, diameter at breast height (DBH), height of lowest hollow).

No targeted threatened species surveys were undertaken.

# 4. Results

## 4.1. Desktop Assessment

### 4.1.1. Biodiversity mapping

Sensitive biodiversity mapped under the Biodiversity Values Map (BV Map) and natural resources mapped under Council's *Natural Resources - Terrestrial Biodiversity* mapping are shown on Figure 3. Spring Creek is mapped under the BV Map and the creek traversers through the study area from south to north (Figure 3).

The subject site intersects the BV map at two locations at the northern and southern end of the study area for the purpose of road infrastructure (Figure 3). However, these areas of intersection are existing roads that cross Spring Creek; namely, Long Brush Road in the southern section and a paved driveway accessing the dwelling at 103 Jamberoo Road Kiama in the northern section of the study area.

The subject site also intersects land mapped under Council's *Natural Resources – Terrestrial Biodiversity* mapping (Figure 3). The Planning Proposal to rezone the land would need to consider potential constraints under the Kiama LEP 2011. Any future biodiversity assessment prepared in support of a DA would need to address Section 6.4 of the LEP.

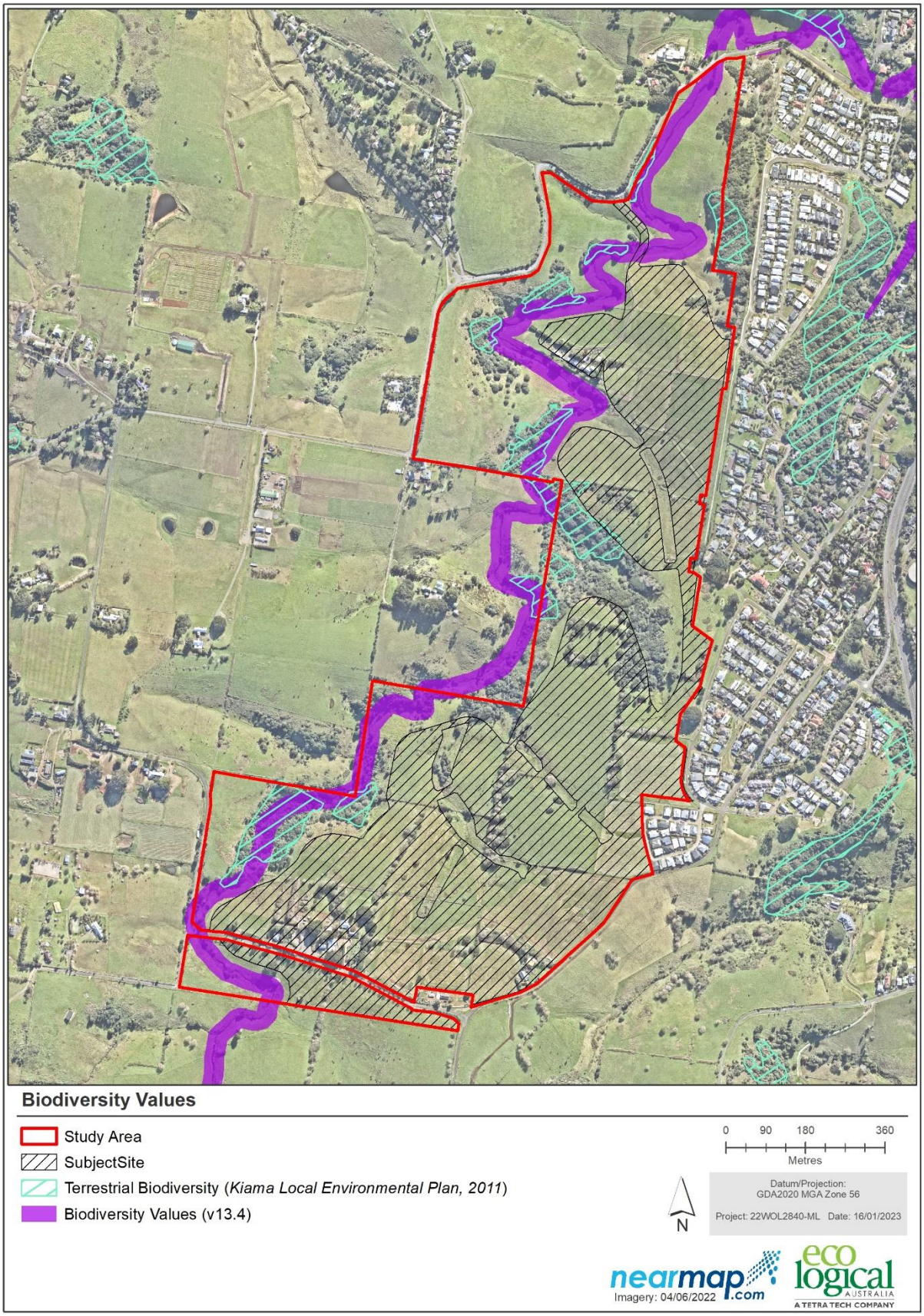



**Figure 3: Biodiversity Values Map (DPE 2022) and Terrestrial Biodiversity Mapping (KLEP)**

### 4.1.2. Vegetation communities

NSW State Vegetation Type mapping within the study area is shown in Figure 4 (VIS_ID DPE 2022). This shows four PCTs as occurring within the study area:

- PCT 3077 Illawarra Complex Dry Rainforest
- PCT 3872 Illawarra Basalt Melaleuca Scrub
- PCT 3013 Illawarra Lowland Subtropical Rainforest
- PCT 3153 Illawarra Escarpment Bangalay x Blue Gum Wet Forest

PCT 3872 is associated with a Threatened Ecological Community (TEC): *Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion,* which is listed as a Critically Endangered Ecological Community (CEEC) under the BC Act.

PCT 3013 and PCT 3077 are associated with the TEC: *Illawarra Subtropical Rainforest in the Sydney Basin Bioregion*, which is listed as Endangered Ecological Community (EEC) under the BC Act. It is also associated with the community *Illawarra – Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion* which is listed as a CEEC under the EPBC Act.

The Protected Matters Search Tool (PMST) identified eight TECs listed under the EPBC Act that could potentially occur within the 5 km area of the study area (Appendix A).

### 4.1.3. Threatened species records

The BioNet Atlas (DPE 2022a) and PMST searches (DCCEEW 2022a) identified a total of 81 threatened fauna species and 23 threatened flora species that were recorded within, or having the potential to occur within, a 5 km radius of the study area (full list in Appendix A). Of these, 15 fauna species and 4 flora species have records within 5 km radius of the study area (Figure 5 and Figure 6). Using this data, a Likelihood of Occurrence assessment was conducted (Appendix A). This assessment was used to inform the likelihood each species has of occurring within the study area.

Three threatened fauna records occur within the study area (Table 2), although there are multiple records within a 1 km radius for several species.

**Table 2: Threatened fauna recorded within the study area (source: Bionet)**

| Species | Common Name | Date | Count | Location |
|---|---|---|---|---|
| *Haliaeetus leucogaster* | White-bellied Sea Eagle | 2007 | 1 | Lot 1//609971 |
| *Dasyurus maculataus* | Spotted-tailed Quoll | 1980 | 1 | Lot 188//751279 |
| *Pteropus poliocephalus* | Grey-headed Flying Fox | 2018 | 1 | Lot 100//774878 |

Of the 81 threatened fauna species, 15 were assessed as having the potential to occur within the study area (Table 3). Species that were assessed as having potential to occur were those known to occur within the PCTs identified within the study area and for which there was suitable habitat within the study area.

**Table 3: Threatened fauna with potential to occur within the study area**

| Scientific name | Common name | BC Act listing | EPBC Act listing |
|---|---|---|---|
| *Circus assimilis* | Spotted Harrier | V | |
| *Dasyurus maculataus* | Spotted-tailed Quoll | V | E |
| *Haliaeetus leucogaster* | White-bellied Sea-Eagle | V | |
| *Hieraaetus morphnoides* | Little Eagle | V | |
| *Hirundapus caudacutus* | White-throated Needletail | | M |
| *Litoria aurea* | Green and Golden Bell Frog | E | V |
| *Myotis macropus* | Southern Myotis | V | |
| *Miniopterus orianae oceanensis* | Large Bent-winged Bat | V | |
| *Ninox strenua* | Powerful Owl | V | |
| *Pandion cristatus* | Eastern Osprey | V | |
| *Pteropus poliocephalus* | Grey-headed Flying-fox | V | V |
| *Ptilinopus superbus* | Superb Fruit-Dove | V | |
| *Stictonetta naevosa* | Freckled Duck | V | |
| *Tyto novaehollandiae* | Masked Owl | V | |

Status key: V = Vulnerable; E = Endangered, M=Migratory

Two threatened flora species have been previously recorded within the study area (Table 4), although there are multiple records within a 1 km radius for several species.

**Table 4: Threatened flora recorded within the study area (source: Bionet)**

| Species | Common Name | Date | Count | Location |
|---|---|---|---|---|
| *Daphnandra johnsonii* | Illawarra Socketwood | 1990 | 1 | Lot 100//774878 |
| *Zieria granulata* | Illawarra Zieria | 1974, 1993 and 2014 | 4 | Lot 100//774878, Lot 70//751279 and Lot 184//751279 |

*Status key: V = Vulnerable; E = Endangered*

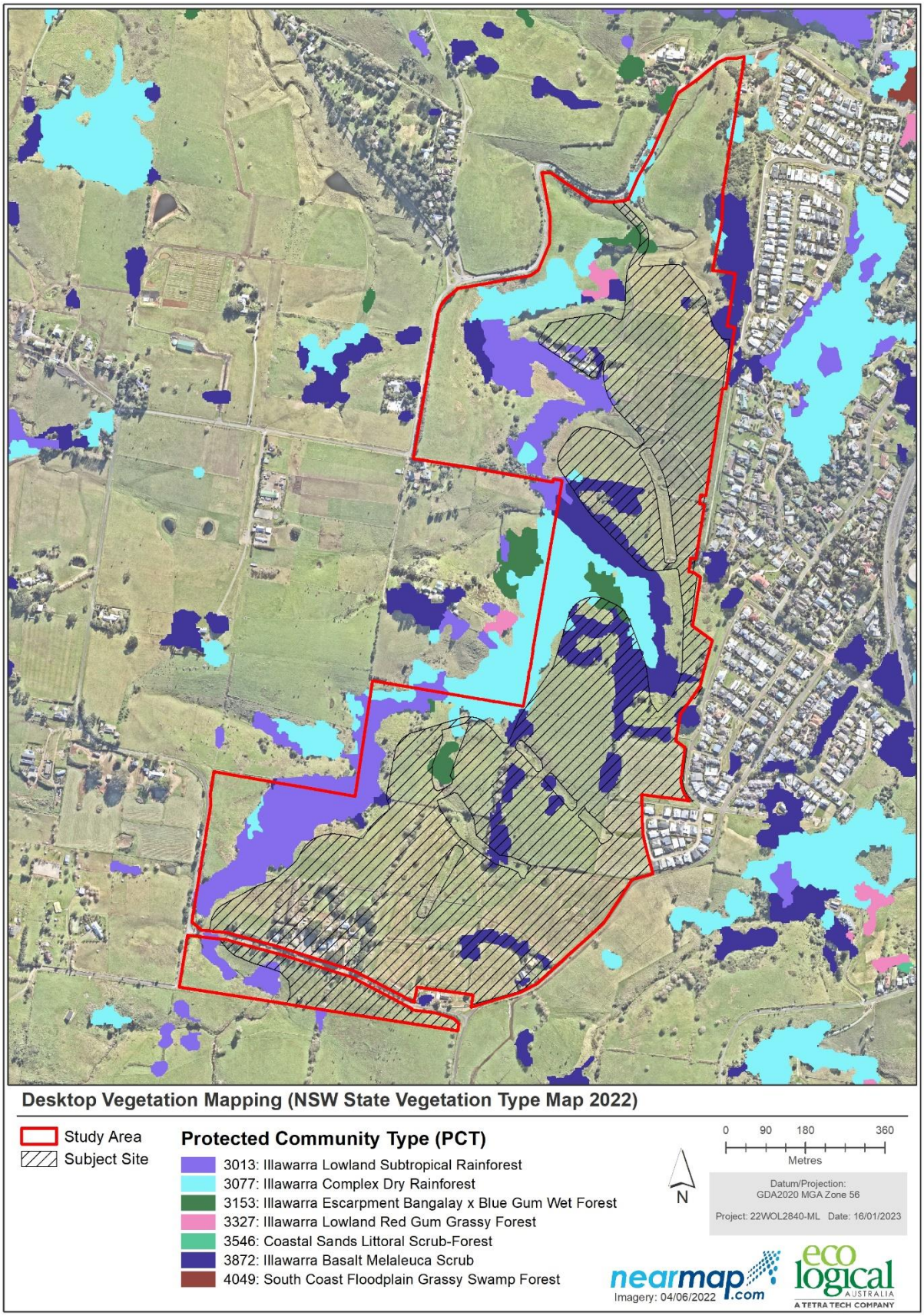



**Figure 4: Publicly available modelled vegetation mapping (source: DPE 2022)**

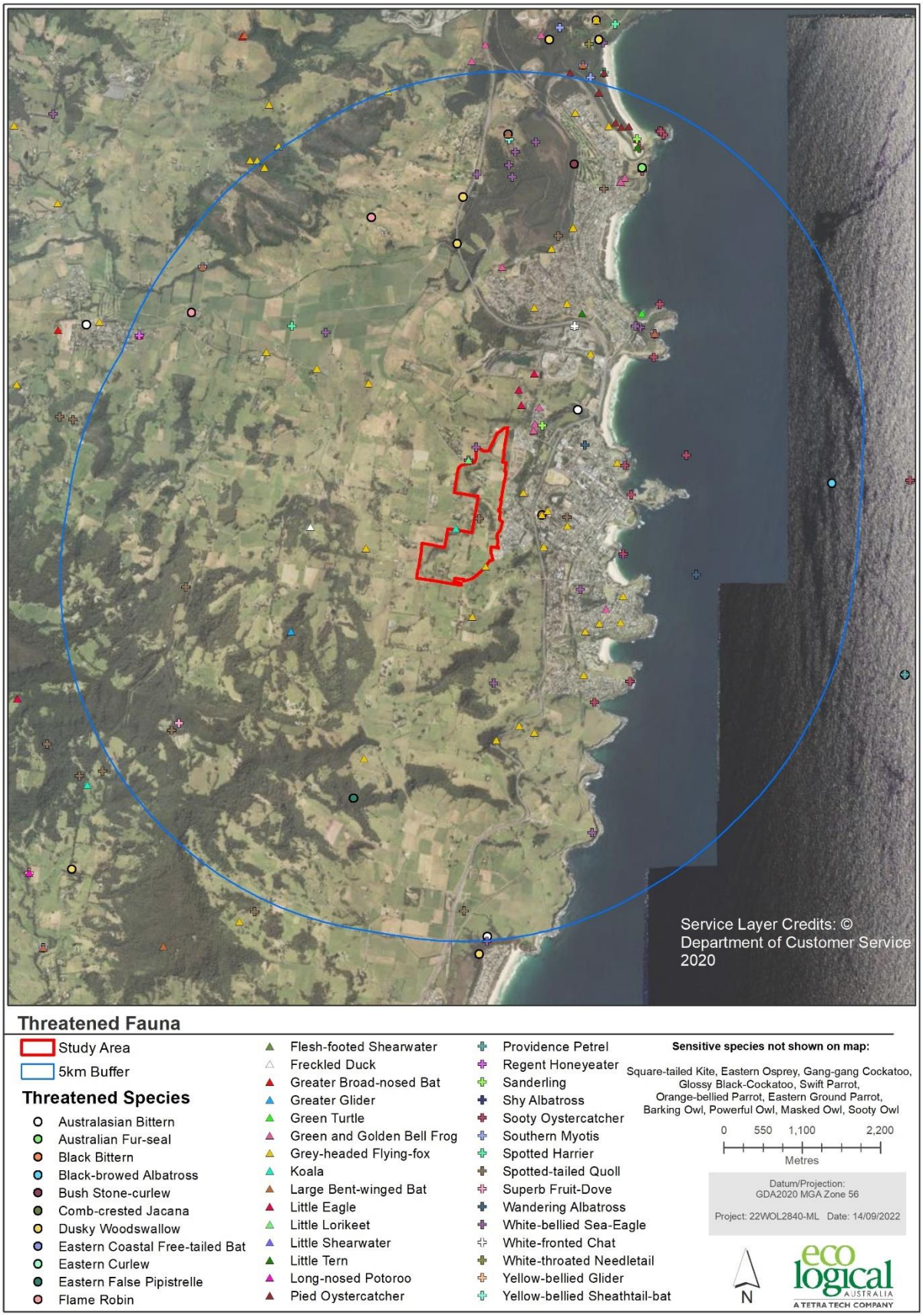



**Figure 5: Threatened fauna previously recorded within the study area (BioNet 2022)**

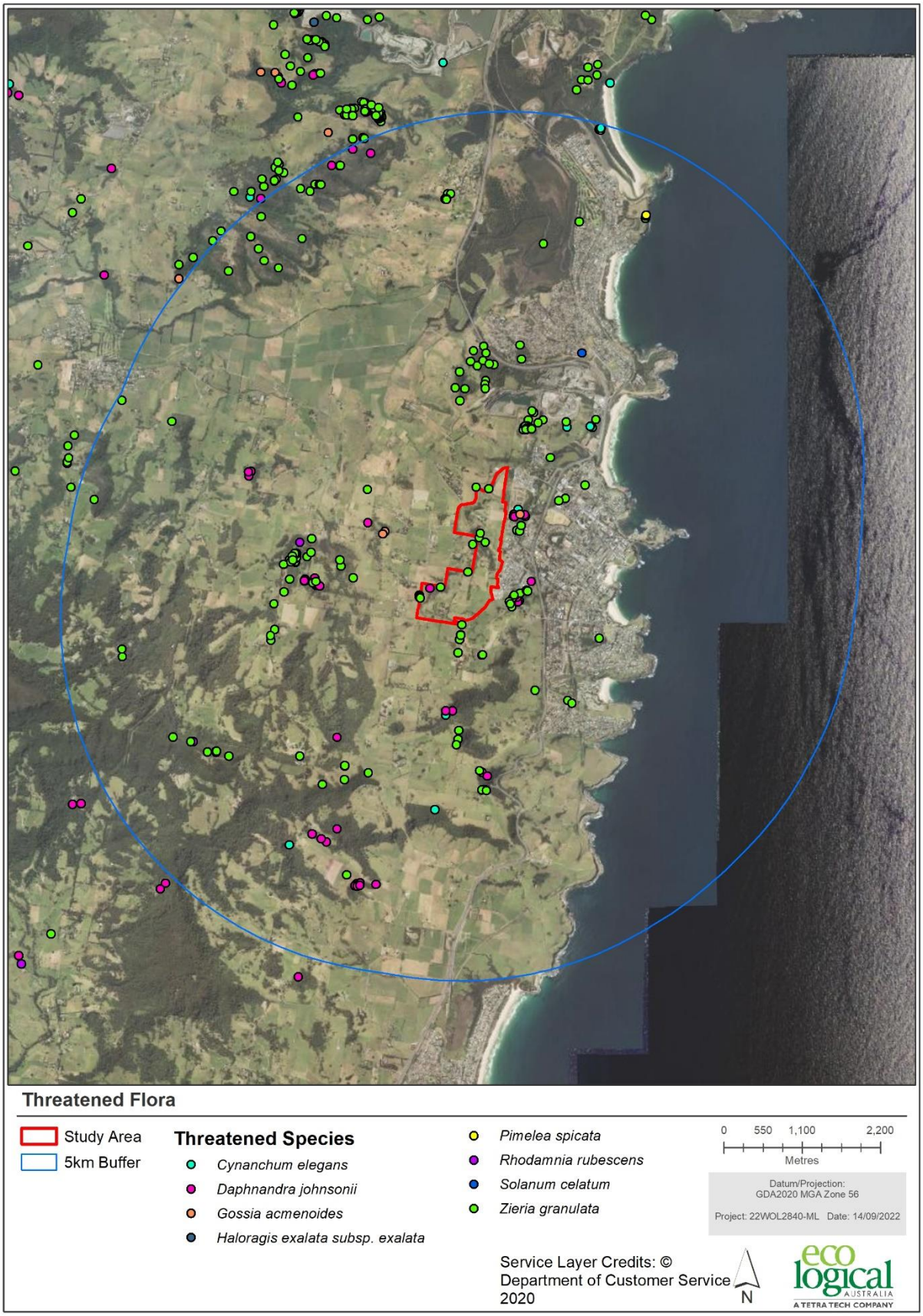



**Figure 6: Threatened flora previously recorded within the study area (BioNet 2022)**

### 4.1.4. Watercourses

Under the Water Management Act 2000 (WM Act), 'waterfront land' includes all land within 40 m of a mapped 'river' when measured from the top of bank. The riparian corridor is the vegetated width required for each stream classification using the Strahler stream order method (Table 5). A riparian corridor comprises a vegetated riparian zone (VRZ) on each side, plus the channel width.

**Table 5: Recommended riparian corridor widths (NRAR 2018)**

| Watercourse type | VRZ width (each side of watercourse) | Total riparian corridor width |
|---|---|---|
| 1st order | 10 m | 20 m + channel width |
| 2nd order | 20 m | 40 m + channel width |
| 3rd order | 30 m | 60 m + channel width |
| 4th order and greater (includes estuaries, wetlands and any parts of rivers influenced by tidal waters) | 40 m | 80 m + channel width |

Spring Creek and its tributaries traverse the length of the study area. There are numerous watercourses within the study area with Strahler Stream Orders ranging from 1-4. The subject site intersects waterfront land and associated riparian buffers across the whole study area (Figure 7).

Farm dams are also present within the subject site.

### 4.1.5. Key Fish Habitat

Spring Creek is mapped by DPI Fisheries as Key Fish Habitat (KFH, Figure 7), which is a trigger for permits or inter-agency consultation under Part 7 of the *Fisheries Management Act 1994* (FM Act) for works that involve earthworks within the bed or bank of the stream, dredging, reclamation or obstruction of fish passage (e.g. crossings).

A review of KFH mapping under the FM Act found that proposed road infrastructure crosses Spring Creek (KFH) at two locations at the northern and southern end of the study area (Figure 7).

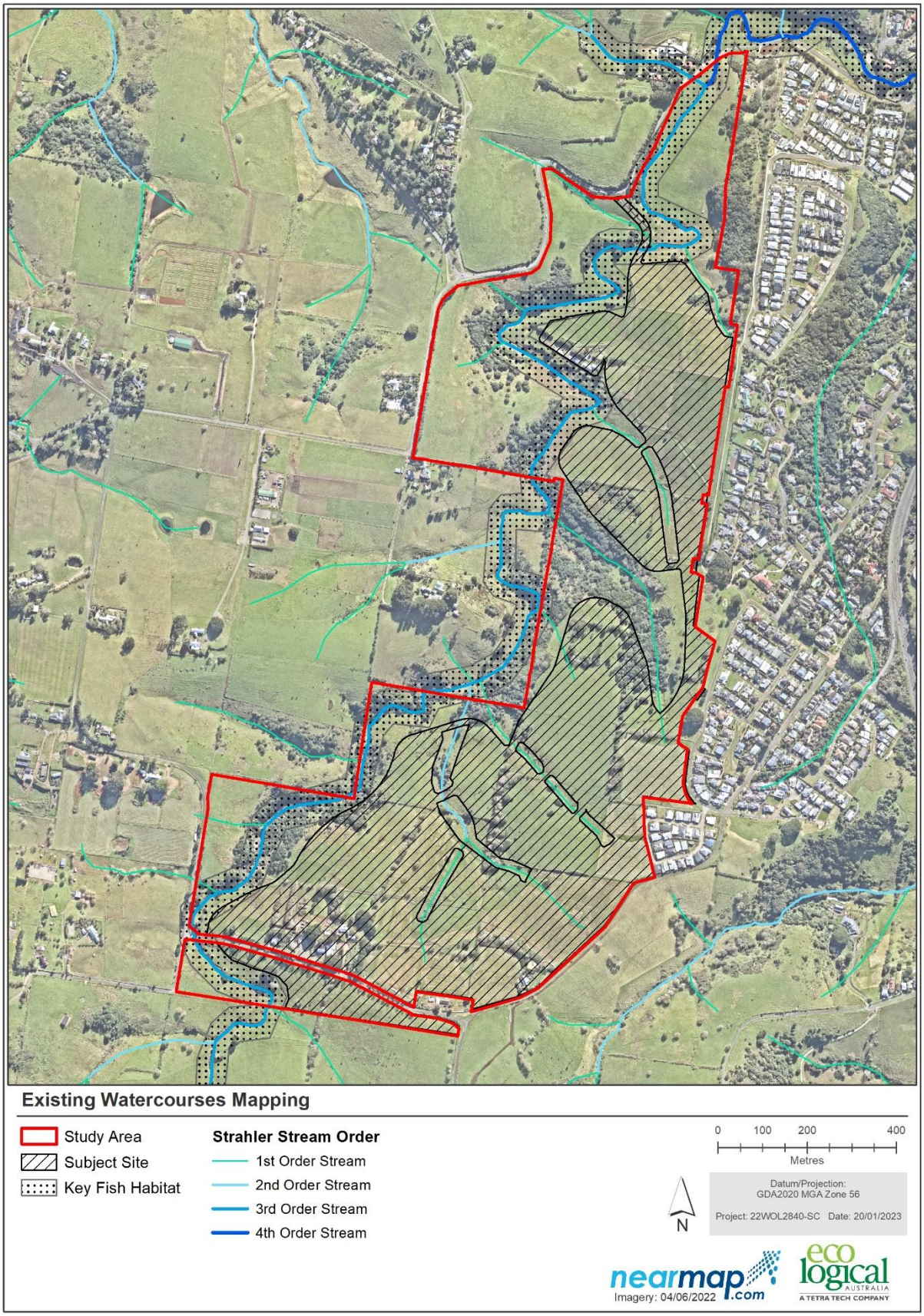



**Figure 7: Mapped watercourses (Hydroline dataset) and Key Fish Habitat**

## 4.2. Field survey results

### 4.2.1. Validated plant community types (PCTs)

The field survey confirmed the presence of two PCTs within the study area, which were assigned different condition zones (Figure 8):

- PCT 3013 Illawarra Lowland Subtropical Rainforest (Good)
- PCT 3013 Illawarra Lowland Subtropical Rainforest (Moderate)
- PCT 3013 Illawarra Lowland Subtropical Rainforest (Low)
- PCT 3872 Illawarra Basalt Melaleuca Scrub (Moderate).

The study area includes areas of exotic dominated vegetation which cannot be assigned a PCT. These have been mapped as 'Native Planted', 'Exotic' and 'Exotic grassland' (Figure 8). The study area also includes built areas which was devoid of vegetation; this has been mapped as 'Built'. A description of each PCT and condition zone is provided below, as well as a justification for each condition assigned.

Table 6 lists the vegetation present and their associated areas within the subject site.

**Table 6: PCTs within the subject site**

| PCT # | Plant Community Type ID and Scientific Name | Area (ha) |
|---|---|---|
| 3013 | Illawarra Lowland Subtropical Rainforest | 4.00 |
| 3872 | Illawarra Basalt Melaleuca Scrub | 0.15 |
| - | Planted native vegetation | 0.68 |
| - | Planted exotic vegetation | 4.50 |
| - | Exotic pasture | 59.60 |

#### PCT 3013 ILLAWARRA LOWLAND SUBTROPICAL RAINFOREST (GOOD)

Within the study area PCT 3013 (Good) occurs in two patches in Lot 100//774878 and Lot 75/751279 (Figure 8). PCT 3013 (Good) within the study area was characterised by a dense canopy (75-85% cover) dominated by *Pittosporum undulatum* (Native Daphne) which made up about 50% of the canopy cover. The other species present included *Acacia maidenii* (Maiden's Wattle), *Claoxylon australe* (Brittlewood), *Ficus coronata* (Sandpaper Fig) also present. The mid-storey layer was sparse (<5% cover) due to the dense canopy. The most notable species here was *Maclura cochinchinensis* (Cockspur Thorn) and *Pittosporum multiflorum* (Orange Thorn). The ground layer was sparse (<5% cover) due to the dense canopy. The species present here included *Commelina cyanea* (Scurvy Weed), *Doodia australis* (Common Rasp Fern), *Geitonoplesium cymosum* (Scrambling Lily), *Lindsea liniaris* (Screw Fern), *Microlaena stipoides* var. *stipoides* (Weeping Grass), *Oplismenus imbecillis* (Creeping Beard Grass), *Pandorea pandorana* subsp. *pandorana* (Wonga Wonga Vine), *Stephania japonica* var. *discolor* (Snake Vine).

There was very little exotic species cover within PCT 3013 (Good) within the study area, with species such as *Ageratina riparia* (Mistflower), *Lantana camara* (Lantana), *Olea europaea* subsp. *cuspidata* (African Olive) occurring at very low densities.

The occurrence of PCT 3013 (Good) within the study area meets the Final Determination definition of the EEC Illawarra Subtropical Rainforest under the BC Act (NSW Scientific Committee 2011) for the following reasons:

- The patch occurs within the Kiama LGA, one of the listed areas of location.
- The geology matches the required coastal Permian volcanics.
- The species composition overlaps well with the assemblage of species detailed in the Final Determination as being characteristic of Illawarra Subtropical Rainforest.

Under the EPBC Act, a patch of vegetation must be consistent with the key diagnostic characteristics and condition thresholds for it to be considered *Illawarra – Shoalhaven Subtropical Rainforest* (TSSC 2019). The patches mapped as PCT 3013 (Good) within the study area align with all the key diagnostic characteristics related to location, soils, structure and species composition of different strata. Condition threshold criteria are based on species present, canopy cover and patch size. The patch mapped as 3013 (Good) in Lot 100//774878 along Spring Creek meets the conditions for Moderate Condition – Category A as it is:

- larger than 1ha
- contains >50% canopy cover
- contains 12 native plant species from Appendix C.

The other patched mapped in Lot 75/751279 meets the condition for Moderate Condition – Category C as it is:

- larger than 0.1ha,
- contains >70% canopy cover
- contains 13 native plant species (Appendix C).

### PCT 3013 ILLAWARRA LOWLAND SUBTROPICAL RAINFOREST (MODERATE)

Within the study area PCT 3013 (Moderate) occurs in multiple locations along Spring Creek (Figure 8). PCT 3013 (Moderate) within the study area was characterised by a dense canopy (65-75% Cover) with an even mix of *Scolopia braunii* (Flintwood), *Streblus brunonianus* (Whalebone Tree), *Acacia maidenii* (Maiden's Wattle), *Alectryon subcinereus* (Native Quince) and *Pittosporum undulatum* (Native Daphne) present. The mid-storey layer was spares (<5% cover) due to the dense canopy. The most notable species here was *Maclura cochinchinensis* (Cockspur Thorn) and *Pittosporum multiflorum* (Orange Thorn). The ground layer was present (30 – 35% cover) with the following species making up the composition: *Adiantum formosum* (Giant Maidenfern), *Cayratia clematidea* (Native Grape), *Dichondra repens* (Kidney Weed), *Commelina cyanea* (Scurvy Weed), *Geitonoplesium cymosum* (Scrambling Lily), *Lindsea liniaris* (Screw Fern), *Microlaena stipoides* var. *stipoides* (Weeping Grass), *Oplismenus imbecillis* (Creeping Beard Grass), *Pellaea falcata* (Sickle Fern) and *Plectranthus parviflorus* (Cockspur Flower).

Exotic species were (20 – 25% cover) present in each layer. They included species such as *Lantana camara* (Lantana), *Ligustrum lucidum* (Broad-leaved Privet) *Olea europaea* subsp. *cuspidata* (African Olive) and *Ehrhata erecta* (Panic Veldtgrass).

The occurrence of PCT 3013 (Moderate) within the study area meets the Final Determination definition of the EEC Illawarra Subtropical Rainforest under the BC Act (NSW Scientific Committee 2011) for the following reasons:

- The patch occurs within the Kiama LGA, one of the listed areas of location.
- The geology matches the required coastal Permian volcanics.
- The species composition overlaps well with the assemblage of species detailed in the Final Determination as being characteristic of Illawarra Subtropical Rainforest.

Under the EPBC Act, a patch of vegetation must be consistent with the key diagnostic characteristics and condition thresholds for it to be considered *Illawarra – Shoalhaven Subtropical Rainforest* (TSSC 2019). The patches mapped as PCT 3013 (Moderate) within the study area align with all the key diagnostic characteristics related to location, soils, structure and species composition of different strata. Condition threshold criteria are based on species present, canopy cover and patch size. The patches mapped as 3013 (Moderate) meet the conditions for Moderate Condition – Category B as it has:

- more than >50% canopy cover
- contains 15 native species (Appendix C).

### PCT 3013 ILLAWARRA LOWLAND SUBTROPICAL RAINFOREST (LOW)

Within the study area PCT 3013 (Low) occurs as patches on Lot 70//751279, Lot 156//751279, Lot 188//751279, Lot 189//751279 and Lot 1//609971. PCT 3013 (Low) within the study area was characterised by a canopy dominated by weeds (>50% Cover), this included *Ligustrum lucidum* (Broad-leaved Privet) and *Olea europaea* subsp. *cuspidata* (African Olive). The native trees present within the canopy included *Acacia maidenii* (Maiden's Wattle), *Streblus brunonianus* (Whalebone Tree). In the areas where a mid-storey was present, it was dominated (>50% cover) by *Lantana camara* (Lantana), the sparse natives present here included *Maclura cochinchinensis* (Cockspur Thorn) and *Pittosporum multiflorum* (Orange Thorn). The ground layer was generally weed dominated with species *Ehrhata erecta* (Panic Veldtgrass), *Sida rhombifolia* (Paddy's Lucerne) and *Bidens pilosa* var. *pilosa* (Cobblers Pegs) comprising most of the cover. The sparse native ground layer included *Dichondra repens* (Kidney Weed), *Commelina cyanea* (Scurvey Weed), *Geitonoplesium cymosum* (Scrambling Lily), *Lindsea liniaris* (Screw Fern), *Microlaena stipoides* var. *stipoides (*Weeping Grass), *Oplismenus imbecillis* (Creeping Beard Grass).

The occurrence of PCT 3013 (Low) within the study area meets the Final Determination definition of the EEC Illawarra Subtropical Rainforest under the BC Act (NSW Scientific Committee 2011) for the following reasons:

- The patch occurs within the Kiama LGA, one of the listed areas of location.
- The geology matches the required coastal Permian volcanics.
- The species composition overlaps well with the assemblage of species detailed in the Final Determination as being characteristic of Illawarra Subtropical Rainforest.

Under the EPBC Act, a patch of vegetation must be consistent with the key diagnostic characteristics and condition thresholds for it to be considered *Illawarra – Shoalhaven Subtropical Rainforest* (TSSC 2019). The patches mapped as PCT 3013 (Low) within the study area align with all the key diagnostic characteristics related to location, soils, structure and species composition of different strata. Condition

threshold criteria are based on species present, canopy cover and patch size. The patches mapped as 3013 (Low) do not meet any condition categories due to not meeting the native canopy cover requirement of >50%.

### PCT 3872 ILLAWARRA BASALT MELALEUCA SCRUB (MODERATE)

Within the study area PCT 3872 (Moderate) occurs as a single patch in Lot 188//751279 (Figure 8). PCT 3872 (Moderate) within the study area was characterised by a small canopy (60% cover) of *Backhousia myrtifolia* (Grey Myrtle), *Acacia maidenii* (Maiden's Wattle), *Melaleuca armillaris* subsp. *armillaris* (Bracelet Honey Myrtle) and *Notelaea venosa* (Veined Mock-olive). A low shrub layer was present including *Leucopogon juniperinus* (Prickly Beard Heath), *Breynia oblongifolia* (Coffee Bush) and *Zieria granulata*. The ground layer was present (50% cover) with *Microlaena stipoides* var. *stipoides* (Weeping Grass), *Oplismenus imbecillis* (Creeping Beard Grass), *Plectranthus parviflorus* (Cockspur Flower) and *Poa labillardierei* var. *labillardierei* (Common Tussock Grass) making up the composition.

The weeds present accounted for approximately 30% cover and included *Bidens pilosa* var. *pilosa* (Cobblers Pegs), *Cynodon dactylon* (Couch Grass), *Delairea odorata* (Cape Ivy) *Senecio madagascariensis* (Fireweed), *Solanum mauritianum* (Tabacco Weed), *Ehrhata erecta* (Panic Veldtgrass) and *Lantana camara* (Lantana).

The occurrence of PCT 3872 (Moderate) within the study area meets the Final Determination definition of the CEEC *Melaleuca armillaris* Tall Shrubland under the BC Act (NSW Scientific Committee 2021) for the following reasons:

- The patch occurs within the Kiama LGA, one of the listed areas of location.
- The landform and geology matches the required ridgetop landform on volcanic soils.
- The species composition overlaps well with the assemblage of species detailed in the Final Determination as being characteristic of *Melaleuca armillaris* Tall Shrubland.

### NATIVE PLANTED

This vegetation was located at Lot 100//774878 around the built areas. This included ground layer species in mulched garden beds with sparse large trees. The species present includes *Lomandra longifolia* (Spiny-head Mat-rush), *Themeda triandra* (Kangaroo Grass), *Dianella caerulea* (Blue-flax Lily), Ficus sp.

### EXOTIC

This vegetation was located at Lot 100//774878 and Lot 180//741279 around the built areas. The areas mapped as exotic within the study area include plantings of non-indigenous species around dwellings and plantings along fence lines. The exotic plantings on fence lines included rows of *Erythrina sykesii* (Coral Tree) and *Tecoma capensis* (Cape Honeysuckle) in the understorey. The exotic trees planted around dwellings includes *Erythrina sykesii* (Coral Tree), *Pinus* sp. *Citrus* sp. and hedges.

### EXOTIC GRASSLAND

Exotic Grassland was found in all lots within the study area. This area was previously cleared and replaced with pasture species for agricultural use. These areas had no native canopy or mid-storey and the ground layer was dominated by exotic pasture species such as *Cenchrus clandestinus* (Kikuyu),

*Paspalum dilatatum* (Paspalum) and *Setaria parviflora* (Pigeon Grass), and weed species such as *Senecio madagascariensis* (Fireweed), *Bidens pilosa* (Cobblers Pegs) and *Sida rhombifolia* (Paddy's lucerne).

### 4.2.2. Threatened ecological communities

PCT 3013 and PCT 3872 present within the study area and also within the subject site both correspond to threatened ecological communities (TECs) (Table 7 and Figure 9).

As detailed in Section 4.1.1, PCT 3013 is associated with the Critically Endangered Ecological Community (CEEC), *Illawarra – Shoalhaven Subtropical Rainforest in the Sydney Basin Bioregion*, listed under both the BC Act and EPBC Act. Given the range of conditions in which this PCT exist within the study area, not all occurrences meet the definition of their associated TEC under both Acts. Therefore, the TEC status for each vegetation zone is addressed following the description (see above), including justification as to why it does or does not conform to the associated TEC. A summary of each vegetation zone found within the study area and whether it corresponds to a TEC listed under the BC Act (NSW Scientific Committee 2011) and EPBC Act (TSSC 2019) is shown in Table 7.

**Table 7: Summary of vegetation condition zones and their correspondence with TECs listed under the BC Act and EPBC Act**

| PCT | Condition | TEC | Description | BC Act | EPBC Act |
|---|---|---|---|---|---|
| 3013 | Good | *Illawarra Subtropical Rainforest in the Sydney Basin Bioregion* (BC Act)<br>*Illawarra – Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion* (EPBC Act) | • Meets the threshold of species typical of the community as listed in BC Act Final Determination and EPBC Act Conservation Advice (Appendix C)<br>• Patch sizes at least >0.1ha (EPBC Act)<br>• Canopy cover >70% (EPBC Ac) | Yes | Yes |
| 3013 | Moderate | *Illawarra Subtropical Rainforest in the Sydney Basin Bioregion* (BC Act)<br>*Illawarra – Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion* (EPBC Act) | • Meets the threshold of species typical of the community as listed in BC Act Final Determination and EPBC Act Conservation Advice (Appendix C)<br>• Patch sizes at least >0.1ha (EPBC Act)<br>• Canopy cover between 50-70% (EPBC Act) | Yes | Yes |

| PCT | Condition | TEC | Description | BC Act | EPBC Act |
|---|---|---|---|---|---|
| 3013 | Low | *Illawarra Subtropical Rainforest in the Sydney Basin Bioregion* (BC Act)<br>*Illawarra – Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion* (EPBC Act) | • Patch sizes at least >0.1ha (EPBC Act)<br>• Canopy cover <50% (EPBC Act) | Yes | No (does not meet canopy cover requirement) |
| 3872 | Moderate | *Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion* | The patch occurs within the Kiama LGA, one of the listed areas of location (BC Act)<br>The landform and geology matches the required ridgetop landform on volcanic soils (BC Act).<br>The species composition overlaps well with the assemblage of species detailed in the Final Determination as being characteristic of *Melaleuca armillaris* Tall Shrubland (BC Act). | yes | Not listed |

### 4.2.3. Threatened species

A large number (>200 plants) of *Zieria granulata* were recorded across the whole study area during the field survey. *Zieria granulata* locations are shown in Figure 8.

There were no threatened fauna species recorded within the study area during the field survey. However, large areas of intact vegetation, waterbodies, connectivity to intact vegetation, large trees and numerous fallen logs provide habitat features for threatened fauna. Many of the species listed in Table 8 would likely use the study area for foraging.

Given the large areas of native vegetation, which represent suitable habitat for some of the fauna listed in Table 8, and that the field survey was conducted in winter, it is possible threatened fauna species could not be detected at this time of year. Targeted surveys at the recommended time of year for each species would need to be conducted to discount the presence of any of the fauna referenced in Table 8.

### 4.2.4. Fauna habitat

A list of habitat features recorded in the study area is listed in Table 8 below. Only two hollow-bearing trees (HBT) containing medium to large (100 to <300mm) hollows were recorded within the study area during the current surveys (Figure 8).

**Table 8: habitat features recorded in the study area**

| Habitat feature | Associated species | Presence |
|---|---|---|
| Large expanse of native vegetation | Birds, microchiropteran bats (microbats), megachiropteran bats (fruit bats), arboreal mammals and reptiles | Yes, the vegetation along Spring Creek provides a large expanse of habitat for fauna movement. |
| Nectar producing species | Arboreal mammals/birds and fruit bats | Present within all the mapped native vegetation. |
| Hollow-bearing trees | Microbats, birds, mammals, amphibians, reptile | Present. |
| Coarse woody debris (fallen logs) | Terrestrial mammals, reptiles, invertebrates | Present in 3013 (Moderate) and 3871 (Moderate). |
| Leaf litter | Reptiles, amphibians, invertebrates | Present in all the mapped native vegetation. |
| Water body | Amphibians, reptiles, microbats | Present along Spring Creek. Still ponds with fringing vegetation and farm dams present within the study area |
| Rocky outcrops | Microbats, reptiles | Not observed during the field survey. |
| Mistletoe | Arboreal mammals/birds and fruit bats | Not observed during the field survey. |
| Winter flowering species | Winter migratory birds, arboreal mammals and megachiropteran bats (fruit bats) | Yes, throughout all the native vegetation. |

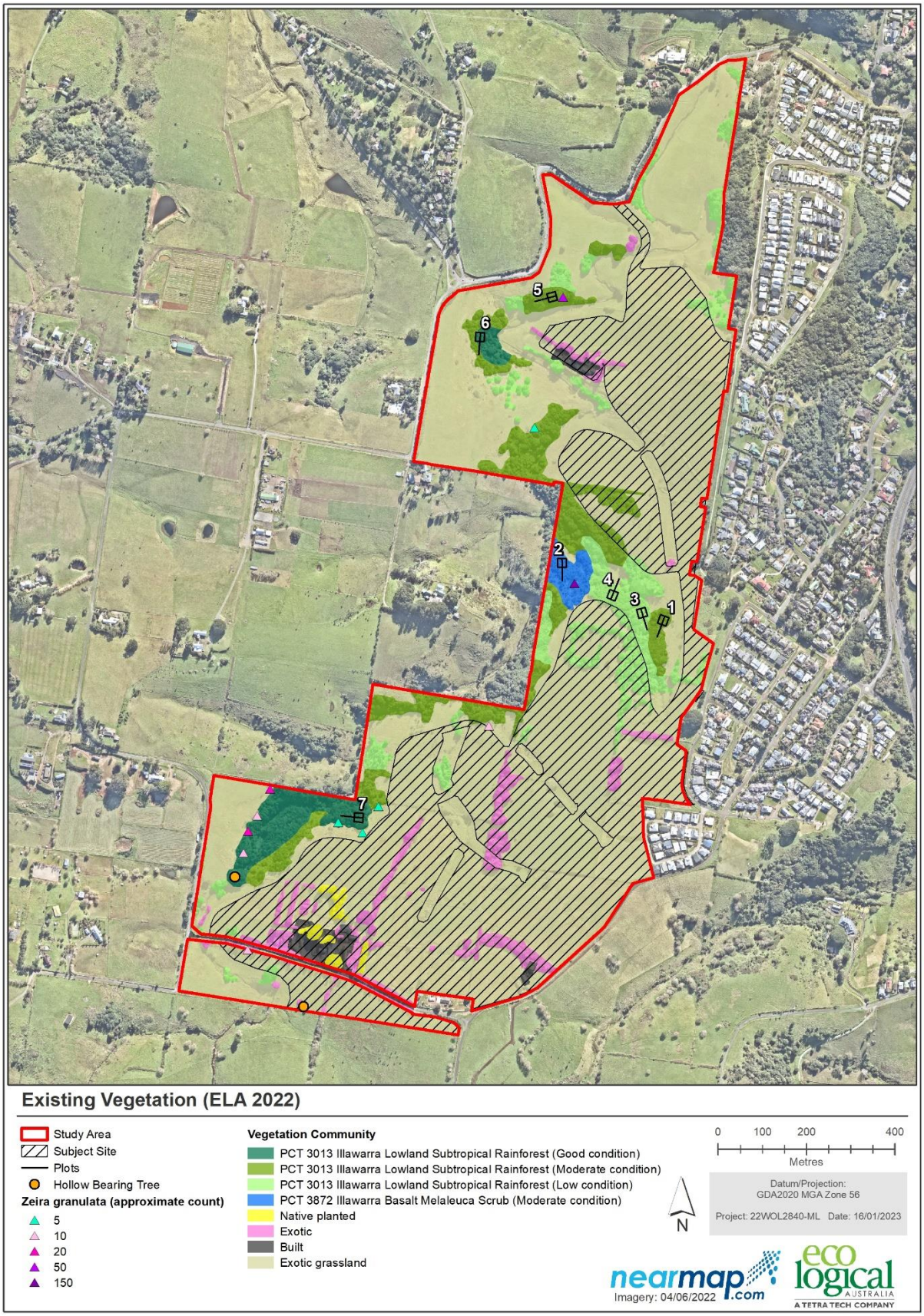



**Figure 8: ELA validated vegetation, hollow bearing trees and *Zieria granulata* locations**

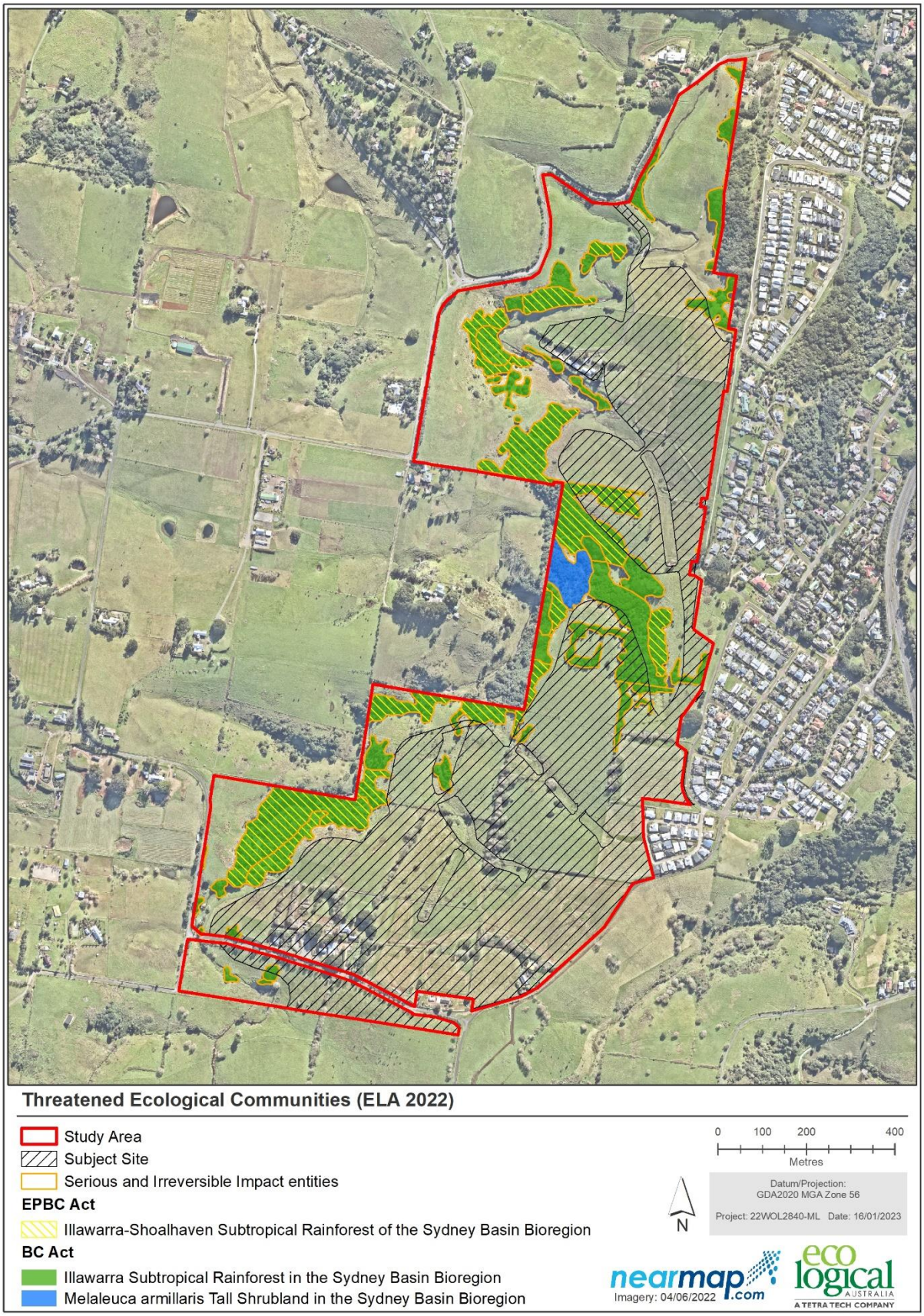



**Figure 9: TECs within the study area**

### 4.2.5. Watercourse validation

The study area was highly modified, with land around the smaller creeks primarily cleared for agricultural use. The third order stream, Spring Creek, was fringed with remnant native vegetation. There were fifteen creeks mapped and assessed within the study area (Figure 7). The mapped top of bank and associated riparian corridor for NRAR's requirements for the site are mapped in Figure 10. Eleven creeks within the study area met the definition of a 'river'. Brief reach descriptions and results are presented in Appendix D.

The top of bank for all streams was estimated using aerial imagery (Nearmap, SIX Maps, Google Maps and Google Earth) and 2 m contours. Watercourses were assessed to determine if they had bed, banks and evidence of geomorphological processes. Each watercourse that met the definition of a river under the WM Act was assigned the appropriate riparian corridor width in accordance with stream order and category (Figure 10).

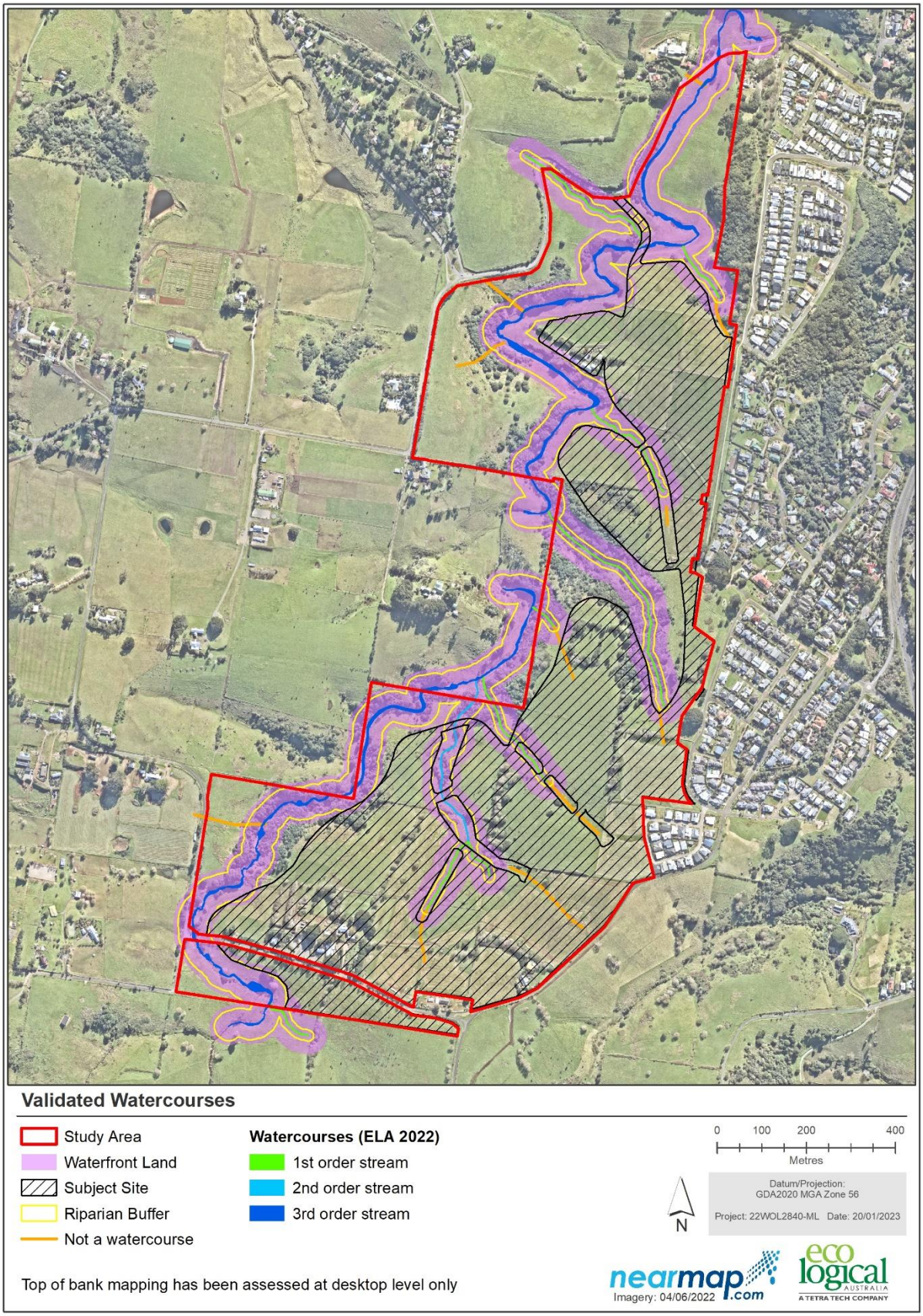



**Figure 10: Validated watercourses, Top of Bank and riparian buffers**

# 5. Ecological constraints and opportunities

## 5.1. Biodiversity constraints summary

The ecological constraints of the study area have been assessed based on the ecological features and values criteria listed in Table 9. This table has been used to assign the overall ecological constraints of the study area, which are illustrated in Figure 11.

**Table 9: Ecological constraint classes, ecological features and report section in which they are addressed**

| Ecological Constraint | Ecological features/values |
|---|---|
| Low | • Non-native vegetation<br>• Areas dominated by weeds<br>• Highly disturbed landscapes with low fauna habitat value<br>• Cleared land and houses |
| Moderate | • Planted native vegetation or non-threatened vegetation communities<br>• First order Riparian corridors without TECs<br>• Farm dams (potential foraging habitat for threatened species)<br>• Stepping-stone habitat or local wildlife corridors for highly mobile species |
| High | • Vegetation mapped as TEC under the BC Act or EPBC Act<br>• Vegetation identified as a SAII entity<br>• Land mapped on the Biodiversity Values map<br>• Riparian corridors with TECs and mapped as KFH<br>• Non-threatened vegetation communities that form regional habitat corridors<br>• Habitat features (including HBTs) that support potential habitat for threatened flora species, or potential foraging habitat for threatened fauna species listed under the BC Act or EPBC Act.<br>• Threatened flora species listed under the BC or EPBC Acts (*Zieria granulata*) |

Based on the current layout, the Planning Proposal would result in the removal of 3.44 ha of remnant native vegetation (PCTs). The proposal will retain 16.08 ha of native remnant vegetation within the study area.

All of the validated PCTs within the study area meet the definition as 'high constraint' based on their status as vegetation corresponding with a threatened ecological community listed under the BC Act or EPBC Act. Both TECs present on-site are also SAII candidate entities under the BC Act. The presence of threatened flora species *Zieria granulata* within the study area also poses a high constraint. Further, many of the riparian corridors throughout the study area pose as a high constraint including Spring Creek which is mapped on the BV Map and is KFH.

First order watercourses (without TECs) are considered moderate constraint as these can be exempt from Controlled Activity Approval (CAA) requirements if NRAR is convinced that they do not exhibit features of a defined channel with bed and bank, and therefore is not waterfront land for the purposes of the WM Act. Dams within the study area are considered moderate constraint as they provide

potential foraging habitat for threatened fauna species, which would trigger impact assessment requirements.

The remaining areas have been mapped as low constraint as they do not contain native vegetation, habitat features, waterfront land or riparian corridors. Instead, they comprise exotic grasslands, cleared land, houses and highly disturbed landscapes that provide low threatened species habitat.

## 5.2. Ecological opportunities

The proposed development has created an opportunity to retain biodiversity values of the area by avoiding direct impact to the majority of surrounding intact native remnant vegetation. If the riparian corridors are restored under a Vegetation Management Plan (VMP) there is the opportunity to not only preserve existing native vegetation but to improve currently degraded remnants within the vicinity of Spring Creek and its tributaries. Furthermore, the proposed rezoning increases the public open space by introducing new parks in the study area. Through planting locally indigenous species within these parks and on public thoroughfares, there is opportunity to increase the urban forest canopy. Avoidance/minimisation of impacts to high constraint areas (Figure 11) is recommended. Retaining as much native vegetation as possible would help mitigate approvals risk for the Planning Proposal. Based on the current layout, the Planning Proposal would result in the removal of 3.44 ha of remnant native vegetation (PCTs). The proposal will retain 16.08 ha of native remnant vegetation within the study area. Minimising biodiversity impacts at the proposal design would further assist any future development applications, which would require adherence with Chapter 7 of the BAM – 'Avoid or minimise impacts on biodiversity values'.

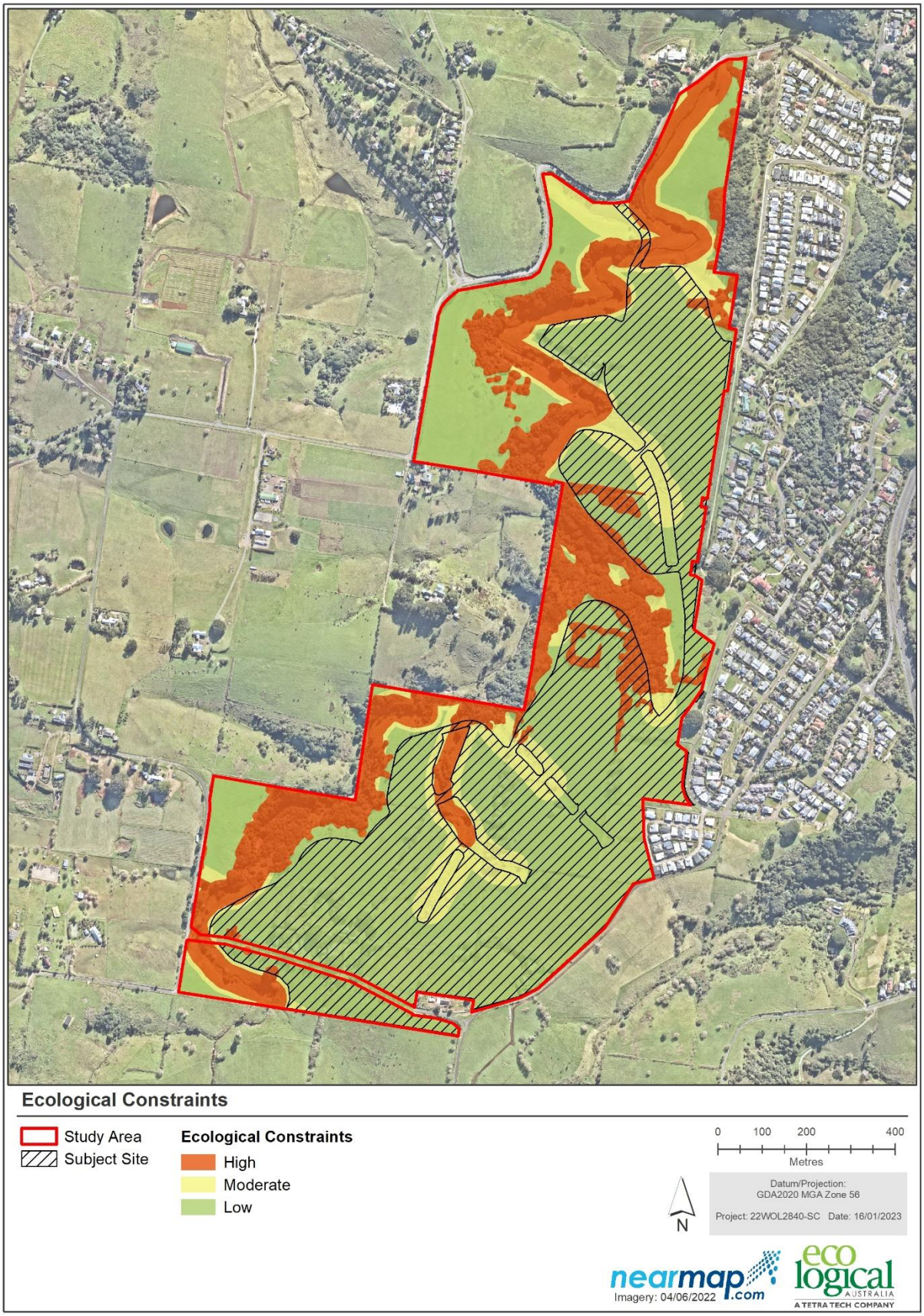



**Figure 11: Ecological constraints of the study area**

## 5.3. Future impact assessment

Any future DAs for the site should be accompanied by appropriate biodiversity impact assessment reports. Outlined below are some of the considerations that would need to be included in impact assessments for any future DAs.

### 5.3.1. Biodiversity offset scheme

The Biodiversity Offset Scheme (BOS) can be triggered by the following:

- any impacts to native vegetation within areas mapped as 'high biodiversity values' (as per the Biodiversity Values Map), which includes Spring Creek riparian corridors (Figure 3)
- native vegetation clearing thresholds:
  - >0.25 ha clearing threshold (for a minimum lot size of less than 1 ha)
  - >0.5 ha clearing threshold (for a minimum lot size of 1 ha to less than 40 ha)
- significant impacts to threatened species or threatened ecological communities, determined through the application of a test of significance consistent with s7.3 of the BC Act.

If a future development triggers the BOS, a Biodiversity Development Assessment Report (BDAR) would be required to accompany a DA. The BDAR will require field survey and report preparation consistent with the Biodiversity Assessment Method 2020 (BAM), as well as the calculation of any necessary offsets using the online BAM tool. Targeted surveys, if required, may add to the length of the assessment process, particularly if there are seasonal requirements (see below).

Under the BC Act, a development must demonstrate that impacts to biodiversity have been avoided, minimised and mitigated prior to any offsets being considered.

Based on the current footprint there would be the potential for future DAs to trigger the clearing threshold limits or significantly affect threatened species or ecological communities. Based on the current proposal, rezoned land would result in the removal of up to 3.44 ha of remnant native vegetation (PCTs). The proposal would retain 16.08 ha of native remnant vegetation within the study area.

The proposed footprint intersects land identified on the BV Map. However, these areas of intersection are existing roads that cross Spring Creek. Therefore, these areas would not be considered new development within BV mapped areas. However, any proposed future development that extends beyond the footprint of the existing roads (for example, road widening works) within BV mapped areas would trigger the BOS.

Furthermore, the study area contains the following threatened entities listed below:

Threatened ecological communities:

- *Illawarra Subtropical Rainforest in the Sydney Basin Bioregion*
- *Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion*

Threatened flora:

- *Zieria granulata.*

Significant impacts to these entities will need to be determined through the application of a test of significance consistent with s7.3 of the BC Act.

### 5.3.2. BAM: Chapter 7 – Avoid or minimise impacts on biodiversity values

Based on the current layout, the if the rezoning proposed by this Planning Proposal were approved, future developments in re-zoned areas would have the potential to trigger the BOS. Future developments may require detailed assessments in the form of a BDAR in accordance with the BAM. Chapter 7 of the BAM sets out guidance on how proponents can demonstrate they have undertaken reasonable measures to avoid or minimise impacts of the proposed development, activity or clearing on biodiversity values, in accordance with section 6.12 of the BC Act. Inadequate consideration of avoiding and/or minimising biodiversity impacts can compromise the approval of a development application. Feasible alternatives that have been considered as part of the design process should be discussed in any future assessments in order to demonstrate impacts to biodiversity have been minimised during the design stage.

Based on the current layout, the Planning Proposal would result in the removal of 3.44 ha of remnant native vegetation (PCTs) which is listed as a TEC under the BC Act. This includes the removal of 1.26 ha of vegetation listed Critically endangered under the EPBC Act (MNES). The proposal would retain 16.08 ha of native remnant vegetation within the study area.

### 5.3.3. Targeted surveys for threatened species

Under the BAM, targeted survey may be required for threatened species listed as species credit species. Potential habitat for the following threatened species was identified as present in the study area. Depending on the final development footprint, targeted survey may be required for the following threatened species which were determined as potential or likely to occur within the study area (Appendix A):

Fauna:

- White-bellied Sea-Eagle
- Little Eagle
- Green and Golden Bell Frog
- Southern Myotis
- Large Bent-winged Bat
- Powerful Owl
- Eastern Osprey
- Grey-headed Flying-fox
- Masked Owl

Flora:

- *Cynanchum elegans* (White-flowered Wax Plant)
- *Daphnandra johnsonii* (Illawarra Socketwood)
- *Irenepharsus trypherus* (Illawarra Irene)
- *Solanum celatum*
- *Rhodamnia rubescens* (Scrub Turpentine)

- *Zieria granulata.*

### 5.3.4. Matters of national environmental significance

Under the EPBC Act, works likely to affect Matters of National Environmental Significance (MNES) may be considered to be a 'controlled action'. Application of the significant impact criteria would be required at the DA stage. The proponent would also be required to undertake a self-assessment to decide whether a referral to the Minister is required.

Illawarra-Shoalhaven Subtropical Rainforest and *Zieria granulata* are both MNES present within the study area. Therefore, impacts to these MNES need to be assessed.

### 5.3.5. Serious and irreversible impacts

Illawarra Subtropical Rainforest and *Melaleuca armillaris* Tall Shrubland are identified as entities at risk of serious and irreversible impacts (SAII) under the BC Act. SAII entities are those that are most at risk of extinction from potential development. Four principles have been designed to identify impacts which are likely to contribute significantly to the risk of extinction of a threatened species or ecological community in NSW (DPIE 2019). These are impacts that:

- 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
- will further reduce the population size of the species that is currently observed, estimated, inferred or reasonably suspected to have a very small population size, or will further degrade or disrupt an ecological community that is already observed, inferred or reasonably suspected to be severely degraded or disturbed
- 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
- impact on a species or ecological community that is unlikely to respond to measures to improve habitat and vegetation integrity and is therefore irreplaceable.

Illawarra Subtropical Rainforest is a listed ecological community entity at risk of SAII, due to meeting the second principle outlined above. *Melaleuca armillaris* Tall Shrubland is listed due to meeting the first three principles outlined above. Therefore, any vegetation within the study area that has been mapped as Illawarra Subtropical Rainforest or *Melaleuca armillaris* Tall Shrubland (as defined by the BC Act) will be subject to SAII entity requirements, that is any applications for development under Part 4 of the EP&A Act must be assessed by the decision-maker. If the decision-maker forms the opinion that the proposal is likely to have a serious and irreversible impact on the candidate SAII entity, it must refuse the application.

The BC Act introduced the concept of Serious and Irreversible Impacts (SAII) which aims to protect threatened entities that are most at risk of extinction. The BC Act recognises that there are some types of SAII that the community expects will not occur except where the consent authority considers that this type of impact is outweighed by the social and economic benefits that the development will deliver to the State.

Illawarra Subtropical Rainforest and *Melaleuca armillaris* Tall Shrubland present within the study area are both listed as SAII entities. The subject site intersects both SAII entities listed as TECs (3.44 ha). Thus, Council must form an opinion at the DA stage as to whether the proposed impacts (direct and indirect) to the community would constitute SAII. If Council determines the impacts to be SAII, it must refuse the DA.

Any proposed development should avoid impacts to SAII entities to reduce approvals risk. When preparing a biodiversity assessment, proposed impacts should consider the *Guidance to assist a decision-maker to determine a serious and irreversible impact* (DPIE, 2019d), clause 6.7 of the BC Reg and section 9.1 of BAM.

### 5.3.6. Riparian zones

The subject site occurs on 'waterfront land' defined under the WM Act (within 40 m from top of bank). All earthworks within 40 m of a watercourse would be considered a controlled activity under the WM Act and would likely trigger protection and rehabilitation of riparian corridors under a Vegetation Management Plan (VMP). It is anticipated that a controlled activity approval would be required for works in the vicinity of the Spring Creek and its tributaries. Accordingly, a VMP (or multiple VMPs) would need to be prepared and implemented for these riparian corridors. VMPs provide for the restoration and management of vegetation, typically for a five-year period.

Spring Creek and its tributaries traverse the length of the study area. There are numerous watercourses within the study area with Strahler Stream Orders ranging from 1-4. The subject site intersects NRAR riparian buffers within the study area (Figure 7). The Natural Resources Access Regulator's (NRAR's) *Guidelines for controlled activities on waterfront land* allow encroachment of the outer 50% of the vegetated riparian zone (VRZ) (measured from the top of bank) if riparian offsets are provided elsewhere along the corridor to provide an average VRZ width. This should only be applied in moderation to smooth out some development edges, rather than aim to maximise development yield. The proposed rezoning may be accommodated provided that this riparian averaging exercise is undertaken. The inner 50% VRZ is required to be fully protected as a fully structured riparian community.

Numerous first order streams were identified on the State Hydroline mapping within the proposed study area (Figure 7). If meeting the definition of a 'river' under the WM Act, these streams would be classed as waterfront land. However, the NRAR *Guidelines for controlled activities on waterfront land* state that where a watercourse does not exhibit features of a defined channel with bed and bank, the NRAR may determine that the watercourse is not waterfront land for the purposes of the WM Act. Evidence such as photos and site inspection must support the determination by NRAR. Some of the mapped first order streams within the study area do not meet the definition of a 'river' under the WM Act (see assessment contained in Appendix D). It is recommended that the client seeks confirmation from NRAR that the portions of the Hydroline considered to not meet the definition of a river can be treated as such.

Spring Creek is also mapped as Key Fish Habitat (Figure 7), which is a trigger for permits or inter-agency consultation under Part 7 of the *Fisheries Management Act 1994* (FM Act) for works that involve earthworks within the bed or bank of the stream, dredging, reclamation or obstruction of fish passage (e.g. crossings). Proposed road infrastructure crosses Spring Creek (KFH) at two locations at the northern and southern end of the study (Figure 7). However, these creek crossings are existing roads namely Long Brush Road in the southern section and a paved driveway accessing the dwelling at 103

Jamberoo Road Kiama in the northern section of the study area. Therefore, these areas would not be considered new development within KFH. However, any proposed development that extends beyond the footprint of the existing roads (for example, road widening works) within KFH mapped areas would likely require consultation with Department of Primary Industries (DPI) Fisheries under s.199 of the FM Act.

Farm dams are also present within the subject site. A Dam Dewatering Plan (DDP) is recommended prior to the removal of any dams to relocate any existing aquatic fauna that inhabit the dams.

# 6. Conclusion

Ocean Farm Property Trust are proposing to submit a rezoning application for properties west of Kiama NSW: 103 Jamberoo Road Kiama, 33 Greyleigh Drive Kiama and 177 Long Brush Road Jerrara (the study area). The objective is to rezone the site from RU2 Rural Landscape to a variety of new land use zones including residential (R2, R3 and R5), recreational (RE1), special purpose (SP4) and conservation (C2). This Biodiversity Technical Study was prepared to support the rezoning application and identify the constraints for future development.

The vegetation within the study area is a mix of exotic pasture, planted exotic and native species and remnant subtropical rainforest and Melaleuca Forest. Two Plant Community Types (PCTs) occur within the study area:

- PCT 3013 *Illawarra Lowland Subtropical Rainforest* which corresponds with *Illawarra Subtropical Rainforest in the Sydney Basin Bioregion*, listed as an EEC under the BC Act, as described in the Final Determination (DPE 2020). PCT 3013 also corresponds to a CEEC listed under the EPBC Act, known as *Illawarra–Shoalhaven subtropical rainforest of the Sydney Basin Bioregion*.
- PCT 3872 *Illawarra Basalt Melaleuca Scrub* which corresponds with *Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion*, listed as critically endangered under the BC Act.

PCT 3013 in moderate and good condition within the study area meets the minimum requirements for a vegetation patch to correspond with the EPBC Act definition and is therefore *Illawarra-Shoalhaven Subtropical Rainforest in the Sydney Basin Bioregion* as listed under the EPBC Act.

The field survey also found an abundance of *Zieria granulata* throughout the study area which is listed as endangered under the BC Act and EPBC Act.

Whilst no threatened fauna species were identified during the field survey, a number of habitat features were identified that would provide habitat for a number of threatened species.

Spring Creek and its tributaries traverse the length of the study area. There are numerous watercourses within the study area with Strahler Stream Orders ranging from 1-4. The subject site intersects NRAR riparian buffers within the study area. Development on waterfront land (within 40 m of a watercourse) would require a VMP (or multiple VMPs) to improve riparian vegetation as much as practical. Based on the current layout, it is likely a controlled activity approval would be required along Spring Creek and its tributaries within the study area and a VMP would need to be prepared to guide the restoration of native vegetation within the corridor.

Based off the current layout, the development of land proposed for rezoning under this Planning Proposal would result in the removal of up to 3.44 ha of remnant native vegetation (PCTs). The proposal would retain 16.08 ha of native remnant vegetation within the study area. The study area included several high constraints that would need to be considered for any future development with approval of the rezoning application. High constraints within the study area include threatened ecological communities, threatened flora species (*Zieria granulata*), potential habitat for threatened fauna SAII entities and areas mapped on the NSW DPE's BV Map. Any impacts on these areas are likely to trigger

entry into the NSW BOS, for which assessment using the BAM and preparation of a BDAR would be required. Any residual impacts would be required to be offset.

Illawarra Subtropical Rainforest and *Melaleuca armillaris* Tall Shrubland within the study area are listed as SAII entities. In reviewing any future DAs, Council must form an opinion as to whether the proposed impacts (direct and indirect) to these communities would constitute SAII. If Council determines the impacts to be SAII, it must refuse the DA.

However, there are areas mapped to have low and moderate constraints that may be suitable for future development and comprise exotic vegetation, cleared land and houses.

# 7. References

Department of Agriculture, Water and the Environment (DAWE), 2022a. *EPBC Act Protected Matters Search Tool:* http://www.environment.gov.au/epbc/pmst/. Accessed September2022.

Department of Planning and Environment (DPE), 2022a. *Atlas of NSW Wildlife (BioNet):* http://www.bionet.nsw.gov.au/. Accessed September 2022.

DPE, 2022b. *Biodiversity Values Map and Threshold Tool:* https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BOSETMap. Accessed 15 June 2022.

DPE, 2022d. *Vegetation Information System (VIS) Classification (BioNet):* https://www.environment.nsw.gov.au/research/Visclassification.htm. Accessed September 2022.

DPE 2022e. *Illawarra Zieria – profile*. NSW Office of Environment and Heritage: https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10856. Accessed September 2022.

DPE 2022f. *Illawarra Subtropical Rainforest in the Sydney Basin Bioregion – profile*. NSW Office of Environment and Heritage: https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10427. Accessed September 2022.

DPE 2022e. *Illawarra Shoalhaven Subtropical Rainforest in the Sydney Basin Bioregion – profile.* NSW Office of Environment and Heritage: https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=20396. Accessed September 2022.

DPE 2022f. *Melaleuca armillaris Tall Shrubland in the Sydney basin Bioregion – profile*. NSW Office of Environment and Heritage: https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10513. Accessed September 2022.

Department of Primary Industries (DPI), 2022. *Fisheries NSW Spatial Data Portal – Key Fish Habitat layer*: https://webmap.industry.nsw.gov.au/Html5Viewer/index.html?viewer=Fisheries_Data_Portal. Accessed September 2022.

Department of Planning, Industry and Environment (DPIE), 2019. *Guidance to assist a decision-maker to determine a serious and irreversible impact.* Available from: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Biodiversity/guidance-decision-makers-determine-serious-irreversible-impact-190511.pdf. Accessed September 2022

Kiama Municipal Council, 2011. *Kiama Local Environment Plan 2011*. https://legislation.nsw.gov.au/view/html/inforce/current/epi-2011-0680 . Accessed September 2022

Natural Resources Access Regulator (NRAR), 2018. *Guidelines for controlled activities on waterfront land—Riparian corridors.* Published by NSW Department of Industry: INT19/15607.

NSW Government, 2022. ePlanning *Spatial Viewer*: https://www.planningportal.nsw.gov.au/spatialviewer/#/find-a-property/address.

NSW Scientific Committee, 2019. *Conservation Advice for Illawarra-Shoalhaven subtropical rainforest of the Sydney basin Bioregion*. Department of Climate Change, Energy, the Environment and Water (DCCEEW). https://www.environment.gov.au/biodiversity/threatened/communities/pubs/148-conservation-advice.pdf. Accessed September 2022.

# Appendix A Likelihood of Occurrence

An assessment of likelihood of occurrence was made for all threatened ecological communities, and flora, fauna and migratory species identified from the database search. Five terms for the likelihood of occurrence of species are used in this report. This assessment was based on database or other records, presence or absence of suitable habitat, features of the proposal site, results of the site inspection and professional judgement. Some Migratory or Marine species identified from the Commonwealth database search have been excluded from the assessment, due to lack of habitat. The terms for likelihood of occurrence are defined below:

- 'known' = the species was or has been observed on the site;
- 'likely' = a medium to high probability that a species uses the site;
- 'potential' = suitable habitat for a species occurs on the site, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur;
- 'unlikely' = a very low to low probability that a species uses the site; and
- 'no' = habitat within the study area and in the vicinity is unsuitable for the species.

A test of significance was conducted for threatened species that were recorded within the study area or had a higher likelihood of occurring and were not recorded during the site visit. It is noted that some threatened fauna species that are highly mobile, wide ranging and vagrant may use portions of the study area intermittently for foraging. For these fauna species, the habitat present and likely to be affected is not considered to be important to the threatened species, particularly in relation to the amount of similar habitat remaining in the surrounding landscape. As such, a test of significance in reference to State or Commonwealth legislation was not considered necessary.

Information provided in the habitat associations' column has primarily been extracted (and modified) from the Commonwealth Species Profile and Threats Database and the NSW Threatened Species Profiles.

| Scientific Name | BC Act Status | EPBC Act Status | Distribution and Habitat | Likelihood of occurrence |
|---|---|---|---|---|
| **ECOLOGICAL COMMUNITIES** | | | | |
| *Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community* | | E | Coastal Swamp Oak Forest ecological community is characterised by the dominance of Casuarina glauca in the canopy, with an understorey of rushes, sedges, forbs and grasses. Coastal Swamp Oak Forest is typically found on loose or alluvial soil on coastal flats, floodplains, drainage lines, lake margins, wetlands and estuarine fringes where soils are at least occasionally saturated, water-logged or inundated. Swamp Oak is the main tree seen in the canopy, other species like lilly pillies (*Acmena smithii*), red ash or soap tree (*Alphitonia excelsa*), weeping bottlebrush (*Callistemon saligna*), tuckeroo (*Cupaniopsis anacardioides*) and cheese trees (*Glochidion ferdinandi*) can form a sub canopy. This community occurs as scatterened patches between Curtis Island (South-east Queensland) and Bermagui (southern New South Whales). | No - this community was not identified during the field survey |
| *Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland* | E | | The most widespread and abundant dominant trees include *Eucalyptus robusta* (swamp mahogany), *Melaleuca quinquenervia* (paperbark) and, south from Sydney, *Eucalyptus botryoides* (bangalay) and *Eucalyptus longifolia* (woollybutt). Shrubs include *Acacia longifolia*, *Dodonaea triquetra*, *Ficus coronata*, *Leptospermum polygalifolium* subsp. *polygalifolium* and *Melaleuca* spp. Occasional vines include *Parsonsia straminea*, *Morinda jasminoides* and *Stephania japonica* var. *discolor*. The groundcover is composed of abundant sedges, ferns, forbs, and grasses including *Gahnia clarkei*, *Pteridium esculentum*, *Hypolepis muelleri*, *Calochlaena dubia*, *Dianella caerulea*, *Viola hederacea*, *Lomandra longifolia*, *Entolasia marginata* and *Imperata cylindrica*. Known from parts of the Local Government Areas of Tweed, Byron, Lismore, Ballina, Richmond Valley, Clarence Valley, Coffs Harbour, Bellingen, Nambucca, Kempsey, Hastings, Greater Taree, Great Lakes and Port Stephens, Lake Macquarie, Wyong, Gosford, Hornsby, Pittwater, Warringah, Manly, Liverpool, Rockdale, Botany Bay, Randwick, Sutherland, Wollongong, Shellharbour, Kiama and Shoalhaven. | No - this community was not identified during the field survey |
| ***Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion*** | **E** | **CE** | **Characteristic tree species include *Baloghia inophylla* (Brush Bloodwood), *Brachychiton acerifolius* (Flame Tree), *Dendrocnide excelsa* (Giant Stinging Tree), *Diploglottis australis* (Native Tamarind), *Ficus spp., Pennantia cunninghamii* (Brown Beech), and *Toona ciliata* (Red Cedar). Species of *Eucalyptus, Syncarpia* and *Acacia* may also be present as emergents or incorporated into the dense canopy. While rainforest canopies are generally closed, in highly disturbed stands the canopy of ISR may be irregular and open. The height of the canopy varies considerably, and structurally some stands of ISR are scrub. Illawarra coastal plain and escarpment foothills, rarely extending onto the upper escarpment slopes. Recorded from the local government areas of Wollongong, Shellharbour, Shoalhaven and Kiama. Mainly occurs between Albion Park and Gerringong, but outlying occurrences extend south to the Shoalhaven River and west into the Kangaroo Valley.** | **Yes – this community was identified during the field survey** |

| Scientific Name | BC Act Status | EPBC Act Status | Distribution and Habitat | Likelihood of occurrence |
|---|---|---|---|---|
| *Illawarra and south coast lowland forest and woodland ecological community* | E | | Characteristic tree species include *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus eugenioides* (Thin-leaved Stringybark), *Eucalyptus longifolia* (Woollybutt), *Eucalyptus bosistoana* (Coast Grey Box) and *Melaleuca decora* (White Feather Honey-myrtle). The understorey is not necessarily grassy as moist forest vegetation types are also included within this broad community. Common shrub species include *Acacia mearnsii* and *Dodonaea viscosa subsp. angustifolia.* Floodplain vegetation dominated by *Casuarina* species or rainforests on latite soils are not part of this community. Illawarra coastal plain and escarpment foothills. Recorded from the LGAs of Wollongong, Shellharbour and Kiama, and Shoalhaven. | No - this community was not identified during the field survey |
| *Littoral Rainforest and Coastal Vine Thickets of Eastern Australia* | E | CE | Typically is a closed canopy of trees that can be interspersed with canopy gaps that are common in exposed situations or with storm events. The canopy forms a mosaic due to canopy regeneration, typically in the form of basal coppice following canopy decapitation due to prevailing salt laden winds and storm events. Emergents may be present, for example, *Banksia* or *Eucalyptus.* The ground stratum of the vegetation typically is very sparse. Typically occurs within two kilometres of the coast; in NSW, found in the NSW North Coast, Sydney Basin and South East Corner bioregions. | No - this community was not identified during the field survey |
| *River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria* | E | | The structure of the community may vary from tall open forests (>40m) to woodlands. The most widespread and abundant dominant trees include *Eucalyptus tereticornis* (forest red gum*), E. amplifolia* (cabbage gum), *Angophora floribunda* (rough-barked apple) and *A. subvelutina* (broad-leaved apple). *Eucalyptus baueriana* (blue box), *E. botryoides* (bangalay) and *E. elata* (river peppermint) may be common south from Sydney. *E. ovata* (swamp gum) occurs on the far south coast, *E. saligna* (Sydney blue gum) and *E. grandis* (flooded gum) may occur north of Sydney, while *E. benthamii* is restricted to the Hawkesbury floodplain. A layer of small trees may be present, including *Melaleuca decora*, *M. styphelioides* (prickly-leaved teatree), *Backhousia myrtifolia* (grey myrtle), *Melia azadarach* (white cedar), *Casuarina cunninghamiana* (river oak) and *C. glauca* (swamp oak). Scattered shrubs include *Bursaria spinosa*, *Solanum prinophyllum*, *Rubus parvifolius, Breynia oblongifolia, Ozothamnus diosmifolius, Hymenanthera dentata, Acacia floribunda* and *Phyllanthus gunnii*. The groundcover is composed of abundant forbs, scramblers and grasses. Found on the river flats of the coastal floodplains. Known from parts of the Local Government Areas of Port Stephens, Maitland, Singleton, Cessnock, Lake Macquarie, Wyong, Gosford, Hawkesbury, Baulkham Hills, Blacktown, Parramatta, Penrith, Blue Mountains, Fairfield, Holroyd, Liverpool, Bankstown, Wollondilly, Camden, Campbelltown, Sutherland, Wollongong, Shellharbour, Kiama, Shoalhaven, Palerang, Eurobodalla and Bega Valley. | No - this community was not identified during the field survey |
| *Robertson Rainforest in the* | E | | Warm or cool temperate rainforest with a generally dense structure. It is dominated by *Quintinia sieberi* (Possumwood), *Polyosma cunninghamii* (Featherwood), *Doryphora sassafras* (Sassafras) and *Acacia melanoxylon* (Blackwood). Common shrub species include *Hymenanthera dentata* (Tree Violet), *Coprosma quadrifida* (Prickly Coprosma) and | No - this community was not identified during the field survey |

| Scientific Name | BC Act Status | EPBC Act Status | Distribution and Habitat | Likelihood of occurrence |
|---|---|---|---|---|
| *Sydney Basin Bioregion* | | | *Tasmannia insipida* (Brush Pepperbush). Restricted distribution in the eastern parts of the Southern Highlands of NSW. There are two main occurrences of the community within this distribution: on the Robertson Plateau around the town of Robertson and on the higher parts of the Cambewarra Range further to the south. | |
| *Subtropical and Temperate Coastal Saltmarsh* | | V | Consists mainly of salt-tolerant vegetation (halophytes) including: grasses, herbs, sedges, rushes and shrubs. Succulent herbs, shrubs and grasses generally dominate and vegetation is generally of less than 0.5 m height (with the exception of some reeds and sedges). Many species of non-vascular plants are also found in saltmarsh, including epiphytic algae, diatoms and cyanobacterial mats. In New South Wales, the lower intertidal zone is often dominated by herbs and grasses (e.g. *Sarcocornia quinqueflora, Sporobolus viginicus, Samolus repens* and *Triglochin striata*) which give way to tall sedges and rushes in the landward sections of the intertidal zone. Within a relatively narrow margin of the Australian coastline, within the subtropical and temperate climatic zones south of the South- east Queensland IBRA bioregion. | No - this community was not identified during the field survey |

*Status key: V = Vulnerable; E = Endangered; CE= Critically Endangered*

| Scientific Name | Common name | BC Act Status | EPBC Act Status | Distribution and Habitat | Likelihood of occurrence |
|---|---|---|---|---|---|
| *Actitis hypoleucos* | Common Sandpiper | | M | Summer migrant. In NSW, widespread along coastline and also occurs in many areas inland. Coastal wetlands and some inland wetlands, especially muddy margins or rocky shores. Also estuaries and deltas, lakes, pools, billabongs, reservoirs, dams and claypans, mangroves. | Unlikely – there are limited records of this species within a 5km radius of the study area. |
| *Anthochaera phrygia* | Regent Honeyeater | E4A | CE | Inland slopes of south-east Australia, and less frequently in coastal areas. In NSW, most records are from the North-West Plains, North-West and South-West Slopes, Northern Tablelands, Central Tablelands and Southern Tablelands regions; also recorded in the Central Coast and Hunter Valley regions. Found in eucalypt woodland and open forest, wooded farmland and urban areas with mature eucalypts, and riparian forests of *Casuarina cunninghamiana* (River Oak). | Unlikely – no records have been made within 5km and the study area lacks suitable habitat |
| *Arctocephalus pusillus* | Australian Fur-seal | V | | Reported to have bred at Seal Rocks, near Port Stephens and Montague Island in southern NSW. Haul outs are observed at isolated places along the NSW coast. Found in rocky parts of islands with flat, open terrain. | No – the study area lacks suitable habitat for this species. |
| *Ardenna carneipes* | Flesh-footed Shearwater | V | M | Recorded in NSW coastal waters. Breeds on Lord Howe Island. Found in marine environments | No – the study area lacks suitable habitat for this species. |
| *Ardenna grisea* | Sooty Shearwater | | M | Breeds on islands off NSW from Montague Island to Broughton Island. Present in eastern NSW on islands offshore. | No – the study area lacks suitable habitat for this species. |
| *Ardenna tenuirostris* | Short-tailed Shearwater | | M | Breeds on islands north to Broughton Island off NSW. Present in eastern NSW on islands offshore | No – the study area lacks suitable habitat for this species. |
| *Balaenoptera musculus* | Blue Whale | E1 | E,M | Found in marine environments 20 to 70 degrees south, including NSW waters. | No – the study area lacks suitable habitat for this species. |
| *Botaurus poiciloptilus* | Australasian Bittern | E1 | E | Found over most of NSW except for the far north-west. Permanent freshwater wetlands with tall, dense vegetation, particularly *Typha* spp. (bullrushes) and *Eleocharis* spp. (spikerushes). | Unlikely – the study area lacks suitable |

| Scientific Name | Common name | BC Act Status | EPBC Act Status | Distribution and Habitat | Likelihood of occurrence |
|---|---|---|---|---|---|
| | | | | | habitat for this species. |
| *Calidris acuminata* | Sharp-tailed Sandpiper | | M | Summer migrant. Widespread in most regions of NSW, especially in coastal areas, but sparse in the south-central Western Plain and east Lower Western Regions. Shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. | Unlikely – the study area lacks suitable habitat for this species. |
| *Calidris melanotos* | Pectoral Sandpiper | | M | Summer migrant to Australia. Widespread but scattered in NSW. East of the Great Divide, recorded from Casino and Ballina, south to Ulladulla. West of the Great Divide, widespread in the Riverina and Lower Western regions. Shallow fresh to saline wetlands, including coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. | Unlikely – No records have been made for this species within 5km radius of the study area and it lacks suitable habitat for this species. |
| *Calidris alba* | Sanderling | V | M | Occur along the NSW coast, with occasional inland sightings. It is found in coastal areas on low beaches of firm sand, near reefs and inlets, along tidal mudflats and lagoons; rarely recorded in near-coastal wetlands. | Unlikely – the study area lacks suitable habitat for this species |
| *Calidris canutus* | Red Knot | | E,M | Occurs in suitable habitat along the coast. It is found in intertidal mudflats, sandflats sheltered sandy beaches, estuaries, bays, inlets, lagoons, harbours, sandy ocean beaches, rock platforms, coral reefs, terrestrial saline wetlands near the coast, sewage ponds and saltworks. Rarely found in inland lakes or swamps. | Unlikely No records have been made for this species within 5km radius of the study area and it lacks suitable habitat for this species. |
| *Calidris ferruginea* | Curlew Sandpiper | E1 | CE,M | Occurs along the entire coast of NSW, and sometimes in freshwater wetlands in the Murray-Darling Basin. Found in littoral and estuarine habitats, including intertidal mudflats, non-tidal swamps, lakes and lagoons on the coast and sometimes inland. | Unlikely No records have been made for this species within 5km radius of the study area and it |

| Scientific Name | Common name | BC Act Status | EPBC Act Status | Distribution and Habitat | Likelihood of occurrence |
|---|---|---|---|---|---|
| | | | | | lacks suitable habitat for this species. |
| *Callocephalon fimbriatum* | Gang-gang Cockatoo | V | | In NSW, distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. Isolated records known from as far north as Coffs Harbour and as far west as Mudgee. Tall mountain forests and woodlands in summer; in winter, may occur at lower altitudes in open eucalypt forests and woodlands, and urban areas. | Unlikely - No records have been made for this species within 5km radius of the study area. |
| *Calyptorhynchus lathami* | Glossy Black-Cockatoo | V | | In NSW, widespread along coast and inland to the southern tablelands and central western plains, with a small population in the Riverina. Open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. | Unlikely – the study area lacks suitable habitat for this species |
| *Caretta caretta* | Loggerhead Turtle | E1 | E, M | In NSW, seen in coastal waters as far south as Jervis Bay and have been recorded nesting on the NSW north coast and feeding around Sydney. It is found in marine environments with nesting occurring on beaches. | No – the study area lacks suitable habitat for this species. |
| *Chalinolobus dwyeri* | Large-eared Pied Bat | V | V | Recorded from Rockhampton in Qld south to Ulladulla in NSW. Largest concentrations of populations occur in the sandstone escarpments of the Sydney basin and the NSW north-west slopes. Wet and dry sclerophyll forests, Cyprus Pine dominated forest, woodland, sub-alpine woodland, edges of rainforests and sandstone outcrop country. | Unlikely - No records have been made for this species within 5km radius of the study area. |
| *Charadrius leschenaultii* | Greater Sand-plover | V | V, M | In NSW, recorded between the northern rivers and the Illawarra, with most records coming from Clarence and Richmond estuaries. It is almost entirely restricted to coastal areas in NSW, mainly on sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks. | Unlikely - No records have been made for this species within 5km radius of the study area and it lacks suitable habitat for this species. |
| *Chelonia mydas* | Green Turtle | V | V, M | Occurs in coastal waters of NSW, generally on the north or central coast, with occasional records from the south coast. Scattered nesting records along the NSW coast. Found in marine environments with nesting occurring on beaches. | No – the study area lacks suitable habitat for this species. |

| Scientific Name | Common name | BC Act Status | EPBC Act Status | Distribution and Habitat | Likelihood of occurrence |
|---|---|---|---|---|---|
| ***Circus assimilis*** | **Spotted Harrier** | **V** | | **Found throughout the Australian mainland, except in densely forested or woodland habitats, and rarely in Tasmania. Found in Grassy open woodland, inland riparian woodland, grassland, shrub steppe, agricultural land and edges of inland wetlands.** | **Potential – records have been made for this species within a 5 km radius of the study area. The study area likely contains foraging habitat.** |
| *Dasyornis brachypterus* | Eastern Bristlebird | E1 | E | There are three main populations: Northern - southern Qld/northern NSW, Central - Barren Ground NR, Budderoo NR, Woronora Plateau, Jervis Bay NP, Booderee NP and Beecroft Peninsula and Southern - Nadgee NR and Croajingalong NP in the vicinity of the NSW/Victorian border. Central and southern populations inhabit heath and open woodland with a healthy understorey. | Unlikely - No records have been made for this species within 5km radius of the study area. |
| ***Dasyurus maculatus maculatus* (SE mainland population)** | **Spotted-tailed Quoll** | **V** | **E** | **Found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Qld. Rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.** | **Potential – records have been made within the study area, however these are old and land use change has occurred since then** |
| *Dermochelys coriacea* | Leatherback Turtle | E1 | E, M | All coastal waters of Australia. Large numbers feed in coastal waters south to the central coast of NSW. Occasional breeding records from NSW coast, including between Ballina and Lennox Head in northern NSW. Found in marine environments with nesting occurring on beaches. | No – the study area lacks suitable habitat for this species. |
| *Diomedea antipodensis* | Antipodean Albatross | V | V | Regularly occurs off the NSW south coast from Green Cape to Newcastle during winter. Found in marine environments | No – the study area lacks suitable habitat for this species. |
| *Diomedea exulans* | Wandering Albatross | E1 | V, M | Has been recorded along the length of the NSW coast. Found in marine environments. | No – the study area lacks suitable habitat for this species. |

| Scientific Name | Common name | BC Act Status | EPBC Act Status | Distribution and Habitat | Likelihood of occurrence |
|---|---|---|---|---|---|
| *Epthianura albifrons* | White-fronted Chat | V | | Occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state. Saltmarsh vegetation, open grasslands and sometimes low shrubs bordering wetland areas. | No – the study area lacks suitable habitat for this species. |
| *Eubalaena australis* | Southern Right Whale | E1 | E, M | Migrate between summer feeding grounds in Antarctica and winter breeding grounds around the coasts of southern Australia. Marine | No – the study area lacks suitable habitat for this species. |
| *Falco hypoleucos* | Grey Falcon | E1 | | Arid and semi-arid zones. In NSW, found chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. Found in shrubland, grassland and wooded watercourses, occasionally in open woodlands near the coast, and near wetlands. | Unlikely - No records have been made for this species within 5km radius of the study area. |
| ***Falsistrellus tasmaniensis*** | **Eastern False Pipistrelle** | **V** | | **South-east coast and ranges of Australia, from southern Qld to Victoria and Tasmania. In NSW, records extend to the western slopes of the Great Dividing Range. Tall (greater than 20m) moist habitats.** | **Potential - limited records have been made for this species within 5km radius of the study area and it lacks suitable habitat for this species.** |
| *Fregetta grallaria grallaria* | White-bellied Storm-Petrel | V | V | Vagrant birds occur in coastal NSW waters, particularly after storm events. Marine | No – the study area lacks suitable habitat for this species. |
| *Gallinago hardwickii* | Latham's Snipe | | M | Migrant to east coast of Australia, extending inland west of the Great Dividing Range in NSW. Freshwater, saline or brackish wetlands up to 2000 m above sea-level; usually freshwater swamps, flooded grasslands or heathlands. | Unlikely – the study area lacks suitable habitat for this species. |
| *Glossopsitta pusila* | Little Lorikeet | V | | Found in open Eucalyptus forest and woodlands Isolated flowering trees in open country, eg. Paddocks, roadside remnants and urban trees. | Unlikely - limited records have been |

| Scientific Name | Common name | BC Act Status | EPBC Act Status | Distribution and Habitat | Likelihood of occurrence |
|---|---|---|---|---|---|
| | | | | | made for this species within 5km radius of the study area and it lacks suitable habitat for this species. |
| *Grantiella picta* | Painted Honeyeater | V | V | Widely distributed in NSW, predominantly on the inland side of the Great Dividing Range but avoiding arid areas. Found in Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. | Unlikely - No records have been made for this species within 5km radius of the study area and it lacks suitable habitat for this species. |
| *Haematopus fuliginosus* | Sooty Oystercatcher | V | | Distributed along the entire NSW coast. Found in rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries. | No – the study area lacks suitable habitat for this species. |
| *Haematopus longirostris* | Pied Oystercatcher | E1 | | Thinly scattered along the entire NSW coast. Intertidal flats of inlets and bays, open beaches and sandbanks. | No – the study area lacks suitable habitat for this species. |
| ***Haliaeetus leucogaster*** | **White-bellied Sea-Eagle** | **V** | | **Distributed along the coastline of mainland Australia and Tasmania, extending inland along some of the larger waterways, especially in eastern Australia. Freshwater swamps, rivers, lakes, reservoirs, billabongs, saltmarsh and sewage ponds and coastal waters. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, forest and urban areas.** | **Likely – many records have been made for this species within a 5 km radius of the study area. The study area likely contains foraging habitat.** |
| *Heleioporus australiacus* | Giant Burrowing Frog | V | V | South eastern NSW and Victoria, in two distinct populations: a northern population in the sandstone geology of the Sydney Basin as far south as Ulladulla, and a southern population occurring from north of | Unlikely – no records have been made for this species within a |

| Scientific Name | Common name | BC Act Status | EPBC Act Status | Distribution and Habitat | Likelihood of occurrence |
|---|---|---|---|---|---|
| | | | | Narooma through to Walhalla, Victoria. Heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. | 5km radius of the study area. |
| ***Hieraaetus morphnoides*** | **Little Eagle** | **V** | | **Throughout the Australian mainland, with the exception of the most densely-forested parts of the Dividing Range escarpment. Open eucalypt forest, woodland or open woodland, including sheoak or Acacia woodlands and riparian woodlands of interior NSW.** | **Potential – records have been made for this species within a 5 km radius of the study area. The study area likely contains foraging habitat.** |
| ***Hirundapus caudacutus*** | **White-throated Needletail** | | **M** | **All coastal regions of NSW, inland to the western slopes and inland plains of the Great Divide. Occur most often over open forest and rainforest, as well as heathland, and remnant vegetation in farmland.** | **Potential – records have been made for this species within a 5 km radius of the study area. The study area likely contains foraging habitat.** |
| *Hoplocephalus bungaroides* | Broad-headed Snake | E1 | V | Largely confined to Triassic and Permian sandstones within the coast and ranges in an area within approximately 250 km of Sydney. Dry and wet sclerophyll forests, riverine forests, coastal heath swamps, rocky outcrops, heaths, grassy woodlands. | Unlikely – no records have been made for this species within a 5km radius of the study area. |
| *Hydroprogne caspia* | Caspian Tern | | M | Widespread in coastal and inland NSW. Found in coastal offshore waters, beaches, mudflats, estuaries, rivers and lakes. | Unlikely – the study area lacks suitable habitat for this species. |
| *Isodon obesulus obesulus* | Southern Brown | E1 | E | Found in south-eastern NSW, east of the Great Dividing Range south from the Hawkesbury River. Found in **h**eath or open forest with a heathy understorey on sandy or friable soils. | Unlikely – no records have been made for this species within a |

| Scientific Name | Common name | BC Act Status | EPBC Act Status | Distribution and Habitat | Likelihood of occurrence |
|---|---|---|---|---|---|
| | Bandicoot (eastern) | | | | 5km radius of the study area. No suitable habitat |
| Ixobrychus flavicollis | Black Bittern | V | | In NSW, records are scattered along the east coast, with individuals rarely being recorded south of Sydney or inland. Terrestrial and estuarine wetlands. Also flooded grassland, forest, woodland, rainforest and mangroves where permanent water is present. | Unlikely – the study area lacks suitable habitat for this species. |
| *Lathamus discolor* | Swift Parrot | E1 | CE | Migrates from Tasmania to mainland in Autumn-Winter. In NSW, the species mostly occurs on the coast and south west slopes. Box-ironbark forests and woodlands. | Unlikely – the study area lacks suitable habitat for this species |
| ***Litoria aurea*** | **Green and Golden Bell Frog** | **E1** | **V** | **Since 1990, recorded from ~50 scattered sites within its former range in NSW, from the north coast near Brunswick Heads, south along the coast to Victoria. Records exist west to Bathurst, Tumut and the ACT region. Marshes, dams and stream-sides, particularly those containing *Typha* spp. (bullrushes) or *Eleocharis* spp. (spikerushes). Some populations occur in highly disturbed areas.** | **Potential – records have been made for this species within a 5 km radius of the study area. The study area contains suitable habitat.** |
| *Litoria watsoni* | Watson's Tree Frog | | E | In NSW, records are from near Wollongong in the north to north-eastern Victoria in the south. | Unlikely – no records have been made for this species within a 5km radius of the study area. |
| *Macroectes giganteus* | Southern Giant Petrel | E1 | E, M | Common visitor off the coast of NSW. Marine | No – the study area lacks suitable habitat for this species. |
| *Macroectes halli* | Northern Giant-Petrel | V | V, M | Common visitor in NSW waters, predominantly along the south-east coast during winter and autumn. Marine | No – the study area lacks suitable habitat for this species. |

| Scientific Name | Common name | BC Act Status | EPBC Act Status | Distribution and Habitat | Likelihood of occurrence |
|---|---|---|---|---|---|
| ***Mixophyes balbus*** | **Stuttering Frog** | **E1** | **V** | **Along the east coast of Australia from southern Qld to north-eastern Victoria. Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range.** | **Potential - while there are no records within a 5km radius of the study area for this species, there is potential habitat present.** |
| ***Myotis macropus*** | **Southern Myotis** | **V** | | **In NSW, found in the coastal band. It is rarely found more than 100 km inland, except along major rivers. Foraging habitat is waterbodies (including streams, or lakes or reservoirs) and fringing areas of vegetation up to 20m.** | **Potential – records have been made for this species within a 5 km radius of the study area. The study area contains suitable habitat.** |
| *Neophema chrysogaster* | Orange-bellied Parrot | E4A | CE | Breeds in Tasmania and migrates in autumn to spend the winter on the mainland coast of south-eastern SA and southern Victoria. Occasional reports from NSW, most recently Shellharbour and Maroubra in May 2003. Winter habitat is mostly within 3 km of the coast in sheltered bays, lagoons, estuaries, coastal dunes and saltmarshes. Also small islands and peninsulas, saltworks, golf courses, low samphire herbland and taller coastal shrubland. | Unlikely – no records have been made for this species within a 5km radius of the study area. |
| ***Miniopterus orianae oceanensis*** | **Large Bent-winged Bat** | **V** | | **East coast and ranges south to Wollongong in NSW. Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub.** | **Potential – records have been made for this species within a 5 km radius of the study area. The study area contains suitable habitat.** |
| ***Ninox strenua*** | **Powerful Owl** | **V** | | **In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains. Woodland, open sclerophyll forest, tall open wet forest and rainforest.** | **Potential – records have been made for this species within a** |

| Scientific Name | Common name | BC Act Status | EPBC Act Status | Distribution and Habitat | Likelihood of occurrence |
|---|---|---|---|---|---|
| | | | | | **5 km radius of the study area. The study area likely contains foraging habitat.** |
| *Numenius phaeopus* | Whimbrel | | M | Summer migrant to Australia. Found along almost the entire coast of NSW; scattered inland records. Found in estuaries, mangroves, tidal flats, coral cays, exposed reefs, flooded paddocks, sewage ponds, grasslands, sports fields, lawns. | No – the study area lacks suitable habitat for this species |
| ***Pandion cristatus*** | **Eastern Osprey** | **V** | | **Common around the northern NSW coast, and uncommon to rare from coast further south. Some records from inland areas. Found in rocky shorelines, islands, reefs, mouths of large rivers, lagoons and lakes.** | **Potential – records have been made for this species within a 5 km radius of the study area. The study area likely contains foraging habitat.** |
| *Petrogale penicillata* | Brush-tailed Rock-wallaby | E1 | V | In NSW they occur from the Qld border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges. | Unlikely - No records have been made for this species within 5km radius of the study area and it lacks suitable habitat for this species. |
| *Petaurus australis australis* | Yellow-bellied Glider | V | V | Along the eastern coast to the western slopes of the Great Dividing Range, from southern Qld to Victoria. Tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. | Unlikely – no records have been made for this species within a 5km radius of the study area. |

| Scientific Name | Common name | BC Act Status | EPBC Act Status | Distribution and Habitat | Likelihood of occurrence |
|---|---|---|---|---|---|
| *Petroica phoenicea* | Flame Robin | V | | In NSW, breeds in upland areas, and in winter many birds move to the inland slopes and plains, or occasionally to coastal areas. Likely that there are two separate populations in NSW, one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands. Breeds in upland tall moist eucalypt forests and woodlands. In winter uses dry forests, open woodlands, heathlands, pastures and native grasslands. Occasionally occurs in temperate rainforest, herbfields, heathlands, shrublands and sedgelands at high altitudes. | Unlikely - limited records have been made for this species within 5km radius of the study area and it lacks suitable habitat for this species. |
| *Potorous tridactylus trisulcatus* | Long-nosed Potoroo | V | V | Along the east coast of Australia from Queensland to eastern Victoria. In NSW is it restricted to coastal heaths and forests east of the Great Diving Range, with rainfall over 760mm. | Unlikely – no records have been made for this species within a 5km radius of the study area. |
| *Phascolarctos cinereus* | Koala | E | E | In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. There are sparse and possibly disjunct populations in the Bega District, and at several sites on the southern tablelands. Eucalypt woodlands and forests. | Unlikely - limited records have been made for this species within 5km radius of the study area and it lacks suitable habitat for this species. |
| *Pycnoptilus floccosus* | Pilotbird | | V | In NSW from Blue Mountains NP through to Dandenong Ranges in Victoria. Found in wet sclerophyll forests and temperate rainforest. | Unlikely - limited records have been made for this species within 5km radius of the study area and it lacks suitable habitat for this species. |
| *Phoebetria fusca* | Sooty Albatross | V | V, M | There are occasional sightings off the NSW coast, north of Grafton. Marine | No – the study area lacks suitable habitat for this species |

| Scientific Name | Common name | BC Act Status | EPBC Act Status | Distribution and Habitat | Likelihood of occurrence |
|---|---|---|---|---|---|
| *Pseudomys novaehollandiae* | New Holland Mouse | | V | Fragmented distribution across eastern NSW. Open heathlands, woodlands and forests with a heathland understorey, vegetated sand dunes. | Unlikely – no records have been made for this species within a 5km radius of the study area. |
| *Pterodroma leucoptera leucoptera* | Gould's Petrel | V | E | Recorded off NSW coast. Breeds on Cabbage Tree Island offshore from Port Stephens, and on nearby Boondelbah island. Marine. Nesting habitat is located within steeply sloping rock scree gullies with a canopy of Cabbage Tree Palms. | No – the study area lacks suitable habitat for this species |
| *Pterodroma neglecta neglecta* | Kermadec Petrel (west Pacific subspecies) | V | V | Vagrant birds occur in coastal NSW waters, particularly after storm events. Breeds on Balls Pyramid (near Lord Howe Island) and Phillip Island (near Norfolk Island). Marine | No – the study area lacks suitable habitat for this species |
| ***Pteropus poliocephalus*** | **Grey-headed Flying-fox** | **V** | **V** | **Along the eastern coast of Australia, from Bundaberg in Qld to Melbourne in Victoria. Subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.** | **Likely – records have been made within 5 km radius of the study area. The study area contains suitable foraging habitat** |
| ***Ptilinopus superbus*** | **Superb Fruit-Dove** | **V** | | **Principally from north-eastern Qld to north-eastern NSW. Further south, it is confined to pockets of suitable habitat, and occurs as far south as Moruya. Found in rainforest and closed forests. May also forage in eucalypt or acacia woodland where there are fruit-bearing trees.** | **Potential – records have been made for this species within a 5 km radius of the study area. The study area likely contains foraging habitat.** |

| Scientific Name | Common name | BC Act Status | EPBC Act Status | Distribution and Habitat | Likelihood of occurrence |
|---|---|---|---|---|---|
| *Puffinus assimilis* | Little Shearwater | V | | Recorded off NSW coast. Breeds on Lord Howe Island. Marine | No – the study area lacks suitable habitat for this species. |
| *Rostratula australis* | Australian Painted Snipe | E1 | E | In NSW most records are from the Murray-Darling Basin. Other recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys. Swamps, dams and nearby marshy areas. | Unlikely – no records have been made for this species within a 5km radius of the study area. |
| *Stercoraius pomarinus* | Pomarine Jaegar | | M | Uncommon summer migrant to Australian waters October/November to April/May; most records near shelf break off eastern NSW. Marine | No – the study area lacks suitable habitat for this species. |
| *Seriolella brama* | Blue warehou | | CD | Located off the coast of Southern Australia and New Zealand. | No – the study area lacks suitable habitat for this species. |
| *Sternula albifrons* | Little Tern | E1 | M | In NSW, it arrives from September to November, occurring mainly north of Sydney, with smaller numbers found south to Victoria. Found in sheltered coastal environments, harbours, inlets and rivers. | No – the study area lacks suitable habitat for this species. |
| ***Stictonetta naevosa*** | **Freckled Duck** | **V** | | **Inland river systems, occurring as far as coastal NSW in times of drought. Found in freshwater swamps and creeks, lakes, reservoirs, farm dams and sewage ponds.** | **Potential – records have been made for this species within a 5 km radius of the study area. The study area likely contains suitable habitat.** |
| *Thalassarche cauta* | Shy Albatross | V | V | Occurs along the east coast south from Stradbroke Island and across the south coast to Carnarvon in WA. It is commonly recorded off southeast NSW, though rarely north of Sydney. Marine | No – the study area lacks suitable habitat for this species. |

| Scientific Name | Common name | BC Act Status | EPBC Act Status | Distribution and Habitat | Likelihood of occurrence |
|---|---|---|---|---|---|
| *Thalassarche melanophris* | Black-browed Albatross | V | V | Regularly recorded off the NSW coast during May-November. Marine | No – the study area lacks suitable habitat for this species. |
| *Thalassarche bulleri* | Buller's Albatross | | V | Marine environments off the coast of NSW | No – the study area lacks suitable habitat for this species. |
| *Thalassarche steadi* | White-capped Albatross | | V, M | Marine environments off the coast of NSW | No – the study area lacks suitable habitat for this species. |
| *Thalassarche carteri* | Indian Yellow-nosed Albatross | | V, M | Marine environments off the coast of NSW | No – the study area lacks suitable habitat for this species. |
| ***Tyto novaehollandiae*** | **Masked Owl** | **V** | | **Recorded over approximately 90% of NSW, excluding the most arid north-western corner. Most abundant on the coast but extends to the western plains. Dry eucalypt forests and woodlands from sea level to 1100 m.** | Unlikely – while records have been made for this species within a 5 km radius of the study area, there are no dry eucalypt forests and woodlands within the study area |
| **FLORA** | | | | | |
| *Acacia bynoeana* | Bynoe's Wattle | E1 | V | Found in central eastern NSW, from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains. Heath or dry sclerophyll forest on sandy soils. | Unlikely – there are no records of this species within a 5km radius of the study area. |

| Scientific Name | Common name | BC Act Status | EPBC Act Status | Distribution and Habitat | Likelihood of occurrence |
|---|---|---|---|---|---|
| *Caladenia tessellata* | Thick Lip Spider Orchid | E1 | V | Currently known from two disjunct areas; one population near Braidwood on the Southern Tablelands and three populations in the Wyong area on the Central Coast. Found in grassy sclerophyll woodland on clay loam or sandy soils, or low woodland with stony soil. | Unlikely – there are no records of this species within a 5km radius of the study area and it lacks suitable habitat. |
| *Cryptostylis hunteriana* | Leafless Tongue Orchid | V | V | In NSW, recorded mainly on coastal and near coastal ranges north from Victoria to near Forster, with two isolated occurrences inland north-west of Grafton. Coastal heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodland, and lowland forest. | Unlikely – there are no records of this species within a 5km radius of the study area. |
| ***Cynanchum elegans*** | **White-flowered Wax Plant** | **E1** | **E** | **Restricted to eastern NSW, from Brunswick Heads on the north coast to Gerroa in the Illawarra region, and as far west as Merriwa in the upper Hunter River valley. Dry rainforest; littoral rainforest; *Leptospermum laevigatum-Banksia integrifolia* subsp. *integrifolia* (Coastal Tea-tree– Coastal Banksia) coastal scrub; *Eucalyptus tereticornis* (Forest Red Gum) or *Corymbia maculata* (Spotted Gum) open forest and woodland; and *Melaleuca armillaris* (Bracelet Honeymyrtle) scrub.** | **Likely – many records within proximity to the study area.** |
| ***Daphandra johnsonii*** | **Illawarra Socketwood** | **E1** | **E** | **Restricted to the Illawarra region, in the Shoalhaven, Kiama, Shellharbour and Wollongong areas. Rainforest and moist eucalypt forest on rocky hillsides and gullies of the Illawarra lowlands, occasionally extending onto the upper escarpment slopes.** | **Known – previous records within the study area. Not identified during field survey. Targeted searches recommended.** |
| *Genoplesium baueri* | Bauer's Midge Orchid | E1 | E | Has been recorded from locations between Nowra and Pittwater and may occur as far north as Port Stephens. Dry sclerophyll forest and moss gardens over sandstone. | Unlikely – there are no records of this species within a 5km radius of the study area. |

| Scientific Name | Common name | BC Act Status | EPBC Act Status | Distribution and Habitat | Likelihood of occurrence |
|---|---|---|---|---|---|
| *Gossia acmenoides* population in the Sydney Basin Bioregion south of the Georges River | Scrub Ironwood | E2 | | This disjunct population is located in the Illawarra region in the LGAs of Wollongong, Shellharbour and Kiama. May also occur in the adjoining LGAs of Shoalhaven and Wingecarribee, where there are areas of suitable habitat. Dry and subtropical rainforest. | Potential – there are records of this species within a 5km radius of the study area and suitable habitat. |
| *Haloragis exalata* subsp. *exalata* | Square Raspwort | V | V | Disjunct distribution in the Central Coast, South Coast and North Western Slopes botanical subdivisions of NSW. Protected and shaded damp situations in riparian habitats. | Unlikely – there are no records of this species within a 5km radius of the study area. |
| ***Irenepharsus trypherus*** | **Illawarra Irene** | **E1** | **E** | **Recorded within the local government areas of Kiama, Shellharbour, Shoalhaven, Tallaganda, Wingecarribee, and Wollongong, including Minnamurra Falls, the Jamberoo area, and Morton and Macquarie Pass National Parks. Moist sclerophyll forest, *Backhousia myrtifolia* (Ironwood) thickets, and rainforest, on steep rocky slopes near cliff lines and ridge tops.** | **Potential – there are no records, but good habitat is present.** |
| *Melaleuca biconvexa* | Biconvex Paperbark | V | V | Only found in NSW, populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north. Found in damp places, often near streams or low-lying areas on alluvial soils. | Unlikely – there are no records of this species within a 5km radius of the study area. |
| *Persicaria elatior* | Tall Knotweed | V | V | In south-eastern NSW recorded from Mt Dromedary, Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. In northern NSW known from Raymond Terrace (near Newcastle) and the Grafton area (Cherry Tree and Gibberagee State Forests). Beside streams and lakes, swamp forest or disturbed areas. | Unlikely – there are no records of this species within a 5km radius of the study area. |
| *Persoonia hirsuta* | Hairy Geebung | E1 | | Found in clayey and sandy soils in dry sclerophyll open forest, woodland and heath, primarily on the Mittagong Formation on the upper Hawkesbury Sandstone | Unlikely – there are no records of this species within a 5km |

| Scientific Name | Common name | BC Act Status | EPBC Act Status | Distribution and Habitat | Likelihood of occurrence |
|---|---|---|---|---|---|
| | | | | | radius of the study area. |
| *Pimelea spicata* | Spiked Rice-flower | E1 | E | Two disjunct areas; the Cumberland Plain (Marayong and Prospect Reservoir south to Narellan and Douglas Park) and the Illawarra (Landsdowne to Shellharbour to northern Kiama). | Unlikely – there are limited records of this species within a 5km radius of the study area and no suitable habitat onsite. |
| Pomaderris brunnea | Brown Pomaderris | E1 | V | In NSW, found around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. It also occurs near Walcha on the New England tablelands. Moist woodland or forest on clay and alluvial soils of flood plains and creek lines. | Unlikely – there are no records of this species within a 5km radius of the study area. |
| Prasophyllum affine | Jervis Bay Leek Orchid | E1 | E | Known from three areas south-east of Nowra on South Coast: Kinghorne Point, Wowly Gully near the town of Callala Bay, and near the township of Vincentia. Low heathland and sedgeland communities on poorly drained clay soils. | Unlikely – there are no records of this species within a 5km radius of the study area. |
| Pterostylis gibbosa | Illawarra Greenhood | E1 | E | Known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra). Open forest or woodland, on flat or gently sloping land with poor drainage. | Unlikely – there are no records of this species within a 5km radius of the study area. |
| Rhizanthella slateri | Eastern Australian Underground Orchid | E1 | E | In NSW, currently known from fewer than 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area, Agnes Banks and near Nowra. Sclerophyll forest in shallow to deep loams. | Unlikely – there are no records of this species within a 5km radius of the study area. |

| Scientific Name | Common name | BC Act Status | EPBC Act Status | Distribution and Habitat | Likelihood of occurrence |
|---|---|---|---|---|---|
| ***Rhodamnia rubescens*** | **Scrub Turpentine** | **CE** | | **Occurs in coastal districts north from Batemans Bay in New South Wales, approximately 280 km south of Sydney, to areas inland of Bundaberg in Queensland. Populations of R. rubescens typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m a.s.l. in areas with rainfall of 1,000-1,600 mm. Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils.** | **Potential – there are no records, but good habitat is present.** |
| *Rhodomyrtus psidioides* | Native Guava | | CE | In NSW, occurs north from Gosford. Coastal areas in warmer rainforest and rainforest margins. | Unlikely – there are no records of this species within a 5km radius of the study area |
| ***Solanum celatum*** | | **E1** | | **Restricted to an area from Wollongong to just south of Nowra, and west to Bungonia. Rainforest clearings and wet sclerophyll forests.** | **Potential – records have been made for this species within a 5 km radius of the study area. The study area likely contains suitable habitat.** |
| *Syzygium paniculatum* | Magenta Lily Pily | E1 | | Grows in subtropical and littoral rainforest on sandy soils or stabilised dues, often near the sea. | Unlikely – there are no records of this species within a 5km radius of the study area |
| *Thesium australe* | Austral Toadflax | V | V | In eastern NSW it is found in very small populations scattered along the coast, and from the Northern to Southern Tablelands. Grassland on coastal headlands or grassland and grassy woodland away from the coast. | Unlikely – there are no records of this species within a 5km radius of the study area |

| Scientific Name | Common name | BC Act Status | EPBC Act Status | Distribution and Habitat | Likelihood of occurrence |
|---|---|---|---|---|---|
| *Zeiria granulata* | Illawarra Zieria | E | E | Restricted to the Illawarra region in the Shellharbour and Kiama LGAs. Found on dry ridgetops and rock outcrops on shallow volcanic soils. | Known - records within the study area. |

*Status key: BC Act: E1 = Endangered, E2 = Endangered Population, E4 = Extinct, E4A = Critically Endangered, V = Vulnerable,*
*EPBC Act: M = Migratory, CD = Conservation Dependent, CE = Critically Endangered, E = Endangered, V = Vulnerable, X = Extinct*

# Appendix B Vegetation floristic plot data

| Species data entry | | Field # | Plot 1 | | | Plot 2 | | | Plot 3 | | | Plot 4 | | | Plot 5 | | | Plot 6 | | | Plot 7 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Field Name | 0 | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance |
| Acacia maidenii | | | | 5 | 10 | x | 2 | 100 | x | 5 | 3 | x | 40 | 20 | x | 0.1 | 5 | x | 0.1 | 5 | x | 10 | 5 |
| Acronychia oblongifolia | | | | | | | | | | | | | | | x | 20 | 50 | | | | | | |
| Adiantum formosum | | | | 0.5 | 100 | | | | x | 0.2 | 20 | | | | | | | | | | | | |
| Ageratina riparia | | | | | | x | 0.1 | 2 | | | | x | 0.1 | 20 | x | 0.1 | 50 | x | 1 | 50 | x | 0.1 | 5 |
| Alectryon subcinereus | | | | 10 | 2 | | | | | | | | | | | | | | | | | | |
| Alphitonia excelsa | | | | | | x | 10 | 10 | | | | | | | | | | | | | | | |
| Araujia sericifera | | | | 0.1 | 2 | | | | x | 0.1 | 5 | x | 0.1 | 5 | x | 1 | 1 | | | | | | |
| Asparagus asparagoides | | | | 0.1 | 5 | | | | | | | | | | | | | | | | | | |
| Asparagus scandens | | | | | | | | | | | | | | | x | 0.1 | 20 | x | 0.1 | 5 | | | |

| Species data entry | | Field # | Plot 1 | | | Plot 2 | | | Plot 3 | | | Plot 4 | | | Plot 5 | | | Plot 6 | | | Plot 7 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Field Name | 0 | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance |
| Asparagus spp. | asparagous setaceous | | | | | | | | | | | | | | x | 0.2 | 20 | x | 0.1 | 2 | | | |
| Backhousia myrtifolia | | | | | | x | 30 | 20 | | | | | | | x | 40 | 50 | | | | | | |
| Bidens pilosa var. pilosa | | | | 0.1 | 1 | x | 0.5 | 500 | | | | x | 0.1 | 50 | | | | | | | | | |
| Brachychiton acerifolius | | | | 2 | 1 | | | | | | | | | | | | | | | | x | 0.2 | 1 |
| Breynia oblongifolia | | | | 0.3 | 4 | | | | x | 0.1 | 1 | | | | | | | | | | | | |
| Cardiospermum grandiflorum | young gum vine sample 1 | | | | | | | | | | | | | | x | 0.2 | 20 | | | | | | |
| Carex longebrachiata | | | | 0.1 | 2 | | | | | | | | | | | | | | | | | | |
| Carex longebrachiata | | | | | | x | 0.2 | 20 | | | | | | | x | 0.1 | 10 | | | | | | |
| Cayratia clematidea | | | | 0.1 | 50 | | | | | | | | | | | | | | | | | | |

| Species data entry | | Field # | Plot 1 | | | Plot 2 | | | Plot 3 | | | Plot 4 | | | Plot 5 | | | Plot 6 | | | Plot 7 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Field Name | 0 | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance |
| Cayratia clematidea | | | | | | | | | | | | | | | x | 0.1 | 1 | | | | | | |
| Celastrus australis | vine sampl 2 | | | | | | | | | | | | | | | | | x | 0.1 | 5 | | | |
| Cheilanthes sieberi subsp. sieberi | | | | | | x | 0.1 | 50 | | | | | | | | | | | | | | | |
| Claoxylon australe | | | | | | | | | | | | x | 0.2 | 10 | x | 0.1 | 1 | | | | x | 2 | 3 |
| Clerodendrum tomentosum | | | | | | x | 1 | 5 | | | | | | | | | | | | | | | |
| Commelina cyanea | | | | 0.1 | 10 | x | 0.1 | 20 | x | 0.2 | 50 | | | | x | 0.2 | 100 | x | 0.5 | 100 | x | 0.1 | 10 |
| Commersonia fraseri | | | | | | x | 3 | 100 | | | | x | 0.1 | 20 | | | | | | | | | |
| Conyza sp. | | | | | | x | 0.1 | 5 | | | | | | | | | | | | | | | |
| Cynodon dactylon | | | | | | x | 0.5 | 100 | | | | | | | | | | | | | | | |
| Cyperus gracilis | | | | 0.1 | 20 | | | | | | | | | | x | 0.1 | 10 | x | 0.5 | 100 | | | |

| Species data entry | | Field # | Plot 1 | | | Plot 2 | | | Plot 3 | | | Plot 4 | | | Plot 5 | | | Plot 6 | | | Plot 7 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Field Name | 0 | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance |
| Delairea odorata | | | | 0.1 | 50 | | | | x | 0.1 | 20 | | | | x | 1 | 100 | x | 0.1 | 5 | | | |
| Dendrocnide excelsa | | | | | | | | | x | 0.1 | 1 | | | | | | | x | 0.2 | 5 | | | |
| Dichondra repens | | | | 0.2 | 100 | | | | | | | x | 0.1 | 100 | x | 5 | 500 | x | 0.5 | 100 | | | |
| Diospyros australis | | | | | | | | | | | | | | | | | | x | 0.2 | 1 | | | |
| Doodia australis | | | | | | | | | | | | | | | x | 0.5 | 100 | | | | x | 0.3 | 20 |
| Ehrharta erecta | | | | 2 | 500 | x | 20 | 2000 | x | 1 | 500 | x | 0.3 | 200 | x | 60 | 1000 | x | 2 | 100 | | | |
| Einadia hastata | | | | | | x | 0.1 | 5 | | | | | | | x | 0.1 | 2 | | | | | | |
| Elaeodendron australe var. australe | | | | 10 | 10 | | | | | | | | | | | | | | | | | | |
| Elaeodendron australe var. australe | cassine australe | | x | 1 | 5 | | | | | | | | | | x | 0.5 | 1 | | | | | | |
| Eragrostis leptostachya | | | | | | x | 1 | 100 | | | | | | | | | | | | | | | |

| Species data entry | | Field # | Plot 1 | | | Plot 2 | | | Plot 3 | | | Plot 4 | | | Plot 5 | | | Plot 6 | | | Plot 7 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Field Name | 0 | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance |
| Eustrephus latifolius | | | | | | | | | x | 0.1 | 20 | | | | x | 0.1 | 2 | x | 0.2 | 20 | | | |
| Eustrephus latifolius | | | | 0.5 | 100 | | | | | | | | | | | | | | | | | | |
| Ficus obliqua var. obliqua | | | | | | | | | | | | | | | | 1 | 1 | | | | x | 0.1 | 2 |
| Ficus spp. | morton bay | | | | | | | | | | | x | 0.1 | 1 | | | | | | | | | |
| Geitonoplesium cymosum | | | | 1 | 500 | x | 0.1 | 10 | x | 0.1 | 10 | x | 0.1 | 10 | x | 0.1 | 50 | x | 0.2 | 100 | x | 0.1 | 20 |
| Geranium homeanum | | | | 0.1 | 5 | | | | | | | | | | | | | | | | | | |
| Glycine clandestina | | | | | | x | 0.1 | 10 | | | | | | | | | | | | | | | |
| Gomphocarpus fruticosus | | | | | | x | 0.1 | 1 | | | | xx | 0.1 | 10 | | | | | | | | | |
| Hypochaeris radicata | | | | | | | | | | | | | | | x | 0.1 | 10 | | | | | | |
| Lantana camara | | | | 0.5 | 50 | x | 10 | 100 | x | 5 | 50 | x | 60 | 100 | x | 5 | 100 | x | 0.5 | 20 | x | 0.3 | 50 |

| Species data entry | | Field # | Plot 1 | | | Plot 2 | | | Plot 3 | | | Plot 4 | | | Plot 5 | | | Plot 6 | | | Plot 7 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Field Name | 0 | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance |
| Leucopogon juniperinus | | | | | | x | 0.5 | 20 | | | | | | | | | | | | | | | |
| Ligustrum lucidum | | | | 10 | 100 | | | | x | 75 | 100 | | | | x | 5 | 100 | x | 1 | 100 | | | |
| Ligustrum sinense | | | | 0.5 | 50 | | | | x | 0.1 | 20 | x | 0.1 | 10 | | | | | | | | | |
| Lindsaea linearis | | | | 0.5 | 100 | | | | x | 0.1 | 5 | | | | x | 10 | 500 | x | 5 | 500 | x | 0.2 | 50 |
| Maclura cochinchinensis | | | | 0.2 | 5 | | | | x | 2 | 20 | x | 0.2 | 5 | x | 2 | 20 | x | 0.2 | 20 | x | | |
| Malva spp. | | | | | | | | | | | | | | | x | 0.1 | 1 | | | | | | |
| Melaleuca armillaris subsp. armillaris | | | | | | x | 20 | 20 | | | | | | | | | | | | | | | |
| Melicope micrococca | | | | 0.1 | 3 | | | | | | | | | | | | | | | | | | |
| Microlaena stipoides var. stipoides | | | | 10 | 1000 | x | 40 | 2000 | x | 0.1 | 50 | x | 20 | 500 | x | 0.2 | 50 | x | 0.1 | 50 | x | 0.1 | 20 |

| Species data entry | | Field # | Plot 1 | | | Plot 2 | | | Plot 3 | | | Plot 4 | | | Plot 5 | | | Plot 6 | | | Plot 7 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Field Name | 0 | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance |
| Notelaea venosa | fake notalea | | | 5 | 1 | x | 10 | 5 | x | 0.3 | 3 | | | | x | 2 | 20 | x | 1 | 10 | | | |
| Nyssanthes diffusa | | | | 1 | 100 | | | | x | 0.2 | 10 | | | | | | | | | | | |
| Olea europaea subsp. cuspidata | | | | 10 | 50 | x | 5 | 100 | x | 10 | 10 | | | | x | 10 | 50 | x | 0.1 | 10 | x | 3 | 2 |
| Oplismenus imbecillis | | | | 25 | 2000 | x | 1 | 500 | x | 0.2 | 100 | x | 10 | 500 | x | 15 | 1000 | x | 10 | 500 | x | 0.2 | 100 |
| Pandorea pandorana subsp. pandorana | | | | 1 | 50 | | | | x | 0.1 | 50 | | | | | | | | | | x | | |
| Parsonsia straminea | | | | 0.1 | 2 | | | | | | | | | | | | | | | | | | |
| Passiflora edulis | | | | | | x | 0.1 | 1 | | | | | | | | | | | | | | | |
| Passiflora spp. | passiflora | | | 0.1 | 3 | | | | | | | | | | | | | | | | | | |
| Pellaea falcata | | | | 2 | 100 | | | | x | 2 | 100 | | | | | | | | | | | | |
| Phyllanthus gunnii | | | | | | | | | | | | | | | x | 0.1 | 10 | | | | x | 0.1 | 1 |

| Species data entry | | Field # | Plot 1 | | | Plot 2 | | | Plot 3 | | | Plot 4 | | | Plot 5 | | | Plot 6 | | | Plot 7 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Field Name | 0 | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance |
| Pittosporum multiflorum | | | | 0.2 | 20 | | | | x | 2 | 5 | x | 0.1 | 5 | | | | | | | x | 0.2 | 1 |
| Pittosporum undulatum | | | | | | | | | x | 0.1 | 10 | | | | x | 1 | 10 | x | 50 | 50 | x | 70 | 50 |
| Plectranthus parviflorus | | | | 0.5 | 50 | x | 5 | 2000 | | | | | | | x | 2 | 100 | x | 0.4 | 100 | | | |
| Poa labillardierei var. labillardierei | | | | | | x | 0.3 | 50 | | | | | | | | | | | | | | | |
| Pyrrosia rupestris | | | | | | x | 0.1 | 1 | | | | | | | | | | | | | | | |
| Rubus rosifolius var. rosifolius | | | | | | | | | | | | | | | | | | x | 0.1 | 20 | | | |
| Rumex brownii | | | | | | | | | | | | x | 0.1 | 1 | | | | | | | | | |
| Scolopia braunii | | | | 40 | 10 | | | | | | | | | | | | | | | | | | |
| Senecio linearifolius var. | | | | | | | | | | | | | | | x | 0.1 | 1 | | | | | | |

| Species data entry | | Field # | Plot 1 | | | Plot 2 | | | Plot 3 | | | Plot 4 | | | Plot 5 | | | Plot 6 | | | Plot 7 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Field Name | 0 | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance |
| arachnoideus | | | | | | | | | | | | | | | | | | | | | | | |
| Senecio madagascariensis | | | | | | x | 0.5 | 100 | | | | | | | | | | | | | | | |
| Setaria parviflora | | | | | | x | 0.1 | 50 | | | | | | | | | | | | | | | |
| Sida rhombifolia | | | | 0.1 | 50 | | | | | | | x | 0.1 | 50 | | | | x | 0.1 | 20 | | | |
| Sigesbeckia orientalis subsp. orientalis | | | | | | x | 0.1 | 5 | x | 0.1 | 5 | x | 0.1 | 5 | | | | | | | | | |
| Solanaceae spp. | | | | | | | | | | | | | | | x | 0.1 | 1 | | | | | | |
| Solanum mauritianum | | | | 0.5 | 50 | x | 0.2 | 50 | x | 0.1 | 1 | x | 0.1 | 5 | x | 2 | 20 | x | 0.2 | 20 | x | 0.1 | 1 |
| Stellaria media | | | | | | | | | | | | | | | x | 0.1 | 20 | | | | | | |
| Stephania japonica var. discolor | | | | 0.1 | 5 | | | | x | 0.1 | 1 | x | 0.1 | 20 | | | | | | | x | 0.1 | 1 |

| Species data entry | | Field # | Plot 1 | | | Plot 2 | | | Plot 3 | | | Plot 4 | | | Plot 5 | | | Plot 6 | | | Plot 7 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Field Name | 0 | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance | Stratum & Layer | Cover | Abundance |
| Streblus brunonianus | | | | 30 | 50 | | | | x | 0.3 | 50 | x | 0.1 | 5 | x | 0.2 | 10 | x | 1 | 50 | x | 0.1 | 20 |
| Tagetes minuta | | | | | | x | 0.1 | 3 | | | | | | | | | | | | | | |
| Trema tomentosa var. aspera | | | | | | | | | | | | | | | x | 0.1 | 10 | | | | | |
| Tylophora barbata | | | | | | | | | | | | | | | x | 0.1 | 5 | | | | | |
| Urtica incisa | | | | | | | | | x | 0.1 | 5 | | | | | | | | | | | |
| Veronica plebeia | | | | | | x | 0.1 | 20 | | | | | | | | | | | | | | |
| Xerochrysum bracteatum | | | | | | x | 0.1 | 5 | | | | | | | | | | | | | | |
| Zieria spp. | zieria granulata | | | | | x | 2 | 100 | | | | | | | x | 0.1 | 3 | | | | | |
| | cudweed | | | | | x | 0.1 | 50 | | | | | | | | | | | | | | |
| Citronella moorei | corky backhousia, | | | | | | | | | | | | | | | | | x | 20 | 20 | | |

| Species data entry | | Field # | Plot 1 | | | Plot 2 | | | Plot 3 | | | Plot 4 | | | Plot 5 | | | Plot 6 | | | Plot 7 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Field Name** | **0** | **Stratum & Layer** | **Cover** | **Abundance** | **Stratum & Layer** | **Cover** | **Abundance** | **Stratum & Layer** | **Cover** | **Abundance** | **Stratum & Layer** | **Cover** | **Abundance** | **Stratum & Layer** | **Cover** | **Abundance** | **Stratum & Layer** | **Cover** | **Abundance** | **Stratum & Layer** | **Cover** | **Abundance** |
| | citronella moorei? | | | | | | | | | | | | | | | | | | | | | | |
| | hymanenthera dentata | | | | | | | | | | | | | | | | | | | | x | 0.2 | 2 |
| Ficus coronata | | | | | | | | | | | | | | | | | | | | | x | 5 | 6 |
| Hibbertia scandens | | | | | | | | | | | | | | | | | | | | | x | 0.1 | 2 |

# Appendix C Illawarra-Shoalhaven Subtropical Rainforest EPBC Act Final Determination condition thresholds

| Class, category and rationale | Patch size thresholds | Biotic thresholds |
|---|---|---|
| **Moderate Condition Class**: i.e. for patches of the ecological community that meet the minimum condition thresholds for protection under national environment law. | | |
| **Moderate Condition – Category A**<br>A larger rainforest patch with a moderate to intact canopy. | At least 1 ha. | At least 50% canopy cover[1]<br>**AND**<br>A minimum of 5 native plant species from Table A1 per 0.04 ha sample plot[2] on average[3] for the patch. |
| **Moderate Condition – Category B**<br>A smaller rainforest patch with a moderate to intact canopy; AND either a higher diversity of rainforest plants, OR it is part of a larger patch of native vegetation. | Between 0.1 and 1 ha. | At least 50% canopy cover[1] **AND**<br>A minimum of 15 native plant species from Table A1 per 0.04 ha sample plot[2] on average[3] for the patch **OR** A minimum of 10 native plant species from Table A1 per 0.04 ha sample plot[2] on average[3] for the patch **AND** The patch is contiguous[4] with another patch of native vegetation that is at least 1 ha in size. |
| **Moderate Condition – Category C**<br>A smaller rainforest patch with a relatively intact canopy AND a moderate diversity of rainforest plants. | At least 0.1 ha. | At least 70% canopy cover[1]<br>**AND**<br>A minimum of 10 native plant species from Table A1 per 0.04 ha sample plot[2] on average[3] for the patch. |
| **Regenerating rainforest – Category D**<br>A regenerating rainforest patch that has a higher diversity of rainforest species. | At least 0.1 ha. | At least 30% canopy cover[1]; **AND**<br>A minimum of 15 native plant species from Table A1 per 0.04 ha sample plot[2] on average[3] for the patch **AND**<br>Evidence of regeneration (e.g. seedlings, saplings or other sub-mature stages of rainforest tree species). |
| **High Condition Class:** e.g. to provide further information about higher condition patches & / or to guide management and restoration goals | | |
| **High Condition – Category A**<br>A patch with a relatively intact canopy AND a higher diversity of rainforest plants. | At least 0.1 ha. | ≥ 70% canopy cover[1] **AND**<br>A minimum of 15 native plant species from Table A1 per 0.04 ha sample plot[2] on average[3] for the patch |
| **High Condition – Category B**<br>A patch with a relatively intact canopy AND a moderate diversity of rainforest plants AND specialist subtropical rainforest birds OR a moderate diversity of native birds (given their important role in the EC). | At least 0.1 ha. | At least 70% canopy cover[1] **AND**<br>A minimum of 10 native plant species from Table A1 per 0.04 ha sample plot[2] on average[3] for the patch **AND**<br>At least 2 'specialist[#] subtropical rainforest' native bird species from Table A2 in the patch **OR**<br>At least 10 native bird species from Table A2 in the patch. |
| **High condition – Category C**<br>A patch with a moderate canopy and an even higher diversity of rainforest plants | At least 0.1 ha. | At least 50% canopy cover[1]<br>**AND**<br>A minimum of 30 native plant species from Table A1 per 0.04 ha sample plot[2] on average[3] for the patch. |

| Broad growth form category | Common name | Family Name | Scientific name | *Listed in NSW Milton–Ulladulla TEC | #Listed in NSW Illawarra TEC |
|---|---|---|---|---|---|
| Shrub | Straggly Lantern-bush, Lantern Bush | Malvaceae | *Abutilon oxycarpum* | | |
| Tree | Maiden's Wattle | Mimosoideae | *Acacia maidenii* | | |
| Tree | Blackwood | Mimosoideae | *Acacia melanoxylon* | | |
| | | | *Acmena smithii* – see *Syzygium smithii*, below | | |
| Shrub to Tree | White Aspen, Yellow Wood | Rutaceae | *Acronychia oblongifolia* | | |
| Fern | Common Maidenhair | Pteridaceae | *Adiantum aethiopicum* | | |
| Fern | Black Stem, Black Stem Maidenhair, Giant Maidenhair | Pteridaceae | *Adiantum formosum* | | Yes |
| Fern | Rough Maidenhair Fern | Pteridaceae | *Adiantum hispidulum* | | |

| Broad growth form category | Common name | Family Name | Scientific name | *Listed in NSW Milton–Ulladulla TEC | #Listed in NSW Illawarra TEC |
|---|---|---|---|---|---|
| Shrub | Native Quince, Wild Quince, Bird's Eye | Sapindaceae | *Alectryon subcinereus* | Yes | Yes |
| Tree | Red Ash | Rhamnaceae | *Alphitonia excelsa* | | Yes |
| Forb | – | Commelinaceae | *Aneilema acuminatum* | | |
| Other | Gum Vine | Aphanopetalaceae | *Aphanopetalum resinosum* | Yes | |
| Fern | – | Tectariaceae | *Arthropteris tenella* | Yes | |
| Fern | Bird's Nest Fern | Aspleniaceae | *Asplenium australasicum* | | |
| Fern | Necklace fern | Aspleniaceae | *Asplenium flabellifolium* | Yes | |
| Shrub | Grey Myrtle, Ironwood | Myrtaceae | *Backhousia myrtifolia* | | |
| Tree | Brush Bloodwood, Ivory Birch, Scrub Bloodwood | Euphorbiaceae | *Baloghia inophylla* | Yes | Yes |
| Fern | Prickly Rasp Fern | Blechnaceae | *Blechnum neohollandicum* | Yes | Yes |
| Tree | Flame Tree, Illawarra Flame Tree | Malvaceae | *Brachychiton acerifolius* | | Yes |
| Shrub | Coffee Bush | Phyllanthaceae | *Breynia oblongifolia* | Yes | |
| Shrub | Willow Bottlebrush | Myrtaceae | *Callistemon salignus* | | |
| Grass & grasslike | Staff Climber | Cyperaceae | *Carex longebrachiata* | | |
| Other | Native Grape | Vitaceae | *Cayratia clematidea* | | Yes |
| Other | Staff Climber | Celastraceae | *Celastrus australis* | | Yes |
| Other | Kangaroo Vine, Water Vine | Vitaceae | *Cissus antarctica* | Yes | Yes |
| Other | Water Vine | Vitaceae | *Cissus hypoglauca* | Yes | |
| Shrub | Brittlewood | Euphorbiaceae | *Claoxylon australe* | Yes | |
| Tree | Hairy Clerodendrum, Downy Chance Tree | Lamiaceae | *Clerodendrum tomentosum* | | |
| Forb | – | Commelinaceae | *Commelina cyanea* | | |
| Shrub | Green Native Cascarilla | Euphorbiaceae | *Croton verreauxii* | | |

| Broad growth form category | Common name | Family Name | Scientific name | *Listed in NSW Milton–Ulladulla TEC | #Listed in NSW Illawarra TEC |
|---|---|---|---|---|---|
| Tree | Jackwood | Lauraceae | *Cryptocarya glaucescens* | | |
| Tree | Murrogun | Lauraceae | *Cryptocarya microneura* | | |
| Grass & grasslike | – | Cyperaceae | *Cyperus tetraphyllus* | | |
| Tree | Giant Stinging Tree | Urticaceae | *Dendrocnide excelsa* | Yes | Yes |
| Forb | Kindey Weed, Yilibili (D'harawal) | Convolvulaceae | *Dichondra repens* | | |
| Shrub | Black Plum, Yellow Persimmon, Grey Plum | Ebenaceae | *Diospyros australis* | Yes | |
| Tree | Myrtle Ebony, Grey Persimmon, Black Myrtle, Grey Plum | Ebenaceae | *Diospyros pentamera* | | Yes |
| Tree | Native Tamarind | Sapindaceae | *Diploglottis australis* | | Yes |
| Tree | Sassafras | Atherospermataceae | *Doryphora sassafras* | | |
| Tree | Koda, Silky Ash, Churnwood | Boraginaceae | *Ehretia acuminata* var. *acuminata* | | Yes |
| Shrub | Red Olive Berry | Celastraceae | *Elaeodendron australe* | Yes | Yes |
| Tree | White-topped Box, Coast White Box | Myrtaceae | *Eucalyptus quadrangulata* | | |
| Tree | Forest Red Gum, Buringoa (D'harawal) | Myrtaceae | *Eucalyptus tereticornis* | | |
| Shrub | Bolwarra, Copper Laurel | Eupomatiaceae | *Eupomatia laurina* | | |
| Other | Wombat Berry | Luzuriagaceae | *Eustrephus latifolius* | Yes | |
| Shrub; Tree | Figs | Moraceae | *Ficus spp.* (e.g. *Ficus coronata*, *Ficus macrophylla*, *Ficus obliqua*; but may include other *Ficus* species) **Note: If more than one *Ficus* spp. is present, each one counts towards the diversity threshold in the Condition Thesholds.** | Yes | Yes |
| Other | Scrambling Lily | Luzuriagaceae | *Geitonoplesium cymosum* | Yes | |
| Tree | Guioa | Sapindaceae | *Guioa semiglauca* | | Yes |
| Forb | Settlers Twine/Flax, Boorgay | Araceae | *Gymnostachys anceps* | Yes | |

| Broad growth form category | Common name | Family Name | Scientific name | *Listed in NSW Milton–Ulladulla TEC | #Listed in NSW Illawarra TEC |
|---|---|---|---|---|---|
| Other | Sweet Morinda | Rubiaceae | *Gynochthodes jasminoides* | | |
| Shrub | Native Rosella | Malvaceae | *Hibiscus heterophyllus* subsp. *heterophyllus* | | Yes |
| Fern | Trim Shield-fern, Trim Shield Fern | Dryopteridaceae | *Lastreopsis decomposita* | | |
| Fern | Creeping Shield Fern | Dryopteridaceae | *Lastreopsis microsora* subsp. *microsora* | | |
| Other | Round-leaf Vine | Menispermaceae | *Legnephora moorei* | Yes | Yes |
| Other | Cabbage Fan Palm, Cabbage Tree Palm, Daranggara (Cadigal), Cabbage Palm, Fan Palm | Arecaceae | *Livistona australis* | | |
| Other | Cockspur Thorn | Moraceae | *Maclura cochinchinensis* | | Yes |
| Other | Hairy Milk Vine | Apocynaceae | *Marsdenia flavescens* | | |
| Other | Milk Vine | Apocynaceae | *Marsdenia rostrata* | Yes | |
| Shrub | Prickly-leaved Tea Tree | Myrtaceae | *Melaleuca styphelioides* | | |
| Shrub | Hairy-leaved Doughwood, White Euodia | Rutaceae | *Melicope micrococca* | | |
| Shrub | Tree Violet | Violaceae | *Melicytus dentatus* | | |
| Fern | Fragrant Fern | Polypodiaceae | *Microsorum scandens* | | |
| Shrub | Brush Muttonwood | Primulaceae | *Myrsine howittiana* | | |
| Shrub | | Primulaceae | *Myrsine variabilis* | | |
| Shrub | Large Mock-olive, Large-leaved Olive | Oleaceae | *Notelaea venosa* | Yes | |
| Grass & grasslike | Australian Basket Grass, Wavy Beard Grass | Poaceae | *Oplismenus aemulus* | Yes | |
| Grass & grasslike | Creeping Beard Grass | Poaceae | *Oplismenus imbecillis* | | |
| Other | Wonga Wonga Vine | Bignoniaceae | *Pandorea pandorana* subsp. *pandorana* | Yes | |
| Other | Common Silkpod, Monkey Rope | Apocynaceae | *Parsonsia straminea* | | |
| Fern | Sickle Fern | Pteridaceae | *Pellaea falcata* | Yes | |
| Tree | Brown Beech | Pennantiaceae | *Pennantia cunninghamii* | | Yes |
| Other | Giant Pepper Vine | Piperaceae | *Piper hederaceum* var. *hederaceum* | | Yes |
| Shrub | Orange Thorn | Pittosporaceae | *Pittosporum multiflorum* | Yes | Yes |

| Broad growth form category | Common name | Family Name | Scientific name | *Listed in NSW Milton–Ulladulla TEC | #Listed in NSW Illawarra TEC |
|---|---|---|---|---|---|
| Shrub | Wild Yellow Jasmine, Rough fruit Pittosporum | Pittosporaceae | *Pittosporum revolutum* | | |
| Shrub | Native Daphne, Sweet Pittosporum, Snowdrop Tree (L.H.I.), Mock Orange | Pittosporaceae | *Pittosporum undulatum* | Yes | |
| Tree | Black Apple, Wild Plum, Yellow Buttonwood, Black Plum, Yellow Bulletwood | Sapotaceae | *Planchonella australis* | | Yes |
| Forb | Cockspur Flower | Lamiaceae | *Plectranthus parviflorus* | Yes | |
| Grass & grasslike | Tussock | Poaceae | *Poa labillardierei* var. *labillardierei* | | |
| Tree | Plum Pine, Brown Pine | Podocarpaceae | *Podocarpus elatus* | | Yes |
| Forb | Pastel Flower | Acanthaceae | *Pseuderanthemum variabile* | | |
| Fern | Jungle Brake | Pteridaceae | *Pteris umbrosa* | | |
| Fern | Rock Felt Fern | Polypodiaceae | *Pyrrosia rupestris* | | |
| Shrub | Scrub Turpentine, Brown Malletwood | Myrtaceae | *Rhodamnia rubescens* | | |
| Shrub | Big Yellow Wood, Yellow Wood | Rutaceae | *Sarcomelicope simplicifolia* subsp. *simplicifolia* | | |
| Other | Pearl Vine | Menispermaceae | *Sarcopetalum harveyanum* | Yes | |
| Tree | Flintwood, Mountain Cherry, Brown Birch, Scolopia | Salicaceae | *Scolopia braunii* | | Yes |
| Other | Lawyer Vine, Wait-a-while, Barbwire Vine | Smilacaceae | *Smilax australis* | Yes | |
| Forb | | Caryophyllaceae | *Stellaria flaccida* | | |
| Shrub | Scrub Beefwood, Red Silky Oak | Proteaceae | *Stenocarpus salignus* | | |
| Other | Snake Vine | Menispermaceae | *Stephania japonica* | Yes | |
| Tree | Whalebone Tree | Moraceae | *Streblus brunonianus* | Yes | Yes |
| Shrub | Brush Cherry | Myrtaceae | *Syzygium australe* | Yes | |
| Tree | Lilly Pilly, Midjuburi (Cadigal) | Myrtaceae | *Syzygium smithii* (syn. *Acmena smithii*) | Yes | |
| Tree | Red Cedar, Santhana Vembu | Meliaceae | *Toona ciliata* | Yes | Yes |

| Broad growth form category | Common name | Family Name | Scientific name | *Listed in NSW Milton–Ulladulla TEC | #Listed in NSW Illawarra TEC |
|---|---|---|---|---|---|
| Other | Burny Vine | Moraceae | *Trophis scandens* | Yes | Yes |
| Other | Bearded Tylophora | Apocynaceae | *Tylophora barbata* | | |
| Forb | Stinging Nettle | Urticaceae | *Urtica incisa* | | |
| Shrub | Veiny Wilkiea | Monimiaceae | *Wilkiea huegeliana* | | Yes |

* Milton–Ulladulla Subtropical Rainforest Final Determination (NSW Scientific Committee 2002b)

# Listed in NSW Illawarra Subtropical Rainforest Final Determination (NSW Scientific Committee 2002a)

# Appendix D Watercourse Validation

Eco Logical Australia Pty Ltd (ELA) has provided an assessment of watercourses in relation to the study area which includes:

- 103 Jamberoo Road Kiama
- 33 Greyleigh Drive Kiama
- 177 Long Brush Road Jerrara

The purpose of the assessment was to determine whether the site contained 'waterfront land' for the purposes of the WM Act and therefore whether a Controlled Activity Approval would be required for any future development.

As part of this assessment, each hydroline within the site has been physically checked. ELA concludes that:

- Some of the mapped hydrolines (or parts of the mapped hydrolines) within the site do not have a defined bed or bank and therefore in our opinion do not meet the definition of a 'river' under the WM Act
- NRAR should be consulted to confirm the above.
- If NRAR agrees, the DA should be Integrated Development only for the watercourses which meet the definition of a river, on the basis of the WM Act

## METHODS

The Strahler stream order classification was extracted from the DPI Hydroline Spatial Data. The Top of Bank (TOB) was estimated via a desktop assessment using high resolution aerial imagery, LiDAR and field observations. The TOB identifies the geomorphologic extent of the watercourse and forms the basis for measuring any VRZ.

## RESULTS

The study area contains a mix of natural watercourses with intact remnant fringing vegetation and highly modified agricultural lands. The most dominant land use is extensively cleared paddock/pasture. The current condition of each reach is summarised below in Table 10 using reach names shown in Figure 12. All site dams may provide habitat for common species such as turtles, eels and wetland birds, however, aquatic vegetation was either absent or sparse.

The upper parts of Reaches 1A, 1B, 1C, 1D, 1E, 1F and 1G did not meet the definition of a 'river' under the WM Act, as they had no defined bed and banks or evidence of geomorphological processes. The lower parts of these watercourses had the characteristics of a 'river'.

The entire length of Reaches 1I, 1J, 1K and 2B, where they occurred within the subject site, did not meet the definition of a 'river' under the WM Act, as they had no defined bed and banks or evidence of geomorphological processes

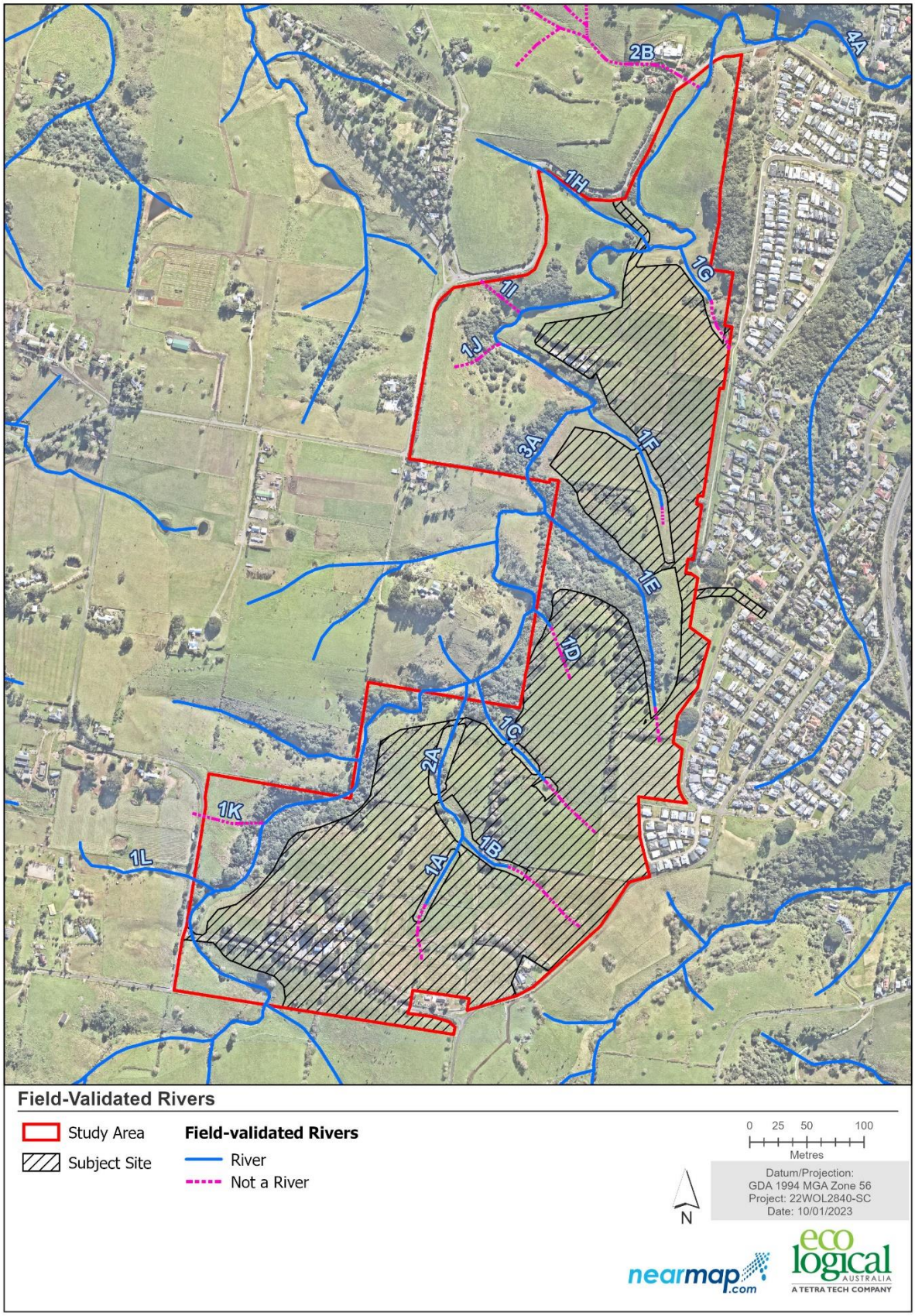
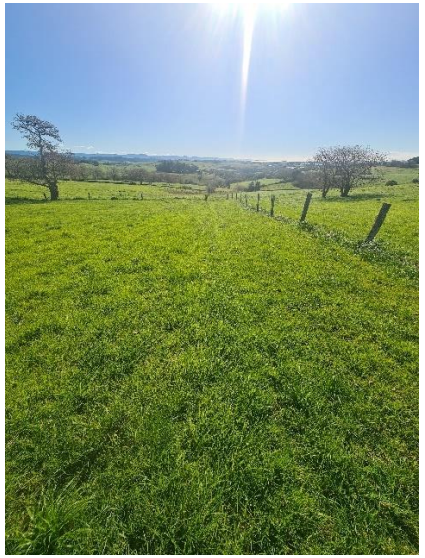
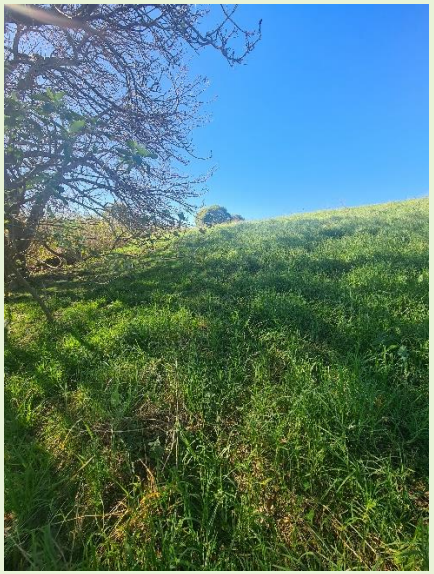
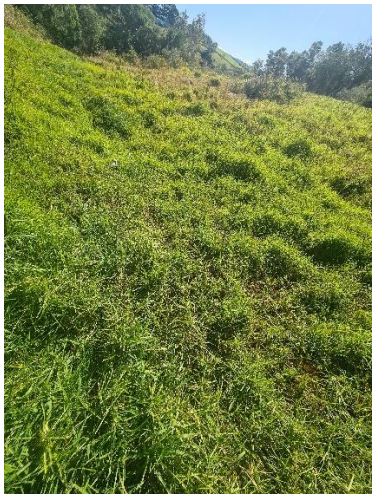



**Figure 12: Field-validated watercourses within the study area**

**Table 10: Reach descriptions**

| Reach name | Strahler stream order ('Hydroline' desktop mapping only) | Likely WM Act 'river' status (field validated) (to be confirmed with NRAR) | Typical features | Representative photos |
|---|---|---|---|---|
| 1A | 1st | River in lower reach / not a river in upper reach | The upper reach of the hydroline occurs as a paddock with exotic pasture grass. No defined bed or bank (overland flows only). See first photo.<br>The lower reach of the hydroline begins to show evidence of bed and banks, with water and aquatic vegetation present. See second photo. |  <br>  |

| Reach name | Strahler stream order ('Hydroline' desktop mapping only) | Likely WM Act 'river' status (field validated) (to be confirmed with NRAR) | Typical features | Representative photos |
|---|---|---|---|---|
| 1B | 1st | River in lower reach / not a river in upper reach | The upper reach of the hydroline occurs as a paddock with exotic pasture grass. No defined bed or bank (overland flows only). See first photo.<br>The lower reach of the hydroline begins to show evidence of bed and banks, with water present. No aquatic vegetation present until Reach 2A. See second photo. |  <br>  |

| Reach name | Strahler stream order ('Hydroline' desktop mapping only) | Likely WM Act 'river' status (field validated) (to be confirmed with NRAR) | Typical features | Representative photos |
|---|---|---|---|---|
| 1C | 1st | River in lower reach / not a river in upper reach | The upper reach of the hydroline occurs as a very steep paddock with exotic pasture grass. No defined bed or bank (overland flows only). See first photo.<br>The lower reach of the hydroline begins to show evidence of bed and banks, with water present. Channel is heavily overgrown with Kikuyu. See second photo. |  <br>  |

| Reach name | Strahler stream order ('Hydroline' desktop mapping only) | Likely WM Act 'river' status (field validated) (to be confirmed with NRAR) | Typical features | Representative photos |
|---|---|---|---|---|
| 1D | 1st | River in lower reach / not a river in upper reach | The upper reach of the hydroline occurs as a cleared paddock with exotic pasture grass. No defined bed or bank (overland flows only). See photo.<br>The lower reach of the hydroline was not accessible, as the hill dropped off very steeply. As this part of the watercourse was not able to be validated, it is assumed to be present. |  |

| Reach name | Strahler stream order ('Hydroline' desktop mapping only) | Likely WM Act 'river' status (field validated) (to be confirmed with NRAR) | Typical features | Representative photos |
|---|---|---|---|---|
| 1E | 1st | River in lower reach / not a river in upper reach | The upper reach of the hydroline occurs as a very steep paddock with exotic pasture grass. No defined bed or bank (overland flows only). See first photo.<br>The lower reach of the hydroline begins to show evidence of bed and banks, with water present. Channel is heavily overgrown with Kikuyu. See second photo. |  <br>  |

| Reach name | Strahler stream order ('Hydroline' desktop mapping only) | Likely WM Act 'river' status (field validated) (to be confirmed with NRAR) | Typical features | Representative photos |
|---|---|---|---|---|
| 1F | 1st | River in lower reach / not a river in upper reach | The upper reach of the hydroline occurs as a steep paddock with exotic pasture grass. No defined bed or bank (overland flows only). See photo.<br>The lower reach of the hydroline shows evidence of bed and banks, with water present. Aquatic vegetation also present. Photo taken from upper paddock which has no bed or banks (visible in foreground). Watercourse appears to begin in mid-ground of photo, on either side of the middle fence. |  |

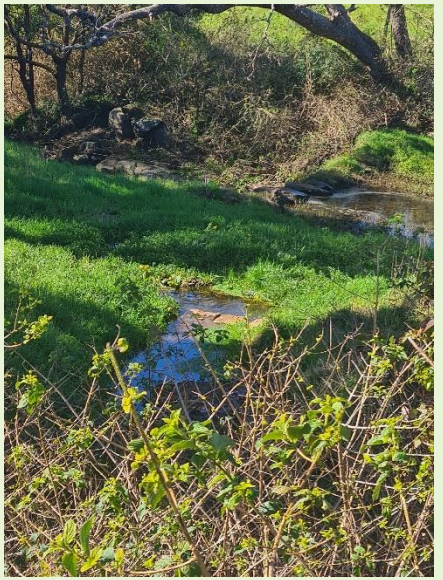
| Reach name | Strahler stream order ('Hydroline' desktop mapping only) | Likely WM Act 'river' status (field validated) (to be confirmed with NRAR) | Typical features | Representative photos |
|---|---|---|---|---|
| 1G | 1st | River in lower reach / not a river in upper reach | The upper reach of the hydroline occurs as a paddock with exotic pasture grass. No defined bed or bank (overland flows only). See first photo.<br>The lower reach of the hydroline begins to show evidence of bed and banks. Channel shows evidence of erosion and deposition. See second photo. |  <br>  |

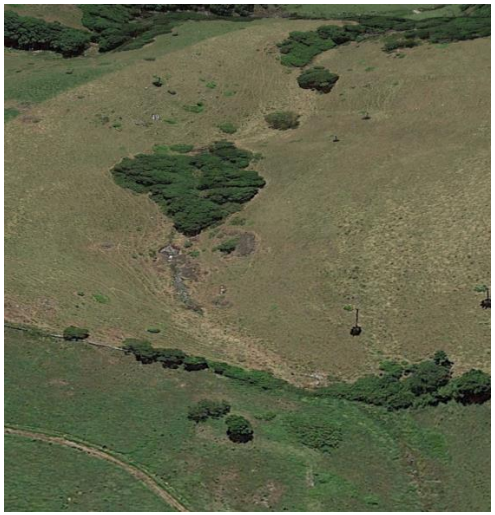
| Reach name | Strahler stream order ('Hydroline' desktop mapping only) | Likely WM Act 'river' status (field validated) (to be confirmed with NRAR) | Typical features | Representative photos |
|---|---|---|---|---|
| 1H | 1st | River | The watercourse has visible bed and banks and flowing water. Channel is infested with Kikuyu in places. |  Source: Google Street View |

| Reach name | Strahler stream order ('Hydroline' desktop mapping only) | Likely WM Act 'river' status (field validated) (to be confirmed with NRAR) | Typical features | Representative photos |
|---|---|---|---|---|
| 1l | 1st | Not a river | This hydroline occurs as a steep paddock with exotic pasture grass. No defined bed or bank or water present (overland flows only). See photo. |  |

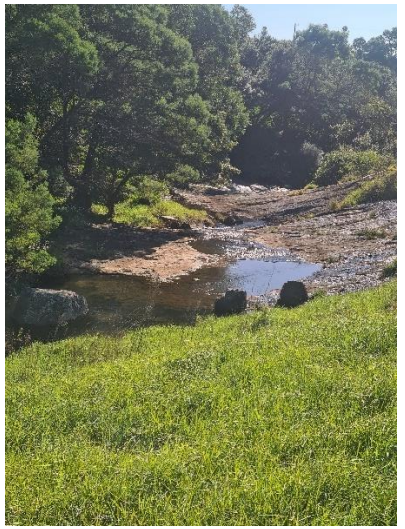
| Reach name | Strahler stream order ('Hydroline' desktop mapping only) | Likely WM Act 'river' status (field validated) (to be confirmed with NRAR) | Typical features | Representative photos |
|---|---|---|---|---|
| 1J | 1st | Not a river | This hydroline occurs as a steep paddock with exotic pasture grass. No defined bed or bank or water present (overland flows only). See photo. |  |

| Reach name | Strahler stream order ('Hydroline' desktop mapping only) | Likely WM Act 'river' status (field validated) (to be confirmed with NRAR) | Typical features | Representative photos |
|---|---|---|---|---|
| 1K | 1st | Not a river | This hydroline occurs as a steep paddock with exotic pasture grass. No defined bed or bank or water present (overland flows only). See photo. |  |

| Reach name | Strahler stream order ('Hydroline' desktop mapping only) | Likely WM Act 'river' status (field validated) (to be confirmed with NRAR) | Typical features | Representative photos |
|---|---|---|---|---|
| 1L | 1st | River | The watercourse has visible bed and banks and flowing water. Channel is infested with Kikuyu in places. |  |

| Reach name | Strahler stream order ('Hydroline' desktop mapping only) | Likely WM Act 'river' status (field validated) (to be confirmed with NRAR) | Typical features | Representative photos |
|---|---|---|---|---|
| 2A | 2nd | River | The watercourse has visible bed and banks and flowing water. Channel is infested with Kikuyu and Lantana in places. |  Source: Google Earth |

| Reach name | Strahler stream order ('Hydroline' desktop mapping only) | Likely WM Act 'river' status (field validated) (to be confirmed with NRAR) | Typical features | Representative photos |
|---|---|---|---|---|
| 2B | 2nd | Not a river | This watercourse appears to have been diverted and now flows parallel to Jamberoo Rd until it joins the 3rd order stream. There is no flow across the study area. See photo. |  |

| Reach name | Strahler stream order ('Hydroline' desktop mapping only) | Likely WM Act 'river' status (field validated) (to be confirmed with NRAR) | Typical features | Representative photos |
|---|---|---|---|---|
| 3A | 3rd | River | Spring Creek. Watercourse has bed, banks and constant flow of water. Riparian vegetation is present along the majority of the length. |  |

ecological AUSTRALIA
A TETRA TECH COMPANY

1300 646 131
www.ecoaus.com.au