Travers

bushfire & ecology

Biodiversity Assessment Report

Proposed Rezoning for
Residential Development
18 Gosford Road
Wyee

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(REF: 18OD14E)

Biodiversity Assessment Report

Proposed Rezoning for Residential Development
Lot 217 DP 755242, 18 Gosford Road, WYEE

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File:	18OD14E

Disclaimer:

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The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features are to be confirmed by a registered surveyor.

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Executive Summary

Travers bushfire & ecology has been engaged to prepare a biodiversity assessment report for a proposed rezoning of Lot 217, DP 755242, 18 Gosford Road, Wyee. This lot, and any external areas where survey has been conducted, is hereafter be referred to as the 'study area'.

The area of direct impact from the proposal will hereafter be referred to as the 'development footprint'.

Planning proposal

The planning proposal is for an application to rezone the property from the current RU1 – Rural Landscape to R2 – Low Density Residential zoning to allow single dwelling lot subdivision.

Recorded biodiversity

Ecological survey and assessment has been undertaken in accordance with the *Biodiversity Assessment Methodology* (BAM) as well as relevant legislation including the *Environmental Planning and Assessment Act 1979* (*EP&A Act*), the *Biodiversity Conservation Act 2016* (*BC Act*), the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*) and the *Fisheries Management Act 1994* (*FM Act*).

Compliant survey and limitations for candidate species are explained in Sections 2.5, Section 4.3.2 (flora) and Section 4.3.3 (fauna).

In respect of threatened species, ecological communities and endangered populations required to be considered under the *EP&A Act* and relating to the species and provisions of the *BC Act*, four (4) state listed threatened fauna species – Eastern Coastal Free-tailed Bat (*Mormopterus norfolkensis*), Greater Broad-nosed Bat (*Scoteanax rueppellii*), Little Bent-winged Bat (*Miniopterus australis*) and Large Bent-winged Bat (*Miniopterus orianae oceanensis* , no threatened flora species, and one (1) threatened ecological community (TEC) *Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*, were recorded within the development footprint.

In respect of matters required to be considered under the *EPBC Act*, no threatened fauna species, no protected migratory bird species, no threatened flora species and no threatened ecological communities listed under this Act were recorded within the development footprint.

In respect of matters relative to the *FM Act*, no suitable habitat for threatened marine or aquatic species was observed within the development footprint.

Impact assessment

The proposal is likely to have the following direct impacts:

- Removal / modification of 0.41 ha of PCT 1636 Scribbly Gum – Red Bloodwood – *Angophora inopina* heathy woodland, including 0.34 ha of moderate–good PCT 1636 vegetation and 0.07 ha of groundcover only PCT 1636 vegetation.
- Removal / modification of 0.1 ha PCT 1718 Swamp Mahogany – Flax-leaved Paperbark swamp forest (equivalent to TEC Swamp Sclerophyll Forest on Coastal Floodplains.
- Subsequent removal of threatened fauna species foraging habitat including:
    a) Seasonal flowering resources for species regarded as having potential habitat onsite such as Swamp Mahogany (*Eucalyptus robusta*) and *Allocasuarina* spp.
    b) Seeding *Allocasuarina* providing potential feed resources for Glossy Black-Cockatoo
    c) Diverse seasonal flowering opportunities for nectivorous species.
    d) Winter flowering trees Swamp Mahogany (*Eucalyptus robusta*).
    e) Air space and prey species habitat for recorded Eastern Coastal Free-tailed Bat, Greater Broad-nosed Bat, Large Bent-winged Bat and Little Bent-winged Bat.
- Removal of one (1)(HT1) and possibly two (2) (HT2) hollow bearing trees which contain one (1) small hollow each, one approximately 0–5 cm and the other 10–15 cm aperture. HT2 may be capable of retention in the future development footprint. The hollow within HT1 is suitable for recorded threatened species including recorded Eastern Coastal Free-tailed Bat and Greater Broad-nosed Bat.

In the case of entry into the Biodiversity Offsets Scheme, the assessment of Serious or Irreversible Impacts (SAIIs) are set out under Section 6.7.2 of the *BC Reg 2017* to guide the determining authority on this decision. On the basis of the ecological survey completed an assessment of SAIIs will be required for the recorded Little Bent-winged Bat and Large Bent-winged Bat, however it is unlikely that the proposal will cause any SAII on these species due to the lack of breeding habitat within the site.

In the case where entry into the biodiversity offsets scheme is not required an assessment of significance of impacts is required.

A preliminary assessment of listed matters to be assessed under *EPBC Act 1999*, the proposal is unlikely to cause a significant impact on matters of national environmental significance. As such a referral to Department of Environment and Energy should not be required.

Avoidance and mitigation of impacts

Recommendations for avoidance and minimisation actions are outlined in Section 5.2. The direct, indirect and cumulative ecological impacts of the proposal have been considered in Section 5.3. Avoidance and mitigation measures have been outlined within Section 6.2.

Biodiversity Offsets Scheme (BOS) – Threshold Assessment

Based on the supplied concept subdivision plan, biodiversity offsetting under the Biodiversity Offsets Scheme (BOS) is likely to be required as:

- The concept impacts on lands mapped as Biodiversity Values Land.

- The concept potentially results in impacts on 0.51 ha of native vegetation which is greater than the future area clearing threshold of 0.25 ha for land zoned R2 Low Density Residential.

Based on the current concept, biodiversity offsetting under BOS applies and a BAM-compliant report will be required. The proposal can avoid entry into the BOS if biodiversity values land is avoided, and the impact on native vegetation is under 0.25 ha, and the test of significance concludes a 'not significant' impact on the entities assessed. As the total possible area of clearing is less than the area clearing limit for lots with a minimum lot size of <1 ha, the small area streamlined assessment can be used.

Suitability of site for proposed R2 - Low Density Residential zoning

Travers bushfire & ecology considers that the site is suitable for zoning as R2 - Low Density Residential zoning based on the identified biodiversity constraints. The concept layout as proposed does not cause any likely significant impacts on matters of biodiversity and may potentially cause entry into the Biodiversity Offsets Scheme.

Avoidance of features of high biodiversity value and mitigation of impacts are considered as part of the biodiversity assessment process.

List of abbreviations

APZ	asset protection zone
BAM	Biodiversity Assessment Method (2020)
BAR	Biodiversity Assessment Report
BC Act	*Biodiversity Conservation Act (2016)*
BC Reg	*Biodiversity Conservation Regulation (2017)*
BCAR	Biodiversity Certification Assessment Report
BDAR	Biodiversity Development Assessment Report
BOS	Biodiversity Offset Scheme
BPA	bushfire protection assessment
BSSAR	Biodiversity Stewardship Site Assessment Report
CEEC	Critically endangered ecological community
CM Act	*Coastal Management Act 2016*
DAWE	Department of Agriculture, Water and the Environment
DCP	development control plan
DEC	NSW Department of Environment and Conservation (superseded by DECC from April 2007)
DECC	NSW Department of Environment and Climate Change (superseded by DECCW from October 2009)
DECCW	NSW Department of Environment, Climate Change and Water (superseded by OEH from April 2011)
DEWHA	Commonwealth Department of Environment, Water, Heritage & the Arts (superseded by SEWPAC)
DOEE	Commonwealth Department of Environment & Energy (superseded by DAWE)
DPIE	NSW Department of Planning, Industry and Environment
EEC	endangered ecological community
EPA	Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act (1979)*
EPBC Act	*Environment Protection and Biodiversity Conservation Act (1999)*
FM Act	*Fisheries Management Act*
IBRA	Interim Biogeographic Regionalisation for Australia
LEP	local environmental plan
LGA	local government area
LLS Act	*Local Land Services Act (2013*)
NES	national environmental significance
NPW Act	*National Parks and Wildlife Act (1974)*
NRAR	Natural Resources Access Regulator (NSW)
NSW DPI	NSW Department of Industry and Investment
OEH	Office of Environment and Heritage (superseded by DPIE from August 2019)
PCT	plant community type
PFC	projected foliage cover
RFS	NSW Rural Fire Service
ROTAP	rare or threatened Australian plants
SAII	Serious And Irreversible Impacts
SEPP	State Environmental Planning Policy
SEWPAC	Commonwealth Dept. of Sustainability, Environment, Water, Population & Communities (superseded by DOEE)
SIS	species impact statement
SULE	safe useful life expectancy
TEC	threatened ecological community
TPZ	tree preservation zone
TSC Act	*Threatened Species Conservation Act (1995) – Superseded by the Biodiversity Conservation Act (2016)*
VMP	vegetation management plan

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Introduction 1

Travers bushfire & ecology has been engaged to prepare a biodiversity assessment report for a proposed rezoning of Lot 217, DP 755242, 18 Gosford Road, Wyee. This lot, and external areas where survey has been conducted, is hereafter be referred to as the 'study area'.

The area of direct impact from the proposal, containing the concept subdivision, APZs and all associated impact on habitat features, is hereafter referred to as the 'development footprint' (Figure 1.4).

The proposal shall be assessed under the *Biodiversity Conservation Act* (*BC Act*), 2016.

Figure 1.1 – Subject lot

1.1 Purpose

The purposes of this Biodiversity Assessment Report (BAR) are to:

- Carry out a botanical survey to describe the vegetation communities and their conditions
- Carry out a fauna habitat survey for the detection and assessment of fauna and their potential habitats
- Complete targeted surveys for threatened species, populations and ecological communities
- Prepare a BAR in accordance with the requirements of the:
  a) *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*),
  b) *Biodiversity Conservation Act 2016* (*BC Act*),
  c) *Biodiversity Conservation Regulation 2017* (*BC Reg*),
  d) *Fisheries Management Act 1994* (*FM Act*), and
- To identify biodiversity constraints relevant to future rezoning, subdivision and development of the site.

1.1.1 Terminology

Throughout this report the terms development footprint and study area are used. It is important to have a thorough understanding of these terms as they apply to the assessment.

Development footprint means the area directly affected by the proposal. It has the same meaning as "subject land" defined below.

Study area is the portion of land that encompasses all surveys undertaken and is usually all land contained within the designated property boundary and immediate peripheral areas (refer to Figure 3.1 for extent of survey assessment for flora and fauna). The study area extends as far as is necessary to assess all important biodiversity values known and likely to occur within the subject land and includes the development footprint and any additional areas which are likely to be affected by the proposal, either directly or indirectly.

Subject land is land to which the BAM is applied in Stage 1 to assess the biodiversity values. It includes land that may be a development site, clearing site, proposed for biodiversity certification or land that is proposed for a biodiversity stewardship agreement. In this case, it refers to the area designated as the development footprint, and has the same meaning for the purposes of this report. The terms "subject land" and "development footprint are interchangeable in this regard.

Direct impacts are those that directly affect the habitat and individuals. They include, but are not limited to, death through clearing, predation, trampling, poisoning of the animal/plant itself and the removal of suitable habitat. When applying each factor, consideration must be given to all of the likely direct impacts of the proposed activity or development.

Indirect impacts occur when project-related activities affect species, populations or ecological communities in a manner other than direct loss. Indirect impacts can include loss of individuals through starvation, exposure, predation by domestic and/or feral animals, loss of breeding opportunities, loss of shade/shelter, deleterious hydrological changes, increased soil salinity, erosion, inhibition of nitrogen fixation, weed invasion, fertiliser drift, or increased human activity within or directly adjacent to sensitive habitat areas. As with direct impacts, consideration must be given, when applying each factor, to all of the likely indirect impacts of the proposed activity or development.

1.2 Site description

1.2.1 Site overview

Table 1.1 provides an overview of the planning, cadastral and topographical details of the study area.

Table 1.1 – Site features

Location	18 Gosford Road, Wyee, Lot 217, DP755242
Location description	The site is located approximately 700 m south of Wyee train station. The site is surrounded on the northern and north-eastern sides by existing urban development, the northern rail corridor to the west, Gosford Road and currently undeveloped bushland to the south.
Area	Approximately 3.15 ha
Local government area	Lake Macquarie City Council
Zoning	RU2 – Rural Landscape
Grid reference MGA-56	359130E 6327020N
Elevation	Approximately 29–41 m AHD
Topography	The site is located on a slope of approximately 5% with a north-westerly aspect.
Catchment and drainage	The site drains via overland flow which is gathered by a drainage channel outside of the western boundary within the railway corridor. This drainage channel flows northwards and eventually flows into Mannering Creek, which flows into Mannering Lake.
Existing land use	Single 2-storey dwelling with surrounding household gardens and large expanses of well-maintained lawns. There are small patches of remnant native vegetation of varying quality and diversity.

1.2.2 Landscape features

Table 1.2 examines the landscape features of the site in accordance with the BAM.

Table 1.2 – Landscape features

Patch size	<5 ha
IBRA bioregions and subregions	Sydney Basin bioregion – Wyong subregion
NSW landscape region	Gosford – Cooranbong Coastal Slopes
Cleared areas	Approximately 2.45 ha of land within the study area is cleared
Evidence to support differences between mapped vegetation extent and aerial imagery	Mapped vegetation closely matches aerial imagery. Unmapped vegetation is exotic.
Rivers and streams classified according to stream order	No mapped streams occur within the study area
Wetlands within, adjacent to and downstream of the site, including important wetlands	There is a wet area in the central western parts of the site which appears to be fed from a subterranean soak. There was until recently, a farm dam located immediately downslope of the aforementioned soak. This dam has recently been filled in. There are no wetlands within the study area. Drainage from the study area is via a channel associated with the

	eastern side of the adjoining rail corridor. This channel discharges into Mannering Creek located to the north.
Connectivity features	There is very poor connectivity to the development footprint on the eastern, northern and western boundaries. There is a narrow corridor of disturbed vegetation located within the rail corridor to the west, however this corridor has little connectivity value to any native vegetation located further to the west, north or south. The southern boundary of the study area is bounded by Gosford Road which has a road reserve from 22–36 m in width and provides connectivity for mobile species such as birds and gliders.
Geology and soils	Geology; undulating low hills and rises on lithic sandstones of the Tuggerah Formation. Local relief <30 m; slope gradients <15%. Broad crests and ridges, long gently inclined slopes. Soils; Gorokan Soil Landscape across the southern parts of the site with possible incursion of Doyalson Soil Landscape in the north-western corner. Moderately deep (50–150 cm) soloths (Dy2.41, Dy3.41), Yellow Podzolic Soils (Dy3.11, Dy3.21) and Grey-brown Podzolic Soils (Db1.21, Db2.21) on slopes.
Identification of method applied (i.e. linear or site-based)	Site based assessment

1.2.3 Zoning

The site is currently zoned RU2 – Rural Landscape under the Lake Macquarie LEP of 2014 (Figure 1.2) which is for the following purposes:

- To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.
- To maintain the rural landscape character of the land.
- To provide for a range of compatible land uses, including extensive agriculture.
- To maintain and enhance the natural amenity and the ecological values of the land.
- To provide for sustainable land management and forestry practices

1.2.4 Proposed zoning

The site is proposed to be re-zoned to R2 – Low Density Residential under an amendment to the Lake Macquarie LEP (see Figure 1.3), which is for the following purposes:

- To provide for the housing needs of the community within a low density residential environment.
- To enable other land uses that provide facilities or services to meet the day to day needs of residents.
- To encourage development that is sympathetic to the scenic, aesthetic and cultural heritage qualities of the built and natural environment.

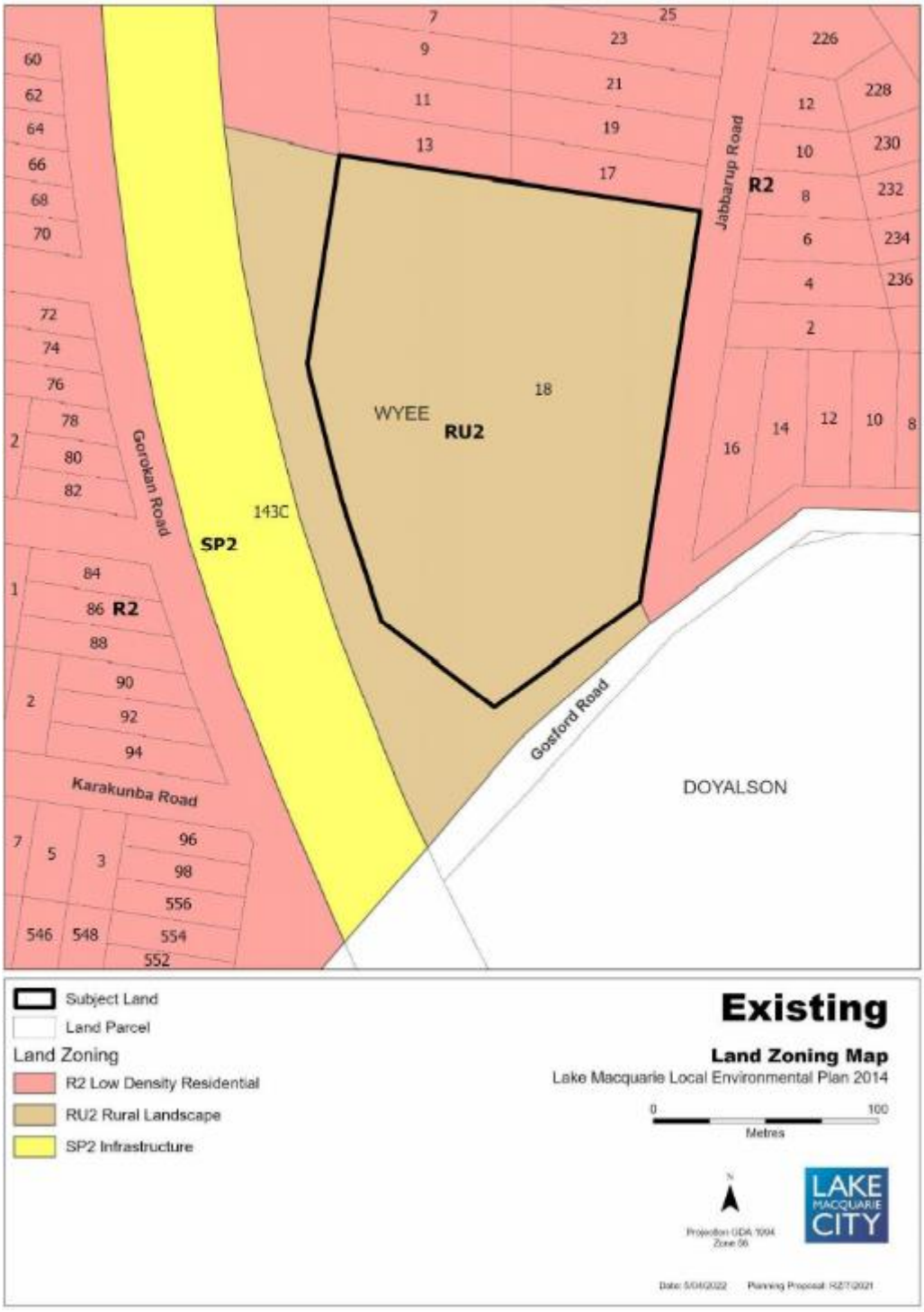

Figure 1.2 – Existing zoning plan

(Source: Planning Portal, 2020)

1.3 Planning Proposal

It is proposed to rezone the land (currently RU2 – Rural Landscape) to R2 Low Density Residential zoning with single dwelling lot subdivision (Figure 1.3). The concept residential subdivision layout is for a 51 lot subdivision including 50 residential lots, one stormwater retention reserve lot, roads, services and bushfire Asset Protection Zone (APZ). The concept layout is shown on Figure 1.4.

The area of land subject to direct impacts caused by the proposal; inclusive of roads, services, development envelopes, stormwater detention management, fences and APZs; will hereafter be referred to as the 'development footprint'. The larger area outside of the development area (development footprint) will hereafter be referred to as the 'study area'.

1.3.1 Identification of development site footprint

Whilst the entire site is approximately 3.15 ha in size, the amount of native vegetation is estimated at 0.51 ha. Most of this native vegetation will be directly impacted through the construction of internal roads, buildings, asset protection zones (APZs) and boundary fences between allotments. Some avoidance and mitigation measures may be considered to reduce the impacts of clearing at the DA stage.

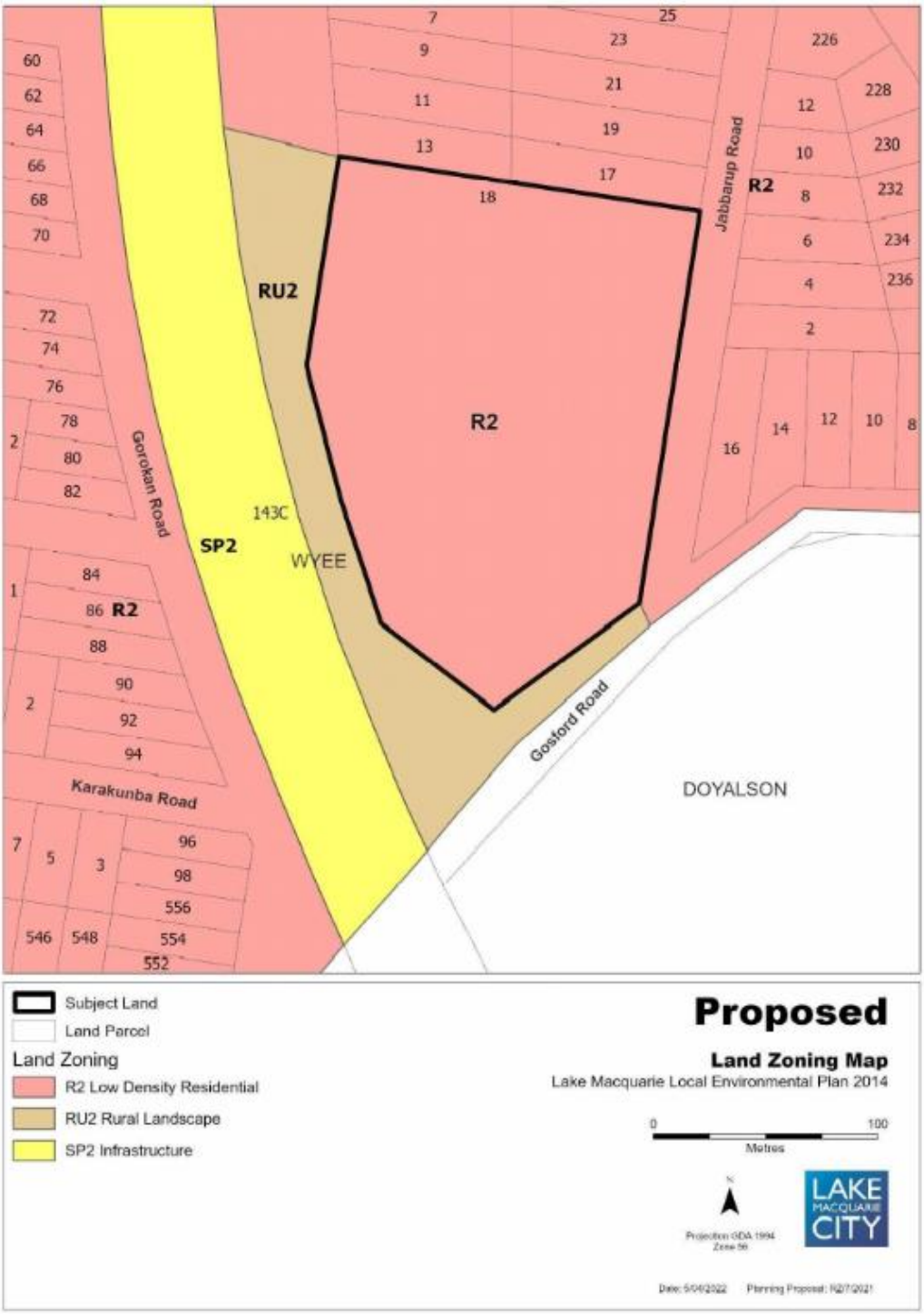

Figure 1.3 – Proposed zoning plan

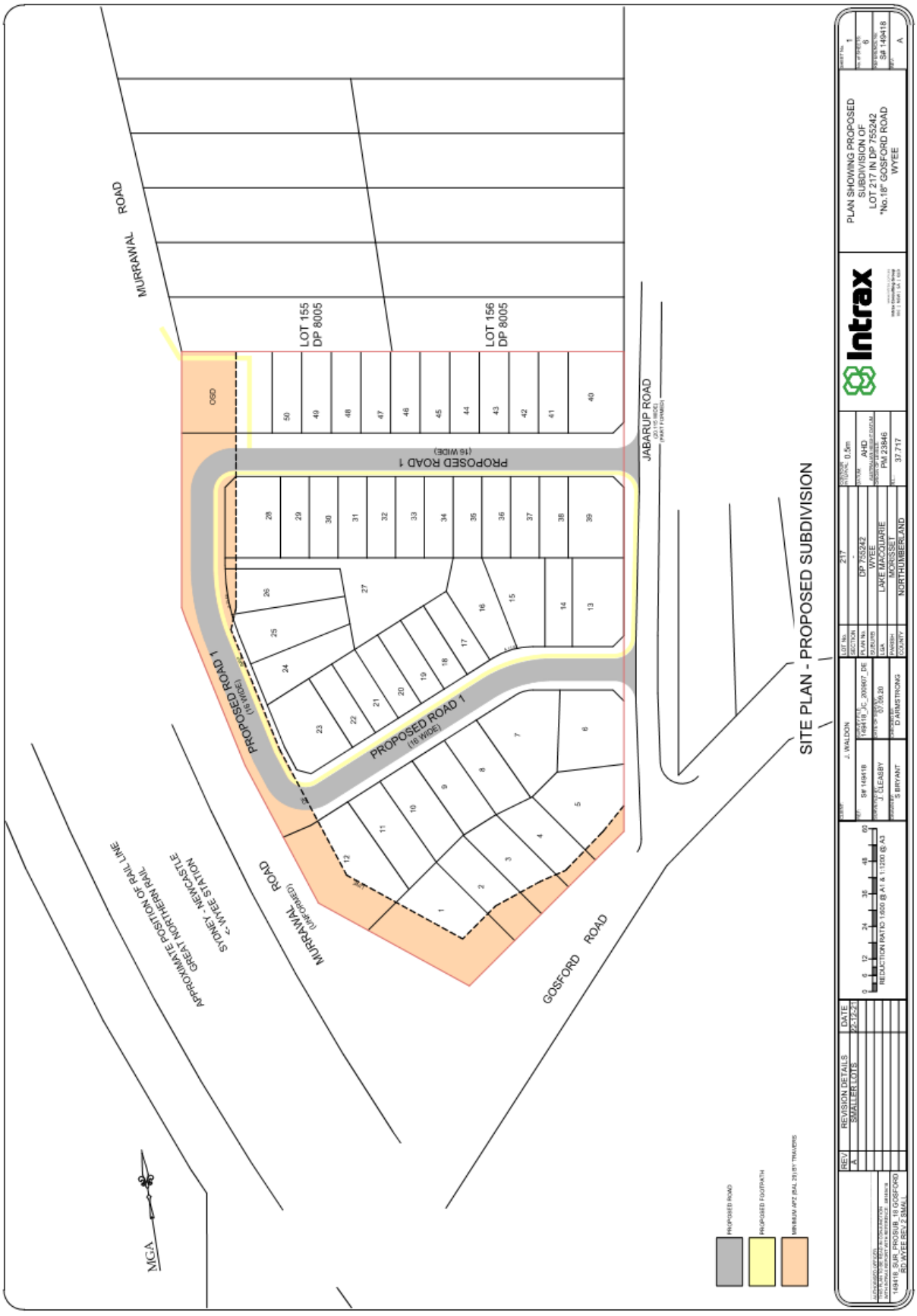

Figure 1.4 – Proposed concept layout

1.4 Statutory assessment requirements

1.4.1 Environmental Planning and Assessment Act 1979 (EP&A Act)

Prior to any development taking place in New South Wales a formal assessment needs to be made of the proposed work to ensure it complies with relevant planning controls and, according to its nature and scale, confirm that it is environmentally and socially sustainable. State, regional and local planning legislation indicates the level of assessment required, and outlines who is responsible for assessing the development. The development assessment and consent system is outlined in Part 4 and the infrastructure and environmental impact assessment system is outlined in Part 5 of the *EP&A Act*.

1.4.2 Biodiversity Conservation Act 2016 (BC Act)

The *BC Act* repeals the *Threatened Species Conservation Act 1995*, the *Nature Conservation Trust Act 2001* and the animal and plant provisions of the *National Parks and Wildlife Act 1974*.

The *BC Act* and the *BC Reg* establishes a regulatory framework for assessing and offsetting impacts on biodiversity values due to potential developments and associated clearing of biodiversity entities and associated habitat. It establishes a framework to avoid, minimise and offset impacts on biodiversity from development through the Biodiversity Offsets Scheme. Where development consent is granted, the authority may impose as a condition of consent an obligation to retire a number and type of biodiversity credits determined under the new Biodiversity Assessment Method (BAM), 2020.

The BOS applies to:

- local development (assessed under Part 4 of the *Environmental Planning and Assessment Act 1979*) that triggers a BOS threshold or is likely to significantly affect threatened species based on the test of significance in section 7.3 of the *Biodiversity Conservation Act 2016*
- state significant development and state significant infrastructure projects, unless the Secretary of the Department of Planning, Industry and Environment and the environment agency head determine that the project is not likely to have a significant impact
- biodiversity certification proposals
- clearing of native vegetation in urban areas and areas zoned for environmental conservation that exceeds a BOS threshold and does not require development consent
- clearing of native vegetation that requires approval by the Native Vegetation Panel under the *Local Land Services Act 2013*
- activities assessed and determined under Part 5 of the *Environmental Planning and Assessment Act 1979* (generally, proposals by government entities) if proponents choose to 'opt in' to the Scheme.

Proponents will need to supply evidence relating to the triggers for the BOS thresholds and the test of significance (where relevant) when submitting their application to the consent authority.

Development consent cannot be granted for non-State significant development under Part 4 of the *EP&A Act* if the consent authority is of the opinion it is likely to have serious and irreversible impacts (SAII) on biodiversity values. The determination of SAII is to be made in accordance with principles prescribed section 6.7 of the *BC Regulation 2017*. The principles have been designed to capture those impacts which are likely to contribute significantly to the risk of extinction of a threatened species or ecological community in New South Wales.

The threatened species test of significance is used to determine if a development or activity is likely to significantly affect threatened species or ecological communities, or their habitats. It is applied as part of the Biodiversity Offsets Scheme entry requirements and for Part 5 activities under the *Environmental Planning and Assessment Act* (*EP&A Act*), 1979.

The test of significance is set out in s.7.3 of the *BC Act.* If the activity is likely to have a significant impact, or will be carried out in a declared area of outstanding biodiversity value, the proponent must either apply the Biodiversity Offsets Scheme or prepare a species impact statement (SIS).

The environmental impact of activities that will not have a significant impact on threatened species will continue to be assessed under s.111 of the *EP&A Act*

1.4.3 Fisheries Management Act 1994 (FM Act)

The *FM Act* provides a list of threatened aquatic species that require consideration when addressing the potential impacts of a proposed development. Where a proposed activity is located in an area identified as critical habitat, or such that it is likely to significantly affect threatened species, populations, ecological communities, or their habitats, an SIS is required to be prepared.

1.4.4 Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The *EPBC Act* requires that Commonwealth approval be obtained for certain actions. It provides an assessment and approvals system for actions that have a significant impact on matters of *national environmental significance* (NES). These may include:

- World Heritage Properties and National Heritage Places
- Wetlands of International Importance protected by international treaty
- Nationally listed threatened species and ecological communities
- Nationally listed migratory species
- Commonwealth marine environment

Actions are projects, developments, undertakings, activities, and series of activities or alteration of any of these. An action that needs Commonwealth approval is known as a controlled action. A controlled action needs approval where the Commonwealth decides the action would have a significant effect on an NES matter.

Where a proposed activity is located in an area identified to be of NES, or such that it is likely to significantly affect threatened species, ecological communities, migratory species or their habitats, then the matter needs to be referred to the Commonwealth Department of Agriculture, Water and the Environment (DAWE) for assessment. In the case where no listed federal species are located on site then no referral is required. The onus is on the proponent to make the application and not the Council to make any referral.

A threshold criterion apply to specific NES matters which may determine whether a referral is or is not required, such as for the *EPBC*-listed ecological communities Cumberland Plain Woodland and Shale-Gravel transition Forest. Consultation with DAWE may be required to determine whether a referral is or is not required. If there is any doubt as to the significance of impact or whether a referral is required, a referral is generally recommended to provide a definite decision under the *EPBC Act* thereby removing any further obligations in the case of 'not controlled' actions.

A significant impact is regarded as being:

important, notable, or of consequence, having regard to its context or intensity and depends upon the sensitivity, value, and quality of the environment which is impacted and upon the duration, magnitude, and geographical extent of the impacts. A significant impact is likely when it is a real or not a remote chance or possibility.

Source: EPBC Policy Statement

Guidelines on the correct interpretation of the actions and assessment of significance are located on the department's web site http://www.environment.gov.au/epbc/publications.

1.4.5 Coastal Management Act 2016 (CM Act)

The *Coastal Management Act* (*CM Act,* 2016) establishes the framework and overarching objects for coastal management in New South Wales. The Act commenced on 29 June 2018 and replaces the previous *Coastal Protection Act* (1979).

The purpose of the *CM Act* is to manage the use and development of the coastal environment in an ecologically sustainable way, for the social, cultural and economic well-being of the people of New South Wales.

The *CM Act* also supports the aims of the *Marine Estate Management Act 2014*, as the coastal zone forms part of the marine estate.

The *CM Act* defines the coastal zone, comprising four (4) coastal management areas:

1. coastal wetlands and littoral rainforests area; areas which display the characteristics of coastal wetlands or littoral rainforests that were previously protected by SEPP 14 and SEPP 26
2. coastal vulnerability area; areas subject to coastal hazards such as coastal erosion and tidal inundation
3. coastal environment area; areas that are characterised by natural coastal features such as beaches, rock platforms, coastal lakes and lagoons and undeveloped headlands. Marine and estuarine waters are also included
4. coastal use area; land adjacent to coastal waters, estuaries and coastal lakes and lagoons.

The *CM Act* establishes management objectives specific to each of these management areas, reflecting their different values to coastal communities.

The subject lot falls within the Hunter / Central Rivers Catchment Management Area.

1.4.6 Licences

Individual staff members of *Travers bushfire & ecology* are licensed under Clause 20 of the *National Parks and Wildlife (Land Management) Regulation 1995* and Sections 120 & 131 of the *National Parks and Wildlife Act 1974* to conduct flora and fauna surveys within service and non-service areas. NPWS Scientific Licence Numbers: SL100848.

Travers bushfire & ecology staff are licensed under an Animal Research Authority issued by the NSW Department of Primary Industries. This authority allows *Travers bushfire & ecology* staff to conduct various fauna surveys of native and introduced fauna for the purposes of environmental consulting throughout New South Wales.

Survey Methodology 2

2.1 Presurvey information collation & resources

Documents reviewed:

- Proposed Subdivision Plan prepared by *Optima Developments Pty Ltd*
- Bushfire Protection Assessment prepared by *Travers bushfire & ecology*

Technical resources utilised:

Legislation

- *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*)
- *Biodiversity Conservation Act 2016* (*BC Act*)
- *Biodiversity Conservation Regulation 2017* (*BC Reg*)
- *Fisheries Management Act 1994* (*FM Act*)

Survey guidelines

- *Survey guidelines for Australia's threatened birds* (DEWHA 2010)
- *Survey guidelines for Australia's threatened mammals* (DEWHA 2011)
- *Survey guidelines for Australia's threatened bats* (DEWHA. 2010)
- *Matters of National Environmental Significance* (Commonwealth of Australia 2013)
- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities 2004* (working draft), Department of Environment and Conservation (DEC)
- *Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna – Amphibians* (DECC – April 2009a)
- *Region based guide to the echolocation calls of Microchiropteran bats* (DEC 2004)
- *Flora and Fauna Survey Guidelines Version 4.2* (LMCC 2013)
- *Field survey methods: Best practice field survey methods for environmental consultants and surveyors when assessing proposed development sites or other activities on sites containing threatened species, populations or ecological communities* (OEH 2004)
- *NSW Guide to Surveying Threatened Plants* (DPIE 2016)
- *Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment Method* (DPIE 2020)

Mapping resources

- Aerial photographs (Google Earth Pro / Spatial Information Exchange / NearMap)
- Topographical maps (scale 1:25,000)
- ESpade – DPIE tool for checking soil types

Threatened species records

- *BioNet* database which holds data from a number of custodians (24/09/20 to 10 km)
- EPBC *Protected Matters Search Tool - DAWE* (2020 to 10 km)
- Royal Botanic Gardens flora database (2020)

Vegetation mapping/resources

- BioNet Vegetation Classification System
- Lake Macquarie City Council Composite Vegetation Community Map (LMCC 2015)

Vegetation mapping:

Previous vegetation mapping provided by Lake Macquarie City Council, as mapped by Bell (2015), is shown on Figure 2.1. This mapping identifies the following communities within the study area:

- Map Unit 37 – Swamp Mahogany – Paperbark Forest (equivalent PCT1718 - Swamp Mahogany - Flax-leaved Paperbark swamp forest on coastal lowlands of the Central Coast) as bushland or Partially Cleared
- Map Unit 31 – Coastal Plains Scribbly Gum Woodland (equivalent PCT1636 - Scribbly Gum - Red Bloodwood - Angophora inopina heathy woodland on lowlands of the Central Coast) as Bushland or Partially Cleared

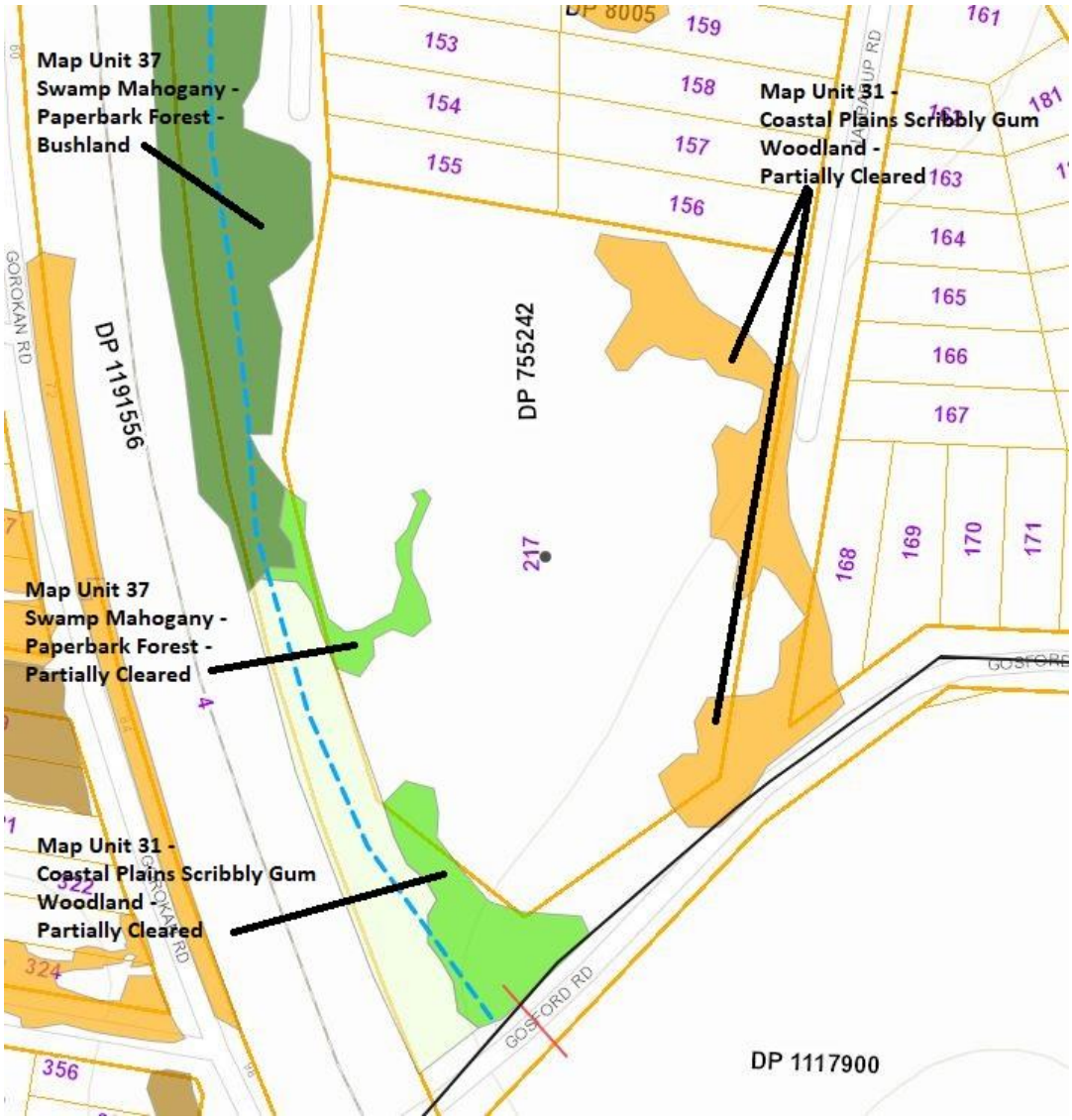

Figure 2.1 – Vegetation mapping (Bell 2015)

2.2 Flora survey methodology

Flora survey was undertaken on 24 September and 27 October 2020, and on 26 May, 8 October and 12 November 2021. A review of the *Atlas of NSW Wildlife* (DPIE 2020) was undertaken prior to the site visit to determine threatened species previously recorded within 10 km of the subject site, and relevant target searches were undertaken as suited, generally as meander transects underneath or adjacent to remnant canopy vegetation.

Stratified survey using the BAM was undertaken. One (1) standard 20 m x 20 m flora plot was undertaken, along with three (3) BAM plots. The following information was collected at each of the BAM plots:

- Native overstorey, mid-storey and ground cover recorded for all observed species and an estimate of stems (20 m x 20 m)
- Stratum (and layer): stratum and layer in which each species occurs (20 m x 20 m)
- Growth form: growth form for each recorded species (20 m x 20 m)
- Species name: scientific name and common name (20 m x 20 m)
- Percent projected foliage cover of the understorey strata and exotic vegetation (20 m x 20 m
- Number of trees with hollows visible from the ground (20 m x 50 m)
- The total length of fallen logs >10 cm in diameter (20 m x 50 m)
- The proportion of regenerating overstorey species (20 m x 50 m)
- Number of large trees (20 m x 50 m)
- Estimates of leaf litter cover, bare ground, cryptograms and rocks in 1 m x 1 m subplots at five (5) locations along the central transect (20 m x 50 m)

Targeted survey for *Angophora inopina, Genoplesium insigne, Tetratheca juncea, Cryptostylis hunteriana*, and *Acacia bynoeana* was undertaken within the whole of the lot (Figure 3.1).

2.3 Fauna survey methodology

Site survey effort accounting for techniques deployed, duration, and weather conditions are outlined in Table 2.1 and are depicted on Figure 3.1.

Diurnal birds

Two (2) diurnal bird census points were undertaken within the development footprint and one (1) was undertaken within remnant vegetation across the road. A minimum of 15 minutes of survey was undertaken at each census point in an area radiating out to between 30–50 m. Bird census points were selected to give an even spread and representation across the site and its communities. Census points were also commenced in locations where bird activity was apparent, as often different small bird species are found foraging together. Opportunistic diurnal bird survey was conducted between census points and whilst undertaking other diurnal surveys.

Nocturnal birds

Given the suitability of habitat present for foraging and roosting by owls, Masked Owl (*Tyto novaehollandiae*), Powerful Owl (*Ninox strenua*) and Barking Owl (*Ninox connivens*) were targeted by call-playback techniques. Spotlighting activities were undertaken during this time. Diurnal survey included searches for any signs of Powerful Owl roosting activity. This was undertaken where dense mid-storey foliage was present, typically in the gully and Dry Rainforest portions of the site. Search areas are shown on Figure 3.1.

Arboreal and terrestrial mammals

Given the suitability of habitat present Koala (*Phascolarctos cinereus*), Yellow-bellied Glider (*Petaurus australis*) and Squirrel Glider (*Petaurus norfolcensis*) were targeted by call-playback techniques. Spotlighting activities were undertaken during this time. Given that two nearby hollow-bearing trees (marked as HT1 & HT2) provided Squirrel Glider denning potential stag-watching was undertaken. Spotlighting activities were undertaken during this time.

Given the expected potential for Koala to occur the complete Spot Assessment Technique described by *Phillips & Callaghan* (2008) was undertaken as a measure of Koala 'activity'. In this case the proportion of trees showing signs of Koala use is calculated and the location and density of droppings found were documented.

Camera traps were used in May 2022 to assess for presence / absence of Squirrel Glider. Two traps were placed in each of the two PCTs, giving a total of four camera traps. The camera traps were left in place for a total of 14 days, in accordance with advice from BCD.

Alternate approved survey methodology for Squirrel Glider as support by BCD (Steve Lewer BCD 17/02/2022)

Correspondence with the BCD confirmed that camera trapping is a suitable method for surveying for Squirrel Glider:

> *BCD recognizes under section (c), an accredited assessor / consultant can request (to DPE) for alternate methodologies to be adopted where our guidelines are outdated and new techniques would offer similar or greater success. BCD has consulted both LMCC staff and the 'accountable officer' for the species, and both support the use of infra-red remote camera techniques for Squirrel Gliders in this instance. They recommend:*
>
> - *The cameras are to be placed at a minimum of two cameras per habitat type (i.e. minimum of 4 for the subject site given the two PCTs) for a minimum of two weeks (i.e. 14 days), and*
> - *they are to be baited with a suitable attractant for Squirrel Gliders.*
>
> *In utilising this method, the accredited assessor / consultants accepts all responsibility to show that any images capturing gliders are correctly identified, notably Squirrel Glider vs. Sugar Glider. This evidence is to be included in the Biodiversity Development Assessment Report (BDAR), including appropriate justification to support their identification. In instances where ID can not be categorically determined, you may be required to undertake further surveying (at the bequest of the consent authority) to determine absence / presence. This could include the use of arboreal Elliott B traps.*
>
> *Furthermore, both parties also recognise that the other supporting techniques should also be used to supplement your efforts, such as stag / hollow bearing trees watching and spotlighting. However, this is not a requirement.*
>
> *In summary, BCD supports your request to use infra-red remote camera techniques (as outlined above) as an alternative to typical Elliott B / cage trapping*.

Further stag-watching of the two hollow-bearing trees was undertaken at dusk in June 2022.

Bats

Two (2) ultrasonic frequency recorders were deployed overnight from 1930 targeting areas

which may provide microbat foraging potential such as flyways through and along vegetation onsite. Spotlighting was undertaken on the 20/10/20 which also incorporated stag watching on a nearby hollow-bearing tree (marked as HT1) which provided microbat roosting.

Amphibians

There is no habitat for threatened amphibians on this site. However, opportunistic habitat searches were undertaken during other diurnal survey and call identification was undertaken during spotlighting activities.

Reptiles

There is no habitat for threatened reptiles on this site. However, opportunistic habitat searches were undertaken during other diurnal survey.

Habitat trees

Hollow-bearing trees were identified and recorded within the development footprint on a *Trimble* handheld GPS unit during surveys. All data such as hollow types, hollow size, tree species, diameter at breast height, canopy spread and overall height were collected and a metal tag with the tree number placed on the trunk for field relocation purposes. Other habitat features such as nests and significant sized mistletoe for foraging were also noted.

A summary of hollow-bearing tree results is provided in Table 3.5.

Significant habitat trees

Significant habitat trees are defined as trees containing large hollows suitable for use by owls and/or containing a number of good quality hollows typically consisting of more than one medium (10–30 cm) sized hollow. A tree may also be considered significant where evidence of use by select fauna is found such as Yellow-bellied Glider sap feed tree, raptor nest, or owl roost.

Data such as the number of hollows present in each size category (or other reason for selection), tree species, diameter at breast height, canopy spread and overall height were collected. A summary of significant habitat tree results is provided in Table 3.5.

2.4 Field survey effort

Tables 2.1, 2.2 and 2.3 below detail the flora and fauna survey effort undertaken for the development footprint.

Table 2.1 – Fauna survey effort

Fauna group	Date	Weather conditions	Survey technique(s)	Time effort (24hr)
Diurnal birds	20/10/20	0-8/8 cloud, 11km E wind, previous day rain, temp 19-17°C	Diurnal census x2 and opportunistic	3hrs 15mins 1445 - 1830
	21/10/20	0/8 cloud, 8km NE wind, no rain, temp 16°C	Diurnal census x1 and opportunistic	1hr 0830 - 0930
Nocturnal birds	20/10/20	8/8 cloud, no wind, light rain, previous day rain, temp 16°C	Spotlighting	1hr 45mins 1900 - 2045
			Call playback (Section 2.5 species)	Commenced @ 1930
Arboreal mammals	20/10/20	0-8/8 cloud, 11km E wind, previous day rain, temp 19-17°C	Koala SAT x3	3hrs 15mins 1445 - 1830
	20/10/20	8/8 cloud, no wind, light rain, previous day rain, temp 16°C	Spotlighting	1hr 45mins 1900 - 2045
			Call playback (Section 2.5 species)	Commenced @ 1930
	6–20/05/2022		Camera traps targeting Squirrel Glider	14 days
	16/06/2022	4/8, no wind, light rain, temp 21.6-9°C	Stag watching targeting Squirrel Glider	1 hr 1750 - 1850
Terrestrial mammals	20/10/20	8/8 cloud, no wind, light rain, previous day rain, temp 16°C	Spotlighting	1hr 45mins 1900 - 2045
Bats	20/10/20	8/8 cloud, no wind, light rain, previous day rain, temp 16°C	Spotlighting/ stagwatch	1hr 45mins 1900 - 2045
			Ultrasonic microbat recording (Passive monitoring) x2	Overnight from 18:30
Reptiles	20/10/20	0-8/8 cloud, 11km E wind, previous day rain, temp 19-17°C	Diurnal opportunistic / habitat searches	3hrs 15mins 1445 - 1830
Amphibians	20/10/20	0-8/8 cloud, 11km E wind, previous day rain, temp 19-17°C	Spotlighting / call identification	3hrs 15mins 1445 - 1830
			Diurnal opportunistic / habitat searches	3hrs 15mins 1445 - 1830

Table 2.2 – Flora survey effort

Flora survey	Survey technique(s)	Dates	Time effort
Vegetation communities	- Survey of the boundaries of all communities – field verification, plotting vegetation boundaries on aerial photographs	24 Sep 2020 27 Oct 2020 26 May 2021	4hrs 0.5hr 2hrs
Stratified sampling	- One 20m x 50m BAM plot and one 20 x 20m plot in areas of bushland. - Opportunistic observations of flora species during all on-foot traverses of the development footprint. - One 20m x 50m BAM plot in the disturbed area in the western parts of the site - One 20m x 50m BAM plot in the disturbed area in the western parts of the site	24 Sep 2020 24 Sep 2020 27 Oct 2020 26 May 2021	2hrs 1.5hrs 1.3hrs 1hr
Targeted searches	- Targeted searches in known or potential habitats. - Targeted searches for *Genoplesium insigne* and *Cryptostylis hunteriana*	24 Sep 2020 27 Oct 2020 26 May 2021 8 Oct 2021 12 Nov 2021	3.75hr 0.7hr 2hrs 2hrs 2hrs

2.5 Survey limitations

It is important to note that field survey data collected during the survey period is representative of species occurring within the development footprint for that occasion. Due to effects of fire, breeding cycles, migratory patterns, camouflage, flowering seasons, weather conditions, time of day, visibility, predatory and / or feeding patterns, variations species frequency or richness may be observed within the study area outside the nominated survey period. Habitat assessments based on the identification of micro-habitat features for various species of interest, including regionally significant and threatened species, have been used to minimise the implications of this survey limitation.

Given the limited potential for threatened species to occur on site because of the heavily disturbed (and removed understorey), together with long-term and ongoing management of the surrounding managed lands to the north south and east, it is unlikely that there are any significant limitations of this study.

Flora survey limitations

Survey is compliant for all other predicted species with potential to occur (Table 2.3).

Table 2.3 – Survey adequacy for species credit species (flora)

Species name	*BC Act*	Potential to occur (presence status) / habitat	Preferred survey period (DPIE)	Actual survey period	Survey sufficient to rule out presence
Acacia bynoeana	E	Low	All months	24 Sep 2020 27 Oct 2020 26 May 2021 8 Oct 2021 12 Nov 2021	✓
Angophora inopina	V	Moderate	All months	24 Sep 2020 27 Oct 2020 26 May 2021 8 Oct 2021 12 Nov 2021	✓
Asperula asthenes	V	x			
Astrotricha crassifolia	V	x			
Callistemon linearifolius	V	Marginal	Oct–Jan	27 Oct 2020 8 Oct 2021 12 Nov 2021	✓
Corunastylis sp. Charmhaven	CE	x			
Cryptostylis hunteriana	V	Low	Nov–Jan	12 Nov 2021	✓
Diuris praecox	V	x			
Eucalyptus camfieldii	V	x			
Eucalyptus parramattensis subsp. *decadens*	V	Unlikely	All months	24 Sep 2020 27 Oct 2020 26 May 2021 8 Oct 2021 12 Nov 2021	✓
Genoplesium insigne	CE	Low	Sept–Nov	24 Sep 2020 27 Oct 2020 8 Oct 2021 12 Nov 2021	✓
Grevillea parviflora subsp. *parviflora*	V	Marginal	Aug–Nov	24 Sep 2020 27 Oct 2020 8 Oct 2021 12 Nov 2021	✓
Haloragis exalata subsp. *exalata*	V	x			

Lindernia alsinoides	E	x			
Maundia triglochinoides	V	x			
Melaleuca biconvexa	V	x			
Melaleuca groveana	V	x			
Persicaria elatior	V	x			
Persoonia hirsuta	E	x (vagrant)			
Prostanthera askania	E	x			
Prostanthera cineolifera	V	x			
Rutidosis heterogama	V	Marginal	All months	24 Sep 2020 27 Oct 2020 26 May 2021 8 Oct 2021 12 Nov 2021	✓
Tetratheca glandulosa	V	x			
Tetratheca juncea	V	Low	Sept–Oct	24 Sep 2020 27 Oct 2020 8 Oct 2021	✓

Fauna survey limitations

The BioNet Vegetation Classification Tool (BVCT) has identified a list of threatened fauna species credit species that have potential habitat associated with the recorded PCTs in the development footprint (refer to Table 4.6 for this full list). Species credit species require survey to rule out presence on site otherwise these species must be assumed to be present and will generate subsequent credits for offsetting.

Following a habitat assessment of the site and surrounding study area, as well as the elimination of select species where breeding habitat is absent, the following species require seasonal survey.

Table 2.4 – Survey adequacy for species credit species (fauna)

Common name	*BC Act*	Potential to occur (presence status) / Habitat	Preferred Survey period (DPIE)	Actual survey period	Survey sufficient to rule out presence
Eastern Pygmy Possum	V	Unlikely	Oct–March	Oct	x no trapping
Large-eared Pied Bat	V	Low	Nov–Jan	Oct	x

Additional survey for fauna is recommended to assess presence of these species, preferably between Nov–Jan. This survey as able to be completed prior to submission of a DA.

Survey Results 3

3.1 Flora results

3.1.1 Native vegetation extent

The native vegetation extent within the study area has been ground-truthed. The total amount of native vegetation is 0.51 ha comprised of:

- Vegetation Zone 1 – PCT1636 - Scribbly Gum - Red Bloodwood - Angophora inopina heathy woodland on lowlands of the Central Coast (moderate–good) 0.34 ha
- Vegetation Zone 2 – PCT1636 - Scribbly Gum - Red Bloodwood - Angophora inopina heathy woodland on lowlands of the Central Coast (poor) 0.07 ha
- Vegetation Zone 3 – PCT1718 - Swamp Mahogany - Flax-leaved Paperbark swamp forest on coastal lowlands of the Central Coast (moderate) - TEC - 0.1 ha

3.1.2 Flora species

The plants observed within the vegetation communities of the study area are listed in Table 3.1 below.

Table 3.1 – Flora observations within the study area

Family	Scientific name	Common name
TREES		
Casuarinaceae	*Allocasuarina littoralis*	Black She-oak
Myrtaceae	*Angophora floribunda*	Rough-barked Apple
Lauraceae	*Cinnamomum camphora**	Camphor Laurel
Myrtaceae	*Corymbia gummifera*	Red Bloodwood
Fabaceae	*Erythrina* x *sykesii**	Coral tree
Myrtaceae	*Eucalyptus haemastoma*	Broad-leaved Scribbly Gum
Myrtaceae	*Eucalyptus robusta*	Swamp Mahogany
Phyllanthaceae	*Glochidion ferdinandi* var. *ferdinandi*	Cheese Tree
Proteaceae	*Macadamia integrifolia*	Macadamia Nut
Myrtaceae	*Melaleuca linariifolia*	Snow in Summer
Myrtaceae	*Melaleuca quinquenervia*	Broad-leaved Paperbark
Meliaceae	*Melia azedarach*	White Cedar
Pinaceae	*Pinus radiata**	Radiata or Monterey Pine
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum

SHRUBS		
Fabaceae	*Acacia longifolia* var. *longifolia*	Sydney Golden Wattle
Fabaceae	*Acacia suaveolens*	Sweet Scented Wattle
Proteaceae	*Banksia oblongifolia*	Fern-leaf Banksia
Myrtaceae	*Callistemon linearis*	Narrow-leaved Bottlebrush
Polygalaceae	*Comesperma ericinum*	Pyramid Flower
Sapindaceae	*Dodonaea triquetra*	Hop-bush
Epacridaceae	*Epacris pulchella*	Wallum Heath
Asclepiadaceae	*Gomphocarpus fruiticosus**	Narrow Leaf Cotton Bush
Proteaceae	*Grevillea sericea*	Pink Spider Flower
Myrtaceae	*Kunzea ambigua*	Tick Bush
Proteaceae	*Lambertia formosa*	Mountain Devil
Verbenaceae	*Lantana camara**	Lantana
Myrtaceae	*Leptospermum juniperinum*	Prickly Tea-tree
Myrtaceae	*Leptospermum polygalifolium* subsp. *polygalifolium*	Tantoon
Myrtaceae	*Leptospermum trinervium*	Slender Tea-tree
Oleaceae	*Ligustrum sinense**	Small-leaved Privet
Myrtaceae	*Melaleuca nodosa*	Ball Honey Myrtle
Fabaceae	*Mirbelia rubiifolia*	Heathy Mirbelia
Asteraceae	*Ozothamnus diosmifolius*	Ball Everlasting
Proteaceae	*Persoonia levis*	Broad-leaved Geebung
Proteaceae	*Petrophile pulchella*	Conesticks
Euphorbiaceae	*Phyllanthus hirtellus*	Thyme Spurge
Rosaceae	*Rubus fruticosus* sp. agg. *	Blackberry complex
Myrtaceae	*Sannantha pluriflora*	-
Solanaceae	*Solanum mauritianum**	Wild Tobacco
GROUNDCOVERS		
Poaceae	*Andropogon virginicus**	Whisky Grass
Poaceae	*Anisopogon avenaceus*	Oat Speargrass
Poaceae	*Aristida ramosa*	Purple Wiregrass
Poaceae	*Aristida vagans*	Three-awn Speargrass
Poaceae	*Axonopus fissifolius**	Narrow-leaved Carpet Grass
Restionaceae	*Baloskion tetraphyllum* subsp. *tetraphyllum*	Plume Rush
Asteraceae	*Bidens pilosa**	Cobbler's Pegs
Poaceae	*Briza maxima**	Quaking Grass
Poaceae	*Briza minor**	Shivery Grass
Poaceae	*Briza subaristata**	-
Anthericaceae	*Caesia parviflora* var. *parviflora*	Pale Grass Lily
Orchidaceae	*Calochilus paludosus*	Red Beard Orchid
Dicksoniaceae	*Calochlaena dubia*	Rainbow Fern
Poaceae	*Cenchrus clandestinus**	Kikuyu, Kikuyu Grass
Apiaceae	*Centella asiatica*	Swamp Pennywort
Carophyllaceae	*Cerastium glomeratum**	Mouse-ear Chickweed
Asteraceae	*Conyza bonariensis**	Flax-leaf Fleabane
Cyperaceae	*Cyathochaeta diandra*	-

Poaceae	*Cynodon dactylon*	Common Couch
Cyperaceae	*Cyperus brevifolius**	Mullumbimby Couch
Cyperaceae	*Cyperus eragrostis**	Umbrella Sedge
Phormiaceae	*Dianella caerulea*	Blue Flax-lily
Doryanthaceae	*Doryanthes excelsa*	Gymea Lily
Droseraceae	*Drosera peltata*	Sundew
Poaceae	*Echinopogon caespitosus* var. *caespitosus*	Tufted Hedgehog Grass
Poaceae	*Entolasia marginata*	Bordered Panic
Poaceae	*Entolasia stricta*	Wiry Panic
Poaceae	*Eragrostis brownii*	Brown's Lovegrass
Cyperaceae	*Gahnia clarkei*	Tall Saw-sedge
Asteraceae	*Gamochaeta coarctata**	Cudweed
Goodeniaceae	*Goodenia hederacea* subsp. *hederacea*	Ivy-leaved Goodenia
Zingiberaceae	*Hedychium gardnerianum**	Ginger Lily
Poaceae	*Imperata cylindrica*	Blady Grass
Cyperaceae	*Isolepis inundata*	Swamp Club-rush
Cyperaceae	*Isolepis levynsiana**	-
Juncaceae	*Juncus planifolius*	Broad Rush
Juncaceae	*Juncus usitatus*	Common Rush
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge
Restionaceae	*Lepyrodia scariosa*	Scale Rush
Lobeliaceae	*Lobelia purpurascens*	Whiteroot
Lomandraceae	*Lomandra filiformis* subsp. *filiformis*	Wattle Mat-rush
Lomandraceae	*Lomandra obliqua*	Twisted Mat-rush
Myrsinaceae	*Lysimachia arvensis**	Scarlet Pimpernel
Fabaceae	*Medicago sativa**	Lucerne
Poaceae	*Panicum simile*	Two Colour Panic
Poaceae	*Paspalum urvillei**	Vasey Grass
Poaceae	*Paspalum dilatatum**	Paspalum
Iridaceae	*Patersonia sericea*	Wild Iris
Thymelaeaceae	*Pimelea linifolia* subsp. *linifolia*	Slender Rice Flower
Plantaginaceae	*Plantago lanceolata**	Ribwort
Cyperaceae	*Ptilothrix deusta*	-
Rubiaceae	*Richardia brasiliensis**	White Eye
Poaceae	*Rytidosperma tenuius*	Wallaby Grass
Cyperaceae	*Chaetospora turbinata*	-
Cyperaceae	*Schoenus apogon*	Common Bog-rush
Cyperaceae	*Schoenus melanostachys*	Black Bog Rush
Asteraceae	*Senecio madagascariensis**	Fireweed
Solanaceae	*Solanum nigrum**	Black Nightshade
Asteraceae	*Sonchus oleraceus**	Common Sow-thistle
Poaceae	*Stenotaphrum secundatum**	Buffalo Grass
Asteraceae	*Taraxacum officinale**	Dandelion
Poaceae	*Themeda triandra*	Kangaroo Grass

Commelinaceae	*Tradescantia fluminensis**	Wandering Jew
Fabaceae	*Trifolium repens**	White Clover
Verbenaceae	*Verbena bonariensis**	Purpletop
Violaceae	*Viola hederacea*	Ivy-leaved Violet
Iridaceae	*Watsonia meriana**	-
Xanthorrhoaceae	*Xanthorrhoea latifolia* subsp. *latifolia*	-
VINES		
Pittosporaceae	*Billardiera scandens*	Hairy Appleberry
Lauraceae	*Cassytha glabella* f. *glabella*	Slender Devil's Twine
Fabaceae	*Glycine clandestina*	Twining Glycine
Convolvulaceae	*Ipomoea cairica**	Coastal Morning Glory
Fabaceae	*Vicia sativa* subsp. *sativa**	Common Vetch
*** denotes exotic species** **TS denotes threatened species**		

3.1.3 Plant community types (PCTs)

Table 3.2 – PCTs

PCT code	PCT name	Species relied upon	Vegetation formation	Vegetation class	% Cleared	Area within development site (ha)	TEC status
1636	Scribbly Gum - Red Bloodwood - Angophora inopina heathy woodland on lowlands of the Central Coast	*E. haemastoma* *C. gummifera* *A. littoralis* *P. undulatum*	Dry Sclerophyll Forests (Shrubby sub-formation)	Sydney Coastal Dry Sclerophyll Forests	58	0.41 on site, 0.41 to be impacted	-
1718	Swamp Mahogany - Flax-leaved Paperbark swamp forest on coastal lowlands of the Central Coast	*E. robusta* *M. quinquenervia*	Forested Wetlands	Coastal Swamp Forests	74	0.1 on site, 0.1 to be impacted	Swamp Sclerophyll Forest on Coastal Floodplains

PCT Descriptions

PCT 1636 Scribbly Gum - Red Bloodwood - Angophora inopina heathy woodland on lowlands of the Central Coast

IBRA Subregion: Occurs within the Hunter and Wyong IBRA subregions
Vegetation formation/class: Dry Sclerophyll Forests (Shrubby sub-formation) **/**Sydney Coastal Dry Sclerophyll Forests
Landscape position: Gosford - Cooranbong Coastal Slopes; Sydney - Newcastle Barriers and Beaches; Sydney - Newcastle Coastal Alluvial Plains. The site is located between 29 to 41 m above AHD. The E-spade website has mapped the soil landscape within the study area as the Gorokan Soil Landscape which consists of dark brown loamy sand to sandy loam with single-grained structure and sandy fabric. A yellowish-brown light to medium clay with strong

angular blocky structure and rough ped fabric occurs as the subsoil. The altitude, soils and geology are correct for this vegetation type.

PCT 1718 Swamp Mahogany - Flax-leaved Paperbark swamp forest on coastal lowlands of the Central Coast

IBRA Subregion: Occurs within the Hunter and Wyong IBRA subregions
Vegetation formation/class: Forested Wetlands / Coastal Swamp Forests
Landscape position: Occurs on lower slopes and floodplains. The altitude, soils and geology are correct for this vegetation type.

The vegetation contained a number of species that are listed in the final determinations for Swamp Sclerophyll Forest on Coastal Floodplains. PCT 1718 forms part of the recognised plant community type for this TEC.

3.1.4 Vegetation descriptions of observed communities

The following vegetation communities were identified within the development footprint through ground truthing. Threatened ecological communities are denoted with 'TEC'.

- Vegetation Zone 1 – PCT1636 - Scribbly Gum - Red Bloodwood - Angophora inopina heathy woodland on lowlands of the Central Coast (moderate–good)
- Vegetation Zone 2 – PCT1636 - Scribbly Gum - Red Bloodwood - Angophora inopina heathy woodland on lowlands of the Central Coast (poor)
- Vegetation Zone 3 – PCT1718 - Swamp Mahogany - Flax-leaved Paperbark swamp forest on coastal lowlands of the Central Coast (moderate) - TEC
- Planted vegetation
- Managed lawn / pasture

PCT1636 - Scribbly Gum - Red Bloodwood - Angophora inopina heathy woodland on lowlands of the Central Coast (Zones 1 & 2)

This is the primary native vegetation community on the site with an estimated extent of 0.41 ha. This community is not commensurate with any TEC within the NSW *BC Act* or Commonwealth *EPBC Act* (1999).

Some areas of this vegetation community have been thinned and underscrubbed in the past and have had ongoing maintenance to maintain the areas via regular slashing which has halted any regrowth from the shrub and canopy layers. This has resulted in the creation of areas with a mixture of exotic and native grasses in the ground layer with the shrub layers absent (See Photo 2 below).

- Moderate–good quality (0.34 ha)
- Poor (0.07 ha)

Photo 1 – Moderate-good quality and more intact remnant vegetation (PCT1636) in the north-western portion of the study area

Photo 2 – Poorer quality PCT1636 without midstorey in the south of the study area

Canopy – 18 to 20 m high with 30–40% projected foliage cover (PFC). Dominant species include *Eucalyptus haemastoma* and *Corymbia gummifera.* Within the areas managed by regular slashing, the canopy and shrub layers are absent.

Mid - storey – contains various densities or patches of *Allocasuarina littoralis* and *Pittosporum undulatum* up to 14 m tall and with a patchy PFC of 10–40%. Within the areas managed by regular slashing there is no mid storey.

Groundcovers – Imperata cylindrica, Entolasia stricta, Themeda triandra, Aristida vagans, *Panicum simile, Microlaena stipoides*, *Caesia parviflora, Lomandra obliqua, Aristida ramosa, Lepidosperma laterale, Pratia purpurascens, Phyllanthus hirtellus and Calochilus paludosus.* Exotic grasses are more prevalent in the areas managed by slashing which still have some native groundcovers present.

PCT 1718 - Swamp Mahogany - Flax-leaved Paperbark swamp forest on coastal lowlands of the Central Coast

This vegetation occurs in the western portion of the site and covers an area of 0.1 ha.

It is represented by a thin line of trees and some shrubs and is highly disturbed. The canopy consists of only scattered *Eucalyptus robusta* with a sub canopy comprised of *Allocasuarina littoralis*, *Melaleuca quinquenervia*, *Pinus radiata* and sparse individuals of *Acacia longifolia*. The groundlayer is dominated exotic *Watsonia meriana*.

Photo 3 – PCT 1718 Trees and occasional shrubs growing over a layer solely comprised of Watsonia meriana.

Canopy – The canopy contains *Eucalyptus robusta.* This vegetation is 16–22 m tall with a projected foliage cover of 10–15%.

Mid-storey – has a sub canopy comprised of *Allocasuarina littoralis*, *Melaleuca quinquenervia* and *Pinus radiata.*

Shrub layer – Acacia longifolia, Leptospermum spp. and *Kunzea ambigua* up to 3 m tall and with a projected foliage cover of 3–5%.

Groundcovers – comprised of a dense layer of only one species – *Watsonia meriana,* which is an environmentally invasive exotic species.

Planted vegetation

This vegetation is largely comprised of exotic trees, shrubs and palms, including *Ehretia x sykesii, Syagrus romanzoffiana, Ravenala madagascariensis, Pinus radiata*, *Cinnamomum camphora* and *Phoenix canariensis.* A few native species are present, including *Macadamia integrifolia, Archontophoenix cunninghamiana, Xanthorrhoea* sp., *Doryanthes excelsa, Cyathea* sp. and *Grevillea* sp.

Photo 4 – Planted exotic vegetation in the south of the study area

Photo 5 – Planted exotic and native vegetation in the south of the study area

Managed lawn and cleared areas

This describes the predominantly grassed vegetation and cleared parts of the site and stands of exotic trees. It is maintained by regular mowing and is dominated by exotic grasses, which provide more than 80% coverage. Species include *Cenchrus clandestinus*, *Andropogon virginicus*, *Axonopus fissifolius*, *Briza maxima*, *Briza Minor*, *Briza subaristata*, *Stenotaphrum secundatum*, *Paspalum urvillei* and *Paspalum dilatatum*. A few native species are present but sparse and include *Microlaena stipoides* and *Cynodon dactylon*.

This community includes an area where a dam was previously located and has since been filled in. This area contains very sparse vegetation and appears to have been recently seeded with a turf grass cultivar, which provides up to 30% cover. A few other species are present, including exotic *Watsonia meriana, Cyperus* spp., *Senecio madagascariensis, Axonopus fissifolius, Andropogon virginicus* and *Paspalum urvillei.* A few natives are also present, including *Cyperus tenellus, Eragrostis brownii, Gahnia clarkei, Juncus usitatus, Cynodon dactylon, Sannantha pluriflora, Eucalyptus* sp. seedling and *Goodenia bellidifolia*.

Photo 6 – managed lawn in the north of the study area

Photo 7 – cleared land where dam has previously been infilled

3.2 Fauna results

Fauna species observed throughout the duration of fauna surveys are listed below.

Table 3.3 – Fauna recorded within the study area

Common name	Scientific name	Method observed
Birds		**Oct 20**
Australian Magpie	*Cracticus tibicen*	O
Australian Raven	*Corvus coronoides*	OW
Australian Wood Duck	*Chenonetta jubata*	O
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	OW
Common Myna *	*Sturnus tristis*	OW
Eastern Rosella	*Platycercus eximius*	OW
Eastern Whipbird	*Psophodes olivaceus*	OW
Galah	*Eolophus roseicapillus*	OW
Long-billed Corella	*Cacatua tenuirostris*	OW
Magpie-lark	*Grallina cyanoleuca*	OW
Masked Lapwing	*Vanellus miles*	OW
Noisy Miner	*Manorina melanocephala*	OW
Olive-backed Oriole	*Oriolus sagittatus*	OW
Pied Butcherbird	*Cracticus nigrogularis*	O
Rainbow Lorikeet	*Trichoglossus haematodus*	OW
Spotted Pardalote	*Pardalotus punctatus*	OW
Sulphur Crested Cockatoo	*Cacatua galerita*	O
Rose-ringed Parakeet *	*Psittacula krameri*	OW
Tawny Frogmouth	*Podargus strigoides*	OW
White-faced Heron	*Egretta novaehollandiae*	OW
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	OW
Mammals		
Domesticated Dog *	*Canis lupus familiaris*	OW
Eastern Coastal Free-tailed Bat TS	*Micronomus norfolkensis*	U[PR]
Eastern Freetail-bat	*Mormopterus ridei*	U
Feathertail Glider	*Acrobates pygmaeus*	Q
Gould's Wattled Bat	*Chalinolobus gouldii*	U
Greater Broad-nosed Bat TS	*Scoteanax rueppellii*	U[PR]
Large Bent-winged Bat TS	*Miniopterus orianae oceanensis*	U[PR]
Long-eared Bat sp.	*Nyctophilus sp*	U
Little Bent-winged Bat TS	*Miniopterus australis*	U
Northern Brown Bandicoot	*Isoodon macrourus*	O
White-striped Mastiff-bat	*Austronomus australis*	U
Reptiles		
Cream-striped Shining Skink	*Cryptoblepharus virgatus*	O
Delicate Skink	*Lampropholis delicata*	O
Amphibians		
Common Eastern Froglet	*Crinia signifera*	OW
Dwarf Tree Frog	*Litoria fallax*	W
Laughing Tree Frog	*Litoria tyleri*	W

Common name	Scientific name	Method observed

Note: * indicates introduced species
TS indicates threatened species
MS indicates Migratory species

All species listed are identified to a high level of certainty unless otherwise noted as:

PR indicates species identified to a 'probable' level of certainty – more likely than not
PO indicates species identified to a 'possible' level of certainty – low-moderate level of confidence

E - Nest/roost	H - Hair/feathers/skin	P - Scat	W - Heard call
F - Tracks/scratchings	K - Dead	Q - Camera	X - In scat
FB - Burrow	O - Observed	T - Trapped/netted	Y - Bone/teeth/shell
G - Crushed cones	OW - Obs & heard call	U - Anabat/ultrasound	Z - In raptor/owl pellet

3.3 Habitat results

3.3.1 Fauna habitat observations

The fauna habitats present within the site are identified within the following table.

Table 3.4 – Observed fauna habitat

Topography				
Flat ✓	Gentle ✓	Moderate	Steep	Drop-offs
Vegetation structure				
Closed Forest	Open Forest ✓	Woodland	Heath	Grassland ✓
Disturbance history				
Fire	Under-scrubbing ✓	Cut and fill works ✓		
Tree clearing ✓	Grazing ✓			
Soil landscape				
DEPTH:	Deep ✓	Moderate ✓	Shallow	Skeletal
TYPE:	Clay ✓	Loam ✓	Sand	Organic ✓
VALUE:	Surface foraging ✓	Sub-surface foraging ✓	Denning/burrowing	
WATER RETENTION:	Well Drained ✓	Damp / Moist ✓	Water logged	Swamp / Soak
Rock habitat				
CAVES: CREVICES: ESCARPMENTS: OUTCROPS:	No recorded habitat features onsite			
SCATTERED / ISOLATED:	High Surface Area Hides	Med. Surface Area Hides	Low Surface Area Hides ✓	
Feed resources				
FLOWERING TREES:	Eucalypts ✓	Corymbias ✓	Melaleucas ✓	
	Banksias	Acacias		
SEEDING TREES:	Allocasuarinas	Conifers		
WINTER FLOWERING EUCALYPTS:	*C. maculata*	*E. crebra*	*E. globoidea*	*E. sideroxylon*
	E. squamosa	*E. grandis*	*E. multicaulis*	*E. scias*
	E. robusta ✓	*E. tereticornis*	*E. agglomerata*	*E. siderophloia*
FLOWERING PERIODS:	Autumn	Winter ✓	Spring ✓	Summer ✓
OTHER:	Mistletoe	Figs / Fruit ✓	Sap / Manna ✓	Termites ✓
Foliage protection				
UPPER STRATA:	Dense	Moderate	Sparse ✓	

MID STRATA:	Dense		Moderate		Sparse ✓	
PLANT / SHRUB LAYER:	Dense		Moderate ✓		Sparse ✓	
GROUNDCOVERS:	Dense		Moderate		Sparse ✓	
Hollows / logs						
TREE HOLLOWS:	Large		Medium		Small ✓	
TREE HOLLOW TYPES	Spouts / branch ✓	Trunk ✓	Broken Trunk	Basal Cavities	Stags	
GROUND HOLLOWS:	No ground hollows recorded					
Vegetation debris						
FALLEN TREES:	Large		Medium		Small ✓	
FALLEN BRANCHES:	Large		Medium		Small ✓	
LITTER:	Deep		Moderate		Shallow ✓	
HUMUS:	Deep		Moderate		Shallow ✓	
Drainage catchment						
WATER BODIES	Wetland(s)	Soak(s) ✓	Dam(s)	Drainage line(s)	Creek(s)	River(s)
RATE OF FLOW:	No flow recorded					
CONSISTENCY:	Permanent		Perennial		Ephemeral ✓	
RUNOFF SOURCE:	Urban / Industrial ✓	Parkland	Grazing	Natural ✓		
RIPARIAN HABITAT:	No riparian habitat					
Artificial habitat						
STRUCTURES:	Sheds ✓		Infrastructure ✓		Equipment ✓	
SUB-SURFACE	Pipe / culvert(s) ✓		Tunnel(s)		Shaft(s)	
FOREIGN MATERIALS:	Sheet ✓		Pile / refuse ✓			

3.3.2 Habitat tree data

Hollow-bearing trees / significant habitat trees observed within the development footprint / study area are tabled below. Significant habitat trees are defined as trees containing large hollows suitable for use by owls and/or containing a number of good quality hollows typically consisting of more than one medium (10–30 cm) sized hollow. A tree may also be considered significant where evidence of use by select fauna is found such as Yellow-bellied Glider sap feed tree, raptor nest, or owl roost.

Table 3.5 – Habitat tree data

Tree no	Scientific name	Common name	DBH (cm)	Height (m)	Spread (m)	Vigour (%)	Hollows & other habitat features recorded
HT1	*E. haemastoma*	Scribbly Gum	35	15	12	80	0–5 cm trunk hollow
HT2	*E. haemastoma*	Scribbly Gum	42	19	15	75	5–10 cm branch spout

It is expected that both habitat trees will be removed by the proposal.

Figure 3.1 – Flora and fauna survey effort and results

Biodiversity & Assessment 4

4.1 Previous surveys reviewed

The following regional vegetation mapping was examined to identify the potential vegetation communities and other threatened biodiversity with potential to occur for assessment.

Previous vegetation mapping provided by Lake Macquarie City Council, as mapped by Bell (2015), is shown on Figure 2.1. This mapping identifies the following communities within the study area:

- Map Unit 37 – Swamp Mahogany – Paperbark Forest (equivalent PCT1718 - Swamp Mahogany - Flax-leaved Paperbark swamp forest on coastal lowlands of the Central Coast) as bushland or Partially Cleared
- Map Unit 31 – Coastal Plains Scribbly Gum Woodland (equivalent PCT1636 - Scribbly Gum - Red Bloodwood - Angophora inopina heathy woodland on lowlands of the Central Coast) as Bushland or Partially Cleared

4.2 Flora

No threatened flora species were observed.

All species are listed in Table 3.1.

4.2.1 Local / Regional flora matters

Regionally significant flora species are outlined within the Flora and Fauna Survey Guidelines (*Lake Macquarie City Council Guidelines* 2012). These are all state listed species and have been addressed in Section 4.2.2.

4.2.2 State legislative flora matters

(a) Threatened flora species (NSW)

BC Act – Table 4.1 lists the surrogate flora species that are associated with the PCTs occurring on site and their potential for occurrence.

Table 4.1 – State listed threatened flora species with suitable habitat present

Scientific name	*BC Act*	Potential to occur
Acacia bynoeana	E	Low
Angophora inopina	V	Moderate
Cryptostylis hunteriana	V	Low
Genoplesium insigne	CE	Low
Tetratheca juncea	V	Low

None of the above listed species were observed within the study area, therefore a future proposed residential development is not likely to have any significant impact on the local populations of these species.

(b) Endangered flora populations (NSW)

There is one (1) known endangered population within the Lake Macquarie Local Government Area.

- *Eucalyptus parramattensis* subsp. *parramattensis* in the Wyong and Lake Macquarie LGAs

This species is not represented within the study area, therefore a future proposed residential development is not likely to have any significant impact on this endangered flora population.

(c) Threatened ecological communities (NSW)

One (1) threatened ecological community (TEC) – Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions – was observed within the study area.

The Swamp Sclerophyll Forest community within the study area is highly impacted by past clearing, disturbances and current land management practices within the property. It includes mature trees (*Eucalyptus robusta, Melaleuca quinquenervia* and *Allocasuarina littoralis*) above a dense ground layer consisting entirely of *Watsonia meriana*.

The proposed subdivision will require the removal of all 0.1 ha of the Swamp Sclerophyll Forest within the study area.

Due to the small impact (0.1 ha) and overall poor quality of the Swamp Sclerophyll Forest areas to be removed, it is considered the proposal is not likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

It is also considered that the proposal is unlikely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

It is considered that the proposal is unlikely to fragment or isolate this community from other areas of similar habitat because the Swamp Sclerophyll forest within the study area forms the furthest extent of this vegetation community from the larger patch forming a corridor to the north.

It is considered that the importance of the highly modified or regrowth Swamp Sclerophyll Forest within the site is low.

(d) Ecosystem credit species

The BAM calculator does not generate any threatened flora species as ecosystem credit species.

(e) Species credit species

Although the BAM calculator has not been used, the BioNet Vegetation Classification Tool (BVCT) is able to predict which species will be produced by the BAM-C for credit assessment. The following predicted threatened species were generated by the BVCT and have been considered as confirmed candidate species:

Table 4.2 – Species credit species (flora)

Scientific name	*BC Act*	*Associated PCTs*	Potential to occur	Confirmed candidate species	Survey Adequacy			Presence		Presence
					Preferred Survey period (TBDC)	Actual Survey period	Survey Compliant (Yes/ No)	Assumed	Expert report	
Acacia bynoeana	E1	1636	Low	✓	All months	Sep, Oct	Yes	x		Absent based on survey
Angophora inopina	V	1636, 1718	Moderate	✓	All months	Sep, Oct	Yes	x		Absent based on survey
Asperula asthenes	V	1636, 1718	x							
Astrotricha crassifolia	V	1636	x							
Callistemon linearifolius	V	1636	Marginal	✓	Oct–Jan	Sep, Oct	Yes	x		Absent based on survey
Corunastylis sp. Charmhaven	E4A	1636	x							
Cryptostylis hunteriana	V	1636	Low	✓	Nov–Jan	Nov	Yes	x		Absent based on survey
Diuris praecox	V	1636, 1718	x							
Eucalyptus camfieldii	V	1636	x							
Eucalyptus parramattensis subsp. *decadens*	V	1718	Unlikely	✓	All months	Sep, Oct	Yes	x		Absent based on survey

Scientific name	*BC Act*	*Associated PCTs*	Potential to occur	Confirmed candidate species	Survey Adequacy			Presence		Presence
					Preferred Survey period (TBDC)	Actual Survey period	Survey Compliant (Yes/ No)	Assumed	Expert report	
Eucalyptus parramattensis subsp. *parramattensis* - endangered population	E2	1718	Unlikely	✓	All months	Sep, Oct	Yes	x		Absent based on survey
Genoplesium insigne	E1	1636	Low	✓	Sep–Nov	Sep, Oct, Nov	Yes	x		Absent based on survey
Grevillea parviflora subsp. *parviflora*	V	1636	Marginal	✓	Aug–Nov	Sep, Oct	Yes	x		Absent based on survey
Haloragis exalata subsp. *exalata*	V	1718	x							
Lindernia alsinoides	E1	1718	x							
Maundia triglochinoides	V	1718	x							
Melaleuca biconvexa	V	1718	x							
Melaleuca groveana	V	1636	x							
Persicaria elatior	V	1718	x							
Persoonia hirsuta	E1	1636	x							
Prostanthera askania	E	1636	x							
Prostanthera cineolifera	V	1636	x							
Rutidosis heterogama	V	1636	Marginal	✓	All months	Sep, Oct	Yes	x		Absent based on survey

Scientific name	*BC Act*	*Associated PCTs*	Potential to occur	Confirmed candidate species	Survey Adequacy			Presence		Presence
					Preferred Survey period (TBDC)	Actual Survey period	Survey Compliant (Yes/ No)	Assumed	Expert report	
Tetratheca glandulosa	V	1636	x							
Tetratheca juncea	V	1636	low	✓	Sep–Oct	Sep, Oct	Yes	x		Absent based on survey

Species excluded based on habitat features or vagrancy:

Asperula asthenes

This species does not occur on the Central Coast.

Astrotricha crassifolia

Occurs near Patonga (Gosford LGA), and in Royal NP and on the Woronora Plateau (Sutherland and Campbelltown LGAs). There is also a record from near Glen Davis (Lithgow LGA). This species is not know from Wyee. It grows on dry sandstone ridgetops to 300 m altitude – this habitat feature is absent from the study area.

Diuris praecox

This species occurs on hills and slopes, and has low potential to occur within Zones 1 and 2, but Zone 3 is too flat and low in the landscape. The grassland vegetation (Zone 4) is also too highly disturbed to support this species. As such, we have included *D. praecox* as a candidate species for Zones 1 and 2 only.

Eucalyptus camfieldii

Occurs on shallow sandy soils overlying Hawkesbury sandstone. The study area, however, is located on Tuggerah formation sandstone and thus does not support habitat for this species.

Haloragis exalata subsp*. exalata*

Occurs on the edges of coastal lakes where disturbance has removed other vegetation. There are no coastal lakes within or nearby the study area.

Lindernia alsinoides

This site is outside of its known geographic range.

Maundia triglochinoides

This species grows in swamps, lagoons, dams, channels, creeks or shallow freshwater 30–60 cm deep on heavy clay. The study area lacks any areas of permanent freshwater. The soil is very sandy and lacks any areas of heavy clay. Given these factors, it is considered that the study area does not provide suitable habitat for *Maundia triglochinoides*.

Melaleuca biconvexa

Grows in wetlands adjoining perennial streams and on the banks of those streams. Vegetation within the development footprint is too dry to support this species. This species is easily detected, and no individuals were observed during targeted survey for other species.

Melaleuca groveana

This species does not occur within the Wyong IBRA subregion according to BioNet records.

Persicaria elatior

This species occurs in damp places, especially beside streams and lakes. There is no suitable habitat within the study area.

Persoonia hirsuta

This species does not occur in the Wyong IBRA subregion, so is treated as absent for the purposes of credit calculation.

Prostanthera askania

Occurs in moist sclerophyll forest and warm temperate rainforest communities. This vegetation is absent from the study area and development footprint.

Prostanthera cineolifera

Restricted to only a few localities near Scone, Cessnock and St Albans, where is grows on exposed sandstone ridges. This species is not known from the Wyong IBRA subregion, and the habitat features present are not suitable for this species.

Tetratheca glandulosa

Associated with shale-sandstone transition habitat where shale-cappings occur over sandstone, with associated soil landscapes such as Lucas Heights, Gymea, Lambert and Faulconbridge. Geology of the study area is Munmorah Conglomerate and Quaternary Alluvium, and Doyalson, Wyong and Tacoma Swamp soil landscapes. Topographically, the plant occupies ridgetops, upper-slopes and to a lesser extent mid-slope sandstone benches – these landscape features are absent from the study area and development footprint.

Corunastylis sp. Charmhaven

Only known from the Wyong Shire of NSW. It is not known from Lake Macquarie LGA.

(f) Local data

Local data has not been used in this case.

(g) Expert reports

Expert reports have not been utilised for flora on this project.

4.2.3 Matters of national environmental significance - flora

(a) Threatened flora species (national)

EPBC Act – A search of the EPBC Search Tool provided a list of nationally threatened fauna species previously recorded, or with considered potential habitat, within a 10 km radius of the development footprint. These species have been listed and considered for habitat potential based on proximity and year of records in Table A1.1 (Appendix 1).

Based on this, it is considered that the development footprint provides varying levels of potential habitat for the following nationally listed threatened flora species:

Table 4.3 – Nationally listed threatened flora species with suitable habitat present

Scientific name	*EPBC Act*	Potential to occur
Acacia bynoeana	V	Low
Angophora inopina	V	Moderate
Cryptostylis hunteriana	V	Low

Scientific name	*EPBC Act*	Potential to occur
Genoplesium insigne	CE	Low
Tetratheca juncea	V	Low

No nationally listed threatened flora species were observed within the study area.

(b) Threatened ecological communities (national)

No nationally listed TECs occur within the development footprint.

4.3 Fauna

All fauna species recorded during survey, key fauna habitat observations and habitat tree data are provided in Section 3.

4.3.1 Key fauna habitat

Most notable habitat features for threatened fauna species considered with most potential to occur (see Sections 4.3.4 & 4.3.5) include:

- Small hollows (<10 cm)
- Seeding *Allocasuarina* present providing potential feed resources for Glossy Black-Cockatoo
- Diverse seasonal flowering opportunities for nectivorous species.
- Winter flowering trees

A complete assessment of the location of habitat trees and the size of hollows within was undertaken as part of surveys. Table 3.55 below provides hollow-bearing tree data and other habitat features recorded.

Figure 3.1 provides locations of habitat trees.

4.3.2 Local fauna matters

Regionally significant fauna species are outlined within the Flora and Fauna Survey Guidelines (*Lake Macquarie City Council Guidelines* 2012). These are all state listed species and have been addressed.

Other locally/regionally relevant documents to threatened fauna species include the:

- Draft Lake Macquarie Squirrel Glider Planning and Management Guidelines (LMCC 2015)
- Swift Parrots and Regent Honeyeaters in the Lake Macquarie City Council area New South Wales (Birdlife 2014)

(a) Regionally significant fauna

One regionally significant fauna species, Yellow-tailed Black-Cockatoo *(Calyptorhynchus funereus)*, was recorded within the study area during surveys by *Travers bushfire & ecology* (2020). Each of these species and their potential impacts by the proposal are discussed further below.

(b) Squirrel Glider habitat assessment

The following discussion is provided with consideration to the *Draft Lake Macquarie Squirrel Glider Planning and Management Guidelines* (LMCC 2015). This document will be referred to as the *SGPMG*.

Key points raised by the SGPMG:

- *Records of Squirrel Glider are concentrated in the centre of its total Australian east-coast geographic range, particularly in the Lake Macquarie/Wyong area and in north-east NSW to south-east Queensland. Smith (2002) considered the population within the Lake Macquarie – Wyong area to be of state and national significance because it represents the highest concentration of records in NSW.*
- *Within the Lake Macquarie LGA the Squirrel Glider is widely distributed and forms part of a larger metapopulation, the full extent of which is unclear.*
- *Records are primarily in areas where field surveys have been conducted and thus are overwhelmingly concentrated in development areas. All but two Squirrel Glider records in the Lake Macquarie LGA are from land with an elevation below 100 m.*
- *High population density is only achievable in habitats with abundant hollow bearing trees (>4 habitat trees/ha) and abundant food trees (Smith and Murray 2003; van der Ree 2000; Sharpe & Goldingay 2010).*
- *Whilst predicted habitat distribution mapping identifies approximately 23,500 ha of suitable habitat within the LGA, there is extensive fragmentation of habitat and all viable populations should be considered to be important populations.*
- *Squirrel glider distribution is determined by two key characteristics, (1) habitat suitability and (2) habitat size and spatial arrangement.*
- *The total estimated squirrel glider population in the LGA is potentially in the approximate range of 6,000 to 10,000 individuals, the majority being distributed in five populations.*
- *A viable population is a population (or metapopulation) with a 95% probability of persistence over 100 years.*

Management in accordance with the guidelines

The Squirrel Gliders in the locality with potential to utilise the study area either seasonally or as part of future recolonization are part of the Morisset / Wyee population. This population area is defined by the *SGPMG* as 2,423 ha of habitat with a variety of habitat patch sizes, potential but tenuous corridor links to Wyong LGA habitat to the south, and no conservation reserve. The population area contains one patch of over 400 ha of high quality habitat with potential for a conservation reserve, with linked habitat in smaller patches through urban development areas. The estimated Morisset / Wyee squirrel glider population is 400–800 individuals.

The *SGPMG* identifies that a significant impact from a proposed development is expected to occur where Squirrel Gliders are present (or are expected to occur) and based on;

- An area of squirrel glider habitat or more than 4 ha will be cleared, and / or
- More than 1 ha of habitat will be cleared and the habitat patch size will be reduced to less than 4 ha, and / or
- There is a greater than 5% loss of a habitat patch with an area of more than 10 ha, and / or

- There will be any impact on a key strategic corridor linkage connecting habitat patches, and / or
- Habitat connectivity to a habitat patch will be lost, or narrowed to a width that is not suitable for maintaining in the long term.

As none of these outcomes will occur, the proposal is not expected to significantly impact on the local population of Squirrel Gliders. The remnant patch size of usable habitat for the Squirrel Glider within the development footprint area is approximately 0.48 ha. This is calculated incorporating the open forest community as well as portions of usable canopy within the cleared lands with scattered trees. Connectivity exists from the eastern and western sides of the subject site running south to an existing expanse of remnant vegetation which is located across Gosford Road. There is limited if any opportunity for Squirrel Glider movement between these connective areas within the development footprint but allows for movement through these thin strips of vegetation from the south for potential foraging. Targeted survey in May 2022 in accordance with advice from Steve Lewer from BCD (see Section 2.4) involving camera trapping over 14 nights did not detect any Squirrel Gliders present within the subject land.

The remnant RU6 transitional lands to the south within the Central Coast Council LGA contain higher quality habitat. This extensive area of connective vegetation amounts to an approximate total of 400 ha, with large portions suitable for Squirrel Glider.

Conclusion of Squirrel Glider assessment

Squirrel Glider has a 'low' potential to occur within the development footprint, and targeted survey in accordance with the BCD has shown that this species is not currently present within the subject land. It is considered that the habitat available within the fringing areas of the development footprint and extending out particularly to the north west provides suitable foraging habitat for the Squirrel Glider, although the poor-quality habitat across much of the site would make it low-level usage site if utilised. Based on local records it is considered that there is potential for Squirrel Gliders to be utilising this habitat seasonally or in future population movements.

There are 312 records of Squirrel Glider within 10 km of the study area, with previous records surrounding Wyee with the closest records 430 m from the subject site to the west with more records to the north-east, south-east and east. The most recent of these nearby records is from 2018. Other recent records in the locality and retention of extensive suitable habitat areas suggest that nearby populations persist.

As the development footprint does not offer any major connectivity value the proposal is unlikely to have any significant impact on Squirrel Gliders movements through the local landscape. However, management of asset protection zones will thin the vegetation on the western boundary and will limit potential Squirrel Glider movement to surrounding food resources within the site. It is considered that the existing habitat within the eastern portions of the site does not currently allow for such cross-site movement.

The study area is considered suitable habitat for the Squirrel Glider based on the above examined habitat attributes although low or minimal usage given the following poor quality or lack of specific resources:

- Seasonal foraging attributes
- Density of suitable hollows for denning
- Connectivity
- Quality of vegetation and patch size.

There is potential for Squirrel Gliders to be utilising the habitats present as part of extended home ranges, or in future population movements. However, based on the absence of Squirrel Gliders during survey efforts, the study area is not expected to form part of the core home range for the species.

4.3.3 State legislative fauna matters

(a) Threatened fauna species (NSW)

BC Act – Table 4.5 lists the surrogate flora species that are associated with the PCTs occurring on site and their potential for occurrence.

Table 4.4 – State listed threatened fauna species with suitable habitat present

Common name	*BC Act*	Potential to occur
Eastern Coastal Free-tailed Bat	V	Recorded
Greater Broad-nosed Bat	V	Recorded
Little Bent-winged Bat	V	Recorded
Large Bent-winged Bat	V	Recorded
White-throated Needletail	P	✓
Swift Parrot	E	✓
Little Lorikeet	V	✓
Squirrel Glider	V	✓
Grey-headed Flying-fox	V	✓
Large-eared Pied Bat	V	Low
Glossy Black-Cockatoo	V	Low
Eastern Pygmy Possum	V	Unlikely
Yellow-bellied Glider	V	Unlikely
White-bellied Sea Eagle	V	Unlikely
Square-tailed Kite	V	Unlikely
Gang-gang Cockatoo	V	Unlikely
Powerful Owl	V	Unlikely
Masked Owl	V	Unlikely
Spotted-tailed Quoll	V	Unlikely
Koala	V	Unlikely
Yellow-bellied Sheathtail-bat	V	Unlikely
Eastern False Pipistrelle	V	Unlikely
Southern Myotis	V	Unlikely

Four (4) state listed threatened fauna species – Eastern Coastal Free-tailed Bat (*Mormopterus norfolkensis*), Greater Broad-nosed Bat (*Scoteanax rueppellii*), Little Bent-winged Bat (*Miniopterus australis*) and Large Bent-winged Bat (*Miniopterus orianae oceanensis)* – were recorded within the development footprint during surveys.

FM Act – No habitats suitable for threatened aquatic species were observed within the development footprint and as such the provisions of this act do not require any further consideration.

(b) Endangered fauna populations (NSW)

There are no endangered fauna populations within the City of Lake Macquarie LGA.

(c) Koala Habitat Protection

State Environmental Planning Policy (Biodiversity and Conservation) 2021 (Koala Habitat Protection)

State Environmental Planning Policy (Biodiversity and Conservation) 2021 (Koala Habitat Protection) applies to land within LGAs listed under Schedule 2 of the Policy. The City of Lake Macquarie LGA is listed under Schedule 2 of the Policy.

However, Part 4.1, Section 4.4.(3)(d) of SEPP 2021 states that the Policy does not apply to land in the following land use zones, or an equivalent land use zone, unless the zone is in a local government area marked with an * in Schedule 2:

(i) Zone RU1 Primary Production
(ii) Zone RU2 Rural Landscape
(iii) Zone RU3 Forestry.

The City of Lake Macquarie LGA is not marked with an * in Schedule 2. Therefore SEPP 2021 does not apply to this planning proposal given the current land zoning of RU2 – Rural Landscape.

State Environmental Planning Policy (Koala Habitat Protection) 2020

This Policy applies to land in the following land use zones, or an equivalent land use zone, in a local government area specified in Schedule 2 of State Environmental Planning Policy (Koala Habitat Protection) 2021, but not if the local government area is marked with an * in that Schedule—

(a) Zone RU1 Primary Production,
(b) Zone RU2 Rural Landscape,
(c) Zone RU3 Forestry.

Under Schedule 1 of the *State Environmental Planning Policy (Koala Habitat Protection) 2021*, The City of Lake Macquarie LGA is not marked with an *. Therefore SEPP 2020 applies to this site as it is zoned RU2.

Part 2 of SEPP 2020 outlines a three (3) step process to assess the likelihood of the land in question being potential or core koala habitat. Part 2 applies to land which has an area of greater than 1 ha or has, together with any adjoining land in the same ownership, an area of more than 1 ha. The total area of the subject site is greater than 1 hectare, hence Part 2 – Development Control of Koala Habitats of SEPP 2020 applies.

Potential Koala Habitat (PKH) is defined as land where at least 15% of the total number of trees in the upper or lower strata constitutes any of the tree species listed in Schedule 2 of SEPP 2020.

Core Koala Habitat (CKH) is defined as an area of land with a resident population of koalas, evidenced by attributes such as breeding females (i.e. females with young) and recent sightings of and historical records of a population.

A Koala Plan of Management is required to be prepared where council is satisfied that the land is CKH.

Step 1 – Is the land PKH?

Two (2) Koala food tree species – Swamp Mahogany (*Eucalyptus robusta*) and Broad-leaved Scribbly Gum (*E. haemastoma*) – as listed on Schedule 2 of SEPP 2020 were found within the study area. Scribbly Gum occurred at approximately 60% within PCT 1636, and Swamp

Mahogany (with a few Scribbly Gum) occurred at likely above 20% within PCT 1718. These percentages are representative of all remnant vegetation within the site. Therefore, the entire vegetated portions of the study area is classified under SEPP 2020 as PKH.

Step 2 – Is the land CKH?

No Koalas were recorded present within subject site during fauna survey on the 20/10/20. Fauna survey incorporated target Koala survey techniques including scat and scratch searches, three (3) Spot Assessment Technique (SAT points) and spotlighting and call-playback.

A search of the *BioNet* Atlas (DPIE 2021) noted twenty (20) records of Koala habitation within a 10 km radius of the subject site. The most recent record outside of the site within a 5km radius is found approximately 2.8 m to the south-east and is from 2017. This is the only record in a 5 km radius which occurred within the time frame of a Koala's average lifespan of 12-15 years. Given the lack of Koala activity recorded on the site, it is considered that any individuals within this locality would use the subject site as transitory habitat.

Target searches were conducted within both vegetation communities on site along with other opportunistic methodologies throughout the subject site. No Koalas were observed during fauna surveys and there was no evidence of previous Koala habitation within the subject site.

Step 3 – Koala Plan of Management

At this stage the land is not considered to comprise CKH. Therefore, a Koala Plan of Management is not considered to be required.

(d) Ecosystem credit species

Although the BAM calculator has not been used, the BioNet Vegetation Classification Tool (BVCT) is able to predict which species will be produced by the BAM-C for credit assessment. The following predicted ecosystem species were generated by the BVCT and have been considered as ecosystem species:

Table 4.5 – Ecosystem credit species (fauna)

Common name	*BC Act*	Potential to occur	Foraging habitat absent	Excluded	Confirmed predicted species	Associated PCT
Eastern Coastal Free-tailed Bat	V	Yes (recorded)	n/a		✓	1718, 1636
Greater Broad-nosed Bat	V	Yes (recorded)	n/a		✓	1718, 1636
Large Bent-winged Bat (foraging)	V	Yes (recorded)	n/a		✓	1718, 1636
Little Bent-winged Bat (foraging)	V	Yes (recorded)	n/a		✓	1718, 1636
Grey-headed Flying-fox (foraging)	V	Yes	x		✓	1718, 1636
White-throated Needletail	P	Yes	x		✓	1718, 1636
Swift Parrot (foraging)	E	Yes	x		✓	1718, 1636
Little Lorikeet	V	Yes	x		✓	1718, 1636
Glossy Black-Cockatoo (foraging)	V	Yes (low)	x		✓	1636
Square-tailed Kite (foraging)	V	Yes (low)	x		✓	1636
Spotted-tailed Quoll	V	Yes (Unlikely)	n/a		✓	1718, 1636
Eastern False Pipistrelle	V	Yes (Unlikely)	n/a		✓	1718, 1636
Gang-gang Cockatoo (foraging)	V	Yes (Unlikely)	x		✓	1636
Koala (foraging)	V	Yes (Unlikely)	x		✓	1718, 1636
Masked Owl (foraging)	V	Yes (Unlikely)	x		✓	1636
Powerful Owl (foraging)	V	Yes (Unlikely)	x		✓	1636
White-bellied Sea Eagle (foraging)	V	Yes (Unlikely)	✓	✓		
Yellow-bellied Glider	V	Yes (Unlikely)	x		✓	1636
Yellow-bellied Sheathtail-bat	V	Yes (Unlikely)	x		✓	1718, 1636
Barking Owl (foraging)	V	Yes (Unlikely)	x		✓	1718, 1636
Black Bittern	V	No		✓		
Black-chinned Honeyeater	V	No		✓		
Brown Treecreeper	V	No		✓		
Eastern Chestnut Mouse	V	No		✓		
Eastern Osprey	V	No		✓		
Golden-tipped Bat	V	No		✓		
Grey-crowned Babbler	V	No		✓		
Little Eagle (foraging)	V	Yes (Unlikely)	x		✓	1718
Long-nosed Potoroo	V	No		✓		
Painted Honeyeater	V	No		✓		
Turquoise Parrot	V	Yes (Unlikely)	x		✓	1636

White-bellied Sea Eagle (foraging), and Eastern Osprey

There is no open-water habitat within the study area suitable for hunting by these species.

Black Bittern

There is no permanent water to support this species.

Black-chinned Honeyeater

Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts. These features are absent from the study area.

Brown Treecreeper

Found in eucalypt woodlands and dry open forest of the inland slopes and plains inland of the Great Dividing Range. These features are absent from the study area.

Eastern Chestnut Mouse

Occurs in heathland, which is not present within the study area.

Golden-tipped Bat

Found in rainforest and adjacent sclerophyll forest. Also recorded in tall open forest, *Casuarina*-dominated riparian forest and coastal Melaleuca forests. These vegetation types are absent from the study area.

Grey-crowned Babbler

In coastal regions this species occurs in woodlands on fertile soils. The soils within the study area are depauperate and sandy, with low fertility.

Long-nosed Potoroo

Dense understorey is an essential part of habitat, and this is absent from the study area.

Painted Honeyeater

Inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests. These vegetation types are absent from the study area.

(e) Species credit species

Although the BAM calculator has not been used, the BioNet Vegetation Classification Tool (BVCT) is able to predict which species will be produced by the BAM-C for credit assessment. The following predicted threatened species were generated by the BVCT and have been considered as candidate species:

Table 4.6 – Species credit species (fauna)

Common name	*BC Act*	Potential to occur (presence status) / habitat	Breeding habitat absent	Survey adequacy			Presence of species		Confirmed Candidate Species	Associated PCTs
				referred Survey period (TBDC)	Actual Survey period	Survey sufficient to rule out presence	Assumed	Expert report		
Barking Owl (breeding)	V	No								
Brush-tailed Phascogale	V	No								
Brush-tailed Rock Wallaby	E	No								
Black Bittern	V	No								
Bush Stone-curlew	E	Unlikely	n/a	All months	Oct	✓				
Common Planigale	V	No								
Eastern Pygmy Possum	V	Unlikely	n/a	Oct–March	Oct	no trapping	✓	no	✓	1718, 1636
Giant Burrowing Frog	V	No								
Giant Dragonfly	E	No								
Glossy Black-Cockatoo (breeding)	V	No								
Green and Golden Bell Frog	E	No								
Green-thighed Frog	V	No								
Grey-headed Flying-fox (breeding)	V	No								
Koala (breeding)	V	Yes (unlikely)		All months	Oct	✓				
Large Bent-winged Bat (breeding)	V	Yes (species recorded)	✓							
Large-eared Pied Bat	V	Low	n/a	Nov–Jan	Oct	x	✓		✓	1718, 1636
Southern Myotis	V	No								
Little Bent-winged Bat (breeding)	V	Yes (species recorded)	✓							
Little Eagle (breeding)	V	No								
Long-nosed Potoroo	V	No								
Mahony's Toadlet	E	No								

Common name	*BC Act*	Potential to occur (presence status) / habitat	Breeding habitat absent	Survey adequacy			Presence of species		Confirmed Candidate Species	Associated PCTs
				referred Survey period (TBDC)	Actual Survey period	Survey sufficient to rule out presence	Assumed	Expert report		
Masked Owl (breeding)	V	No								
Osprey (breeding)	V	No								
Pale-headed Snake	V	No								
Powerful Owl (breeding)	V	No								
Regent Honeyeater (breeding)	E4A	No - outside mapped areas								
Sooty Owl (breeding)	V	No								
Square-tailed Kite (breeding)	V	No								
Squirrel Glider	V	Yes	n/a	All months	May	✓				
Swift Parrot (breeding)	E	No - outside mapped areas								
Wallum Froglet	V	No								
White-bellied Sea Eagle (breeding)	V	No								

Excluded species based on the absence of general habitat

Brush-tailed Phascogale

The vegetation onsite is mostly cleared and what remains heavily degraded by incursion of invasive ground cover and shrub weed species. The site also lacks suitable hollows for denning and breeding.

Brush-tailed Rock-wallaby

No rocky escarpments, outcrops or cliffs are present suitable to provide habitat for species.

Black Bittern

There is no permanent water to support this species.

Common Planigale

The vegetation onsite is mostly cleared and what remains is heavily degraded by incursion of invasive ground cover and shrub weed species. The site also lacks suitable terrestrial hollows and fallen timber for denning and breeding.

Giant Burrowing Frog

The vegetation onsite is mostly cleared and what remains heavily degraded. There are no soaks or pools within first or second order streams located within the subject site or within close proximity.

Green and Golden Bell frog

There are no marshes, dams or streams within close proximity to the subject site.

Green Thighed Frog

This site lacks the wetter forests this species depends on within the extent of its known distribution. This site also lacks any opportunity for water to gather after immense rain and therefore breeding habitat is not present.

Giant Dragonfly

Permanent swamps and bogs are not present within the development footprint.

Long-nosed Potoroo

This species depends on dense shrub layer or alternatively high canopy cover exceeding 70%. The site lacks these features and has a sparse understorey and relatively low canopy cover.

Mahony's Toadlet

There are no ephemeral or semi-permanent swamps within heath or wallum habitats associated with leached white sand located in or within close proximity to the subject site.

Pale-headed Snake

The vegetation onsite is mostly cleared and what remains heavily degraded by incursion of invasive ground cover and shrub weed species. There are no water sources available within the subject site limiting the main food source for the species, frogs. The site also lacks any suitable hollows for breeding or brumation.

Southern Myotis

The site is further than 200 m from water bodies providing foraging habitat for this species.

Wallum Froglet

There are no ephemeral or semi-permanent swamps within heath or wallum habitats in or within close proximity to the subject site.

Excluded species based on the absence of breeding habitat

Barking Owl, Masked Owl, Powerful Owl, Sooty Owl (breeding)

Potential nest trees are living or dead trees with hollows greater than 20 cm diameter and (for Barking Owl) greater than 4 m above the ground. No such hollows occur within the development footprint. Caves and cliff ledges are also absent (for Sooty Owl).

Glossy Black Cockatoo (breeding)

Requires tree hollows greater than 15 cm diameter and greater than 5m above ground. No such hollows occur within the development footprint.

Grey-headed Flying-fox (breeding)

No breeding camps occur within the study area.

Large Bent-winged Bat, Little Bent-winged Bat (breeding)

No caves, tunnels, mines or other suitable structures are present within the study area.

Little Eagle, Osprey, White-bellied Sea-eagle (breeding)

No potential raptor nests or trees are present within the study area.

Excluded species based on the absence of important mapped habitat:

Swift Parrot, Regent Honeyeater

The site is not mapped as containing important habitat for these species on the *BAM - Important Areas* (*DPIE*) mapping.

(f) Local data

Local data has not been used in this case.

(g) Expert reports

Expert reports have not been utilised for fauna on this project.

4.3.4 Matters of national environmental significance - fauna

(a) Threatened fauna species (National)

EPBC Act – A search of the EPBC search tool provided a list of nationally threatened fauna species previously recorded, or with considered potential habitat, within a 10 km radius of the development footprint. These species have been listed and considered for habitat potential based on proximity and year of records in Table A1.2 (Appendix 1).

Based on this, it is considered that the development footprint provides varying levels of potential habitat for the following nationally listed threatened fauna species:

Table 4.7 – Nationally listed threatened fauna species with suitable habitat present

Common name	*EPBC Act*	Potential to occur
White-throated Needletail	V,C,J,K	✓
Swift Parrot	E	✓
Grey-headed Flying-fox	V	✓
Large-eared Pied Bat	V	Low
Spotted-tailed Quoll	E	Unlikely
Koala	V	Unlikely

No nationally listed threatened fauna species were recorded within the development footprint during surveys undertaken.

Grey-headed Flying-fox

No Grey-headed Flying-foxes were recorded during 2020 survey. There was no record of this species foraging within the site, although this is expected on a seasonal basis. There is no likelihood of this species utilising the site for roosting and subsequent breeding habitat.

The significant impact criteria for a vulnerable species listed under the *EPBC Act* (Appendix 2) was reviewed to assess the impacts on this species as a result of the planning proposal within the subject site. As the subject site does not contain any likely roosting or subsequent breeding habitat and foraging habitat will remain well represented in the locality, it is concluded that there will not be any significant impact on this species.

Swift Parrot

The Swift Parrot also has potential to seasonally forage within the study area. Winter flowering habitat in the southern portions will be retained by the planning proposal. It is concluded that there will not be any significant impact on the above considered species or any other nationally listed threatened fauna species with potential to occur, as a result of the likely future subdivision of the lands.

(b) Protected migratory species (National)

The EPBC Act Protected Matters Report provides additionally listed terrestrial, wetland and marine migratory species of national significance likely to occur, or with habitat for these species likely to occur, within a 10 km radius of the development footprint. The habitat potential

of migratory species that have not been considered in the threatened species habitat assessment are considered in Table A2.3 (Appendix 2).

No nationally protected migratory bird species were recorded present during the preliminary survey or are considered likely to constrain development within the study area.

The impact assessment for these species is not likely to contribute a significant impact under the *EPBC Act*.

The impact assessment for this species and other nationally protected migratory species with potential to occur has concluded a not significant impact.

As the development footprint does not contain any likely roosting, breeding or other habitat of importance, and given that foraging habitat will remain well represented in the locality, there will not be any significant impact on White-throated Needletail, or likely on any other nationally protected migratory bird species with potential to occur, as a result of development from the rezoning.

4.4 Watercourses, GDEs & Wetlands

4.4.1 Endangered wetland communities

A number of wetland communities have been listed as TECs under the *BC Act*. We note that 'wetlands' are included in the definition of 'waterfront lands' in accordance with the *Water Management Act 2000* (*WM Act*) due to their inclusion in the definition of a 'lake' under the same Act. TECs that are considered to be an endangered protected wetland are as follows:

- Artesian springs ecological community
- Castlereagh Swamp Woodland Community
- Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions
- Coastal Upland Swamp in the Sydney Basin bioregion
- Coolibah–Black Box woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain and Mulga Lands bioregions
- Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions
- Kurri sand swamp woodland in the Sydney Basin Bioregion
- Lagunaria swamp forest on Lord Howe Island
- Maroota Sands swamp forest
- Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion
- Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions
- Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions
- The shorebird community occurring on the relict tidal delta sands at Taren Point
- Upland wetlands of the drainage divide of the New England Tableland Bioregion
- Wingecarribee Swamp

Remnants and very young regrowth areas of Swamp Sclerophyll Forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (SSFCF) were observed within the Study area.

The remnants of SSFCF within the study area are highly disturbed through previous clearing and past or ongoing land management practices. There is a row of trees commensurate with SSFCF (0.08 ha) consisting of a total of approximately 10 trees with species such as *Eucalyptus robusta, Melaleuca quinquenervia* and *Allocasuarina littoralis*. This row of trees has few shrubs and a dense ground layer consisting entirely of *Watsonia meriana* which is an invasive exotic species.

The following assessment of the expected impacts of the concept residential development upon SSFCF within the study area is provided below.

The extent of SSFCF within the locality will be decreased by the removal of a total of 0.1 ha of highly modified and disturbed SSFCF vegetation. There are large areas of SSFCF within the locality situated on lower swampy ground to the north-west and north-east associated with the catchment area of Mannering Lake. It is considered that the removal of the SSFCF vegetation within the study area will not decrease the extent of this TEC such that the extent of this community within the locality will be decreased such that it is at risk of extinction.

The Acid Sulfate Soils Map from the Lake Macquarie LEP (2014) does not map any acid sulfate soil within the study area.

It is considered that direct or indirect impacts caused by changes in stormwater quality and quantity on adjoining areas of SSFCF to the north-west can be adequately mitigated in compliance with Council's WSUD policies using compliant stormwater infrastructure for a future residential subdivision.

Given the nature of the site, a future residential subdivision of the land, is unlikely to cause any impacts on groundwater tables in the locality.

In accordance with the *WM Act*, endangered wetland communities are through the definition of 'lakes' potentially classed as waterfront land. Referral to NSW Natural Resources Access Regulator (NRAR) may be required for determination under the *WM Act* as a controlled activity. As well as protection, a buffer may be applied to these communities as specified by the NRAR.

4.4.2 Groundwater dependent ecosystems (GDEs)

Groundwater dependent ecosystems (GDEs) are communities of plants, animals and other organisms whose extent and life processes are dependent on groundwater. Some examples of ecosystems which depend on groundwater are:

- wetlands;
- red gum forests, vegetation on coastal sand dunes and other terrestrial vegetation;
- ecosystems in streams fed by groundwater;
- limestone cave systems;
- springs; and
- hanging valleys and swamps.

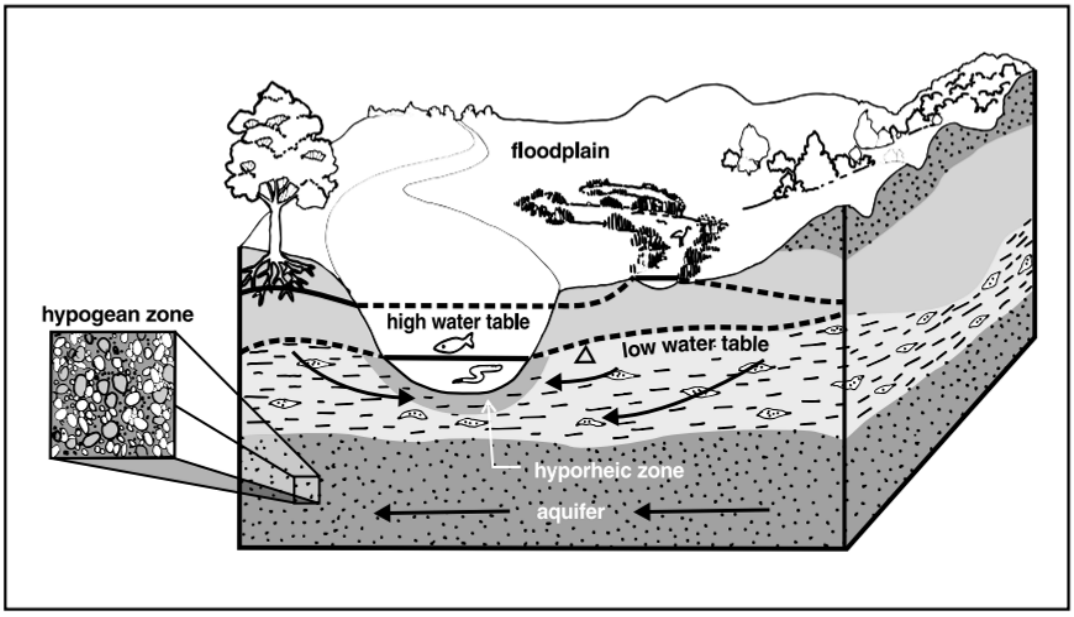

Figure 4.1 – Alluvial groundwater system discharging into a river

GDEs are therefore ecosystems which have their species composition and their natural ecological processes determined by groundwater (NSW State Groundwater Dependent Ecosystems Policy April 2002).

The SSFCF vegetation within the study area is not dependent on ground water. It is dependent on overland flow. Therefore, no GDEs were observed within the development footprint and therefore the policy does not require any further consideration. A referral to NRAR is not required for impacts on waterfront land.

4.4.3 Watercourses

A future proposed residential development will not directly impact on any watercourses or drainage lines. A referral to NRAR is not likely required for impacts on waterfront land.

4.4.4 State Environmental Planning Policy (Coastal Management) 2018

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

The Coastal Management SEPP gives effect to the objectives of the *CM Act* from a land use planning perspective, by specifying how development proposals are to be assessed if they fall within the coastal zone.

An integrated and coordinated approach to land use planning is promoted by the new SEPP. It defines the four (4) coastal management areas in the Act through detailed mapping and specifies assessment criteria that are tailored for each coastal management area. Councils and other consent authorities must apply these criteria when assessing proposals for development that fall within one or more of the mapped areas. The Coastal Management SEPP identifies development controls for consent authorities to apply to each coastal management area to achieve the objectives of the *CM Act*.

The Coastal Management SEPP establishes the approval pathway for coastal protection works.

Wetlands on site or adjacent

The NSW DPIE *Coastal Wetlands and Littoral Rainforests Area Map* (http://webmap.environment.nsw.gov.au/PlanningHtml5Viewer/?viewer=SEPP_CoastalManagement) identifies an area within the wetland as "coastal wetlands", and a buffer area surrounding the margin of the wetland as "proximity area for coastal wetlands" (Figure 4.2).

As stated in the *State Environmental Planning Policy (Coastal Management) 2018*, development consent is required for any development within these areas and must not be given unless the consent authority is satisfied that sufficient measures have been, or will be, taken to protect, and where possible enhance, the biophysical, hydrological and ecological integrity of the coastal wetland. Additionally, within the "proximity area for coastal wetlands" area, development consent must not be given unless the consent authority is satisfied that the proposed development will not significantly impact on the quantity and quality of surface and ground water flows to and from the adjacent coastal wetland.

As can be seen from Figure 4.2, the site is located well outside of any wetland or associated buffer. *Travers bushfire & ecology* consider that proposed residential rezoning will not significantly impact on the quantity and quality of surface and ground water flows to and from the adjacent wetland.

Figure 4.2 – Coastal wetlands area map

Impact Assessment 5

5.1 BOS thresholds

The BOS includes three (3) elements to the threshold test – an area trigger, a Biodiversity Values Land Map trigger and the Test of Significance. If impacts exceed at least one (1) of these triggers, the Biodiversity Offset Scheme applies to the proposed clearing.

5.1.1 Biodiversity Values Land

The study area is located on lands mapped as Biodiversity Values Land (refer to Figure 5.1 – therefore an offset is required as an outcome of this threshold test.

Figure 5.1 – Biodiversity Values Land (purple) relative to the study area (yellow)

(Source: https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BosetMap)

5.1.2 Area clearing threshold

The area threshold varies depending on the minimum lot size (shown in the Lot Size Maps made under the relevant Local Environmental Plan (LEP)), or actual lot size (where there is no minimum lot size provided for the relevant land under the LEP).

The area threshold applies to all proposed native vegetation clearing associated with a development proposal – for example in the case of a subdivision; all future clearing across the lots subject to the subdivision, must be considered. Thresholds outlined under the BOS are outlined in the table below.

Table 5.1 identifies that the site currently has a minimum lot size of 20 ha, and the clearing area threshold for which the BOS applies is 0.5 ha.

Table 5.1 – BOS entry threshold report

Date of Calculation	07/06/2022 12:31 PM	**BDAR Required***
Total Digitised Area	23,143.0 sqm	
Minimum Lot Size Method	LEP	
Minimum Lot Size 10,000sqm = 1ha	200,000 sqm	
Area Clearing Threshold 10,000sqm = 1ha	5,000 sqm	
Area clearing trigger Area of native vegetation cleared	Unknown #	Unknown #
Biodiversity values map trigger Impact on biodiversity values map(not including values added within the last 90 days)?	yes	yes
Date of the 90 day Expiry	N/A	

However, following the proposed rezoning to R2 Low Density Residential, a smaller minimum lot size of <1 ha will apply and the area threshold reduced to 0.25 ha (clause 7.2(4), *BC Reg*). Based on the subdivision plans (Figure 1.4), *Travers bushfire & ecology* concludes that the concept residential subdivision will remove 0.51 ha of of native vegetation therefore biodiversity offsetting under BOS applies and a BAM-compliant report will be required at the DA stage

The development proposal does exceed the nominated clearing thresholds therefore offsetting is required as an outcome of this test.

Travers bushfire & ecology concludes that the concept subdivision could possibly result in 0.51 ha of native vegetation removal should no avoidance measures be implemented to retain some vegetation. The demonstrated avoidance of 2600 m^2 of native vegetation would avoid triggering this threshold. This would potentially bring the proposal to under 0.25 ha and eliminate offsetting requirements under this threshold but would likely result in significant impact on development yield and project viability.

5.1.3 Test of Significance

As the BOS clearing and Biodiversity Values thresholds are potentially triggered, and the BOS applies, a Test of Significance is not required.

5.2 Streamlined assessment modules

The BAM contains three streamlined assessment modules that are set out in Appendices B, C and D of the BAM. The streamlined assessment modules include specific requirements to assess the impacts on biodiversity values for the purpose of preparing a BDAR. These streamlined assessment modules may be used where the proposal impacts on:

a. scattered trees (Appendix B)

b. a small area (Appendix C)

c. planted native vegetation, where the planted native vegetation was planted for purposes such as street trees and other roadside plantings, windbreaks, landscaping in parks and gardens, and revegetation for environmental rehabilitation (Appendix D)

Appendices B, C and D set out the circumstances where each of the streamlined assessment modules can be used to assess a proposal and the specific assessment requirements.

The streamlined assessment modules for scattered trees and planted native vegetation may be used in conjunction with the full BAM to assess particular parts of the subject land under a single BDAR.

Table 5.2 – Streamlined assessment modules

Streamlined assessment module	Criteria for application	Does the impacted vegetation meet this criterion?	Can this module be applied?
Scattered trees	Scattered trees are defined as species listed in the tree growth form group that: **a.** have a percent foliage cover that is less than 25% of the benchmark for tree cover for the most likely plant community type and are on category 2-regulated land and surrounded by category 1-exempt land on the Native Vegetation Regulatory Map under the LLS Act, or	no	no
	b. have a DBH of greater than or equal to 5 cm and are located more than 50 m away from any living tree that is greater than or equal to 5 cm DBH, and the land between the scattered trees is comprised of vegetation that are all ground cover species on the widely cultivated native species list, or exotic species or human-made surfaces or bare ground, or	no	
	c. are three or fewer trees that have a DBH of greater than or equal to 5 cm and are within a distance of 50 m of each other, that in turn, are greater than 50 m away from the nearest living tree that is greater than or equal to 5 cm DBH, and the land between the scattered trees is comprised of vegetation that are all ground cover species on the widely cultivated native species	no	

	list, or exotic species or human-made surfaces or bare ground.		
Small area	Is the area of native vegetation clearing less than or equal to the thresholds as shown in Table 5.3 (BAM Table 12)? This depends on minimum or actual lot size: • **For lot size <1 ha, threshold is ≤1 ha** • For lot size 1–40 ha, threshold is ha ≤2 ha • For lot size 40–1000 ha, threshold is ≤3 ha • For lots size 1000 ha, threshold is ≤5 ha	**Yes**: future minimum lot size is <1 ha, so clearing threshold of ≤1 ha applies. The site contains a total 0.51 ha native vegetation, so this threshold cannot be exceeded, and the criterion is met.	**Yes**.
Planted native vegetation	Is any planted native vegetation impacted?	**Yes**	**Yes**

Table 5.3 – Area clearing limits for application of the small area development module

Minimum lot size associated with the property *	Maximum area clearing limit for application of the small area development module
Less than 1 ha	≤1 ha
Less than 40 ha but not less than 1 ha	≤2 ha
Less than 1000 ha but not less than 40 ha	≤3 ha
1000 ha or more	≤5 ha
*shown in the lot size maps made under the relevant local environmental plan (LEP), or actual lot size (where there is no minimum lot size provided for the relevant land under the LEP	

5.2.1 Streamlined assessment module - small area

Table 5.2 identifies that the small area streamlined assessment module can be used when preparing a BDAR for any future impacts on native vegetation within the site at the DA stage. This will still require offsetting through the BOS, but candidate species credit species that are not at risk of an SAII and are not incidentally recorded on the subject land do not require further assessment or offsets.

5.2.2 Streamlined assessment module - planted native vegetation

Planted native vegetation occurs in the southern portion of the study area, and includes threatened *Macadamia integrifolia*, plus non-threatened species including *Archontophoenix cunninghamiana*, *Doryanthes excelsa*, *Xanthorrhoea* spp. and *Cyathea* sp. Appendix D of the BAM can be applied to this vegetation. In this case, assessment of the planted native vegetation answers yes to question 5 of the *D.1 Decision-making key*:

"Is the native vegetation (including individuals of a threatened flora species) planted for functional, aesthetic, horticultural or plantation forestry purposes? This includes examples such as: windbreaks in agricultural landscapes, roadside plantings (including street trees, median strips, roadside batters), landscaping in parks, gardens and sport fields/complexes, macadamia plantations or teatree farms?"

As such, Chapters 4 and 5 of the BAM (i.e. plot-based survey and assessment for ecosystem and species credits) are not required, and the vegetation will only need to be assessed for use by threatened fauna. No offsets will be required for impacts on the planted vegetation.

5.3 Avoidance and minimisation actions

As an area of low ecological value it is not considered necessary for avoidance of all native vegetation on site. As stated in Section 5.1.2, the demonstrated avoidance of only 100 m^2 of native vegetation would avoid triggering the area clearing threshold.

Mitigation actions are appropriate to the site to mitigate the loss of foraging habitat from the site. This may include restoration actions and activities, such as through a vegetation management plan, that provide for rehabilitation of TEC vegetation and fauna habitat. These are matters for consideration at the DA stage.

Actions that avoid or minimise impacts must be documented as part of any future BDAR.

5.4 Potential ecological impacts

The direct, indirect and cumulative ecological impacts have been considered in respect to recorded biodiversity, threatening processes and extent of impact as a result of the proposed works.

5.4.1 Direct impacts

The potential direct impacts of the proposal are:

- Removal / modification of 0.41 ha of PCT 1636 Scribbly Gum – Red Bloodwood – *Angophora inopina* heathy woodland, including 0.34 ha of moderate–good PCT 1636 vegetation and 0.07 ha of groundcover only PCT 1636 vegetation.
- Removal / modification of 0.1 ha PCT 1718 Swamp Mahogany – Flax-leaved Paperbark swamp forest (equivalent to TEC Swamp Sclerophyll Forest on Coastal Floodplains.
- Subsequent removal of threatened fauna species foraging habitat including:
    f) Seasonal flowering resources for species regarded as having potential habitat onsite such as Swamp Mahogany (*Eucalyptus robusta*) and *Allocasuarina* spp.
    g) Seeding *Allocasuarina* providing potential feed resources for Glossy Black-Cockatoo
    h) Diverse seasonal flowering opportunities for nectivorous species.
    i) Winter flowering trees Swamp Mahogany (*Eucalyptus robusta*)
    j) Air space and prey species habitat for recorded Eastern Coastal Free-tailed Bat, Greater Broad-nosed Bat, Large Bent-winged Bat and Little Bent-winged Bat.

- Removal of two (2) hollow bearing trees which contain one (1) small hollow each, one approximately 0–5 cm and the other 10–15 cm aperture. One of these hollows (HT1) is suitable for recorded threatened species including recorded Eastern Coastal Free-tailed Bat and Greater Broad-nosed Bat

5.4.2 Indirect impacts

The potential indirect impacts of the proposal are considered as:

- Edge effects such as weed incursions into the adjacent natural habitat areas,
- Minor narrowing of a connective remnant,
- Minor reduction of arboreal connectivity for arboreal mammals,
- Reduced cross-site movements by small bird species such as passerines,
- Edge effects such as weed incursions caused from soil disturbance, repeated clearing and landscaping species becoming a nuisance in the adjacent remnant bushland,
- Increased spill-over from noise, activity, scent and lighting effects into the adjacent natural habitat areas,
- Increased soil nutrients from changes to runoff that may provide further opportunities for weed plumes, and
- Concentrated stormwater runoff from solid surfaces and subsequent increased flows.

5.4.3 Cumulative impacts

The potential cumulative impacts (combined results of past, current and future activities) of the proposal are considered as:

- Increased risk of weed invasion and fungal mobilisation or infections,
- Cumulative loss of PCT 1636 Scribbly Gum - Red Bloodwood - Angophora inopina heathy woodland (non-TEC),
- Cumulative loss of PCT 1718 Swamp Mahogany - Flax-leaved Paperbark swamp forest on coastal lowlands of the Central Coast (equivalent to TEC Swamp Sclerophyll Forest),
- Increased varied human presence and activity within the remaining natural habitat areas of the adjacent bushland remnant, and
- Edge effects from inappropriate use of remaining native vegetation areas such as additional clearing, dumping of materials, dumping of faecal, food or general waste and building refuse.

5.4.4 Serious & Irreversible Impacts (SAIIs)

An impact is to be regarded as serious and irreversible if it is likely to contribute significantly to the risk of a threatened species or ecological community most at risk of extinction. Threatened species and communities that are potential for serious and irreversible impacts are outlined in Appendix 2 of *Guidance to assist a decision-maker to determine a serious and irreversible impact* (DPIE 2017). The principles for determining serious and irreversible impacts are set out under Section 6.7.2 of the *BC Reg*.

Candidate SAII entities recorded or with potential to occur within the study area include:

Table 5.4 – Candidate SAII species

Species / TEC (Scientific name)	Species (Common name)	*BC Act*	Potential to occur
Miniopterus schreibersii subsp. *oceanensis*	Large Bent-winged Bat	V	Recorded
Miniopterus australis	Little Bent-winged Bat	V	Recorded
Anthochaera phrygia	Regent honeyeater	CE	✓
Lathamus discolor	Swift parrot	E	✓
Chalinolobus dwyeri	Large-eared Pied Bat	V	Unlikely

Detailed assessment of Serious and Irreversible Impacts (SAII) will be required for the recorded Little Bent-winged Bat and Large Bent-winged Bat, as part of the next stage in biodiversity assessment, but the proposal is not considered to constitute an SAII on these species due to the lack of breeding habitat within the site.

The site also does not likely support any breeding habitat or likely important habitat for other candidate species with potential to occur including Swift Parrot or Regent Honeyeater.

5.5 Vegetation connectivity and habitat corridors

The subject land does not provide any major connective value in the local landscape. Vegetation on site comprises of two thin strips of eucalypt woodland and planted exotics which run north to south along the western and eastern borders of the subject site. The eastern strip terminates within the study area, whilst the western strip extends off site for another 350 m. Connectivity with the northern and eastern boundaries is broken by existing residential lots and roads.

The site is bound to the west by a rail corridor however there is an existing narrow strip of disturbed vegetation within this which provides connectivity for mobile species such as birds and gliders. A Gas Pipeline easement abounds the site to the west and south which is cleared and maintained by Jemena Gas Networks (Figure 5.3). There is a stand of eucalypt trees along the southern boundary lining Gosford Road. This will allow for birds and gliders to pass across Gosford Road from the area of remnant bushland immediately to the south.

The proposal will not break any connective links, but will slightly narrow the western connective vegetation, and reduce arboreal connectivity across Gosford Road. As most of this corridor vegetation exists outside of the subject land this is not likely to be of major importance for connectivity in the broader landscape. Additionally, the connected patch of vegetation to the north only extends a short distance before terminating, thus connective values will only be reduced slightly. Supplementary revegetation of the adjacent railway corridor would enhance local connectivity.

Figure 5.2 – Local connectivity

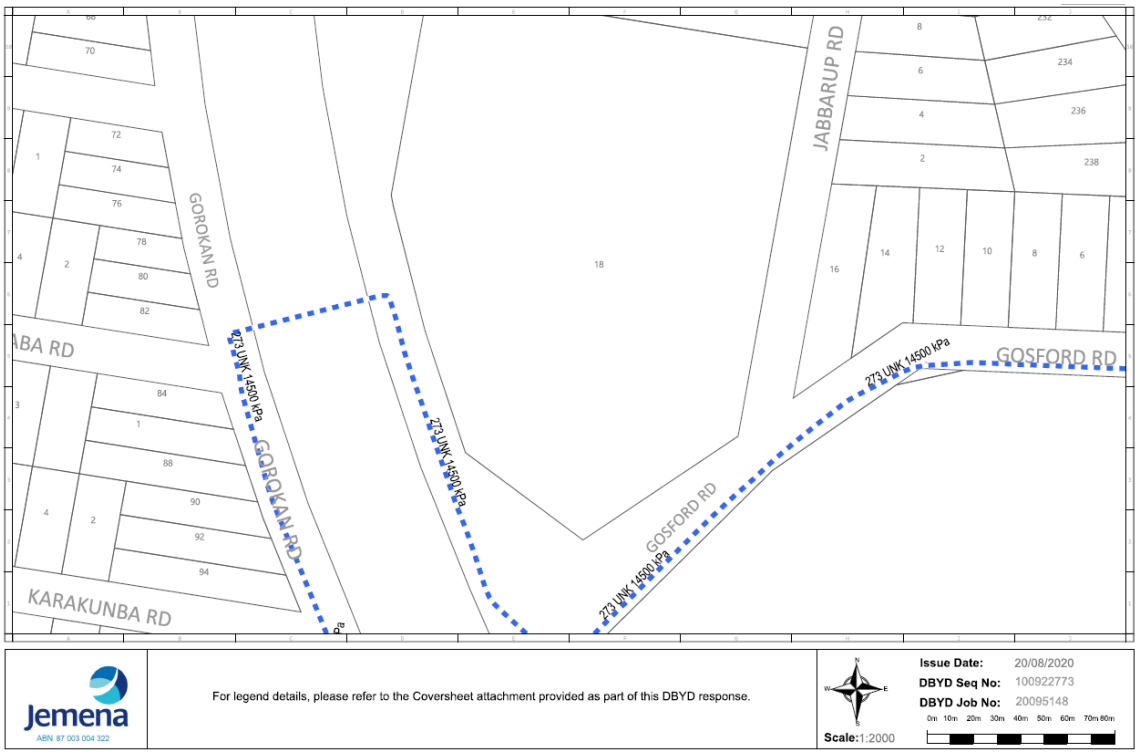

Figure 5.3 – High pressure gas pipeline location

Conclusion 6

Travers bushfire & ecology has been engaged to prepare a biodiversity assessment report for the proposed rezoning of Lot 217, DP 755242, 18 Gosford Road, Wyee.

Ecological survey and assessment has been undertaken in accordance with relevant legislation including the *Environmental Planning and Assessment Act 1979, the Biodiversity Conservation Act 2016,* the commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the *Fisheries Management Act 1994.*

6.1 Legislative compliance

In respect of matters required to be considered under the *Environmental Planning and Assessment Act 1979* and relating to the species and provisions of the *Biodiversity Conservation Act 2016*, four (4) state listed threatened fauna species – Eastern Coastal Free-tailed Bat (*Mormopterus norfolkensis*), Greater Broad-nosed Bat (*Scoteanax rueppellii*), Little Bent-winged Bat (*Miniopterus australis*) and Large Bent-winged Bat (*Miniopterus orianae oceanensis)*, no threatened flora species, and one (1) TEC, Swamp Sclerophyll Forest on Coastal Floodplains, were recorded within the study area.

A biodiversity threshold offset assessment of the concept residential subdivision has identified that biodiversity offsetting under the BOS may be required for the proposal as:

- The study area is located on lands mapped as Biodiversity Values Land.
- The proposed clearing of 0.51 ha of native vegetation is greater than the future area clearing threshold of 0.25 ha for land zoned R2 Low Density Residential. A reduction in clearing of native vegetation to below this threshold will avoid offsetting under this trigger.

A Biodiversity Credit Offset Assessment is to be undertaken within a Biodiversity Development Assessment Report but is not required at this stage. As the total possible area of clearing is less than the area clearing limit for lots with a minimum lot size of <1 ha, the small area streamlined assessment can be used.

In the case of entry into the Biodiversity Offsets Scheme, the assessment of Serious or Irreversible Impacts (SAIIs) are set out under Section 6.7.2 of the *BC Reg 2017* to guide the determining authority on this decision. On the basis of the ecological survey completed an assessment of SAIIs will be required for the recorded Little Bent-winged Bat and Large Bent-winged Bat, however it is unlikely that the proposal will cause any SAII on these species due to the lack of breeding habitat within the site.

The planning proposal is unlikely to cause a significant impact on matters of national environmental significance. As such a referral to Department of Environment and Energy should not be required.

In the case where entry into the biodiversity offsets scheme is not required an assessment of significance of impacts is required. Based on the ecological survey completed, it is unlikely that a significant impact will be caused on matters listed under the *FM Act*.

In respect of matters relative to the *Fisheries Management Act 1994*, no suitable habitat for threatened marine or aquatic species was observed within the study area.

6.2 Avoidance and mitigation measures

The avoidance and mitigation of residual impacts is required to be demonstrated in accordance with the BAM. It is noted that whilst the site is mostly cleared, disturbed remnants of the endangered ecological community Swamp Sclerophyll Forest on Coastal Floodplains and the non-threatened PCT 1636 are present. The Swamp Sclerophyll Forest on Coastal Floodplains is not of high quality and contains some foraging species such as Swamp Mahogany.

The complete avoidance of the Swamp Sclerophyll Forest on Coastal Floodplains does not appear to be warranted given its size and low quality.

The following approach is recommended for the avoidance and mitigation of impacts to minimise or ameliorate the potential ecological impacts, address threatening processes and to guide the proposal towards a more positive ecological outcome for threatened species and their associated habitats.

- Prepare a revegetation plan that replaces removed native vegetation and high quality foraging species within the landscape.
- Offset residual biodiversity impacts through the Biodiversity Offset Scheme
- High quality hollows located and relocation with nest boxes installed to supplement the loss of hollows in an appropriate location.
- Prepare a subdivision landscaping plan that utilises locally occurring native species and includes the planting of high quality foraging tree and shrub species.

6.3 Recommended ecological survey

6.3.1 Strategy

Travers bushfire & ecology recommends that the following strategy be taken:

- Ecological assessment proceeds to a BDAR following gateway determination; this may be in the form of a full or streamlines assessment. As noted in Section 5.2, a streamlined assessment for small areas may be used for this site.
- Revegetation of impacted native vegetation on site is recommended to mitigate impacts.
- As noted in Section 5.1.1, the mapping of Biodiversity Values Land is erroneous and a review will be sought to remove this mapping from the site. It is recommended that this is undertaken following gateway determination. This will only be useful, however, if the impacts on native vegetation can be reduced to less than 0.25 ha, as the BOS will likely be triggered through the area clearing threshold anyway.

6.3.2 Further survey required

This report has identified that further survey will be required for a number of species due to the survey not being complaint with the current survey guidelines. The following threatened species were identified as not having compliant survey:

- Eastern Pygmy Possum (trapping survey needed Oct–March)
- Large-eared Pied Bat (survey needed Nov–Jan)

Eastern Pygmy Possum

Whilst there is potential habitat for this species on site, there are limited records locally. To sufficiently rule out the species for presence/absence and biodiversity offsetting, trapping or tubes are required during the warmer months of October to March.

Large-eared Pied Bat

This is a species credit species for which credits are not determined by impacts on breeding habitat. There is no breeding habitat present on site however there may be suitable breeding habitat nearby in former mine shafts or derelict buildings. To rule out the presence of this species, suitable survey is required during summer (November to January).

6.4 Minimising biodiversity offset requirements

To avoid entering the offset scheme, the Biodiversity Values need to be avoided and the impact on native vegetation cannot exceed 0.25 ha. As noted in Section 5.1.2, this area threshold is based on the proposed rezoning to R2 with a minimum lot size of <1 ha. If these two (2) thresholds are met, a test of significance is applied. If the test of significance concludes a not significance impact, the third trigger for the BOS is avoided.

The proposal will impact on land mapped as biodiversity values and it will also cause impacts to vegetation above the 0.25 ha threshold (potential 0.51 ha loss of native vegetation). Subsequently, the BOS will be triggered and a BAM-compliant assessment report will be required.

Reduction of impacts to native vegetation to below 0.25 ha, and avoidance of areas mapped as biodiversity values land, will avoid triggering the BOS.

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Threatened & Migratory Species Habitat Assessment

A1

Table A1.1 provides an assessment of potential habitat within the development footprint for nationally listed threatened flora species recorded within 10 km on *BioNet* (DPIE) or indicated to have potential habitat present within 10 km on the *EPBC Act* Protected Matters Tool.

Table A 1.1 – State and Nationally Threatened flora habitat assessment

Scientific name DATABASE SOURCE	***BC Act***	***EPBC Act***	**Growth form and habitat requirements** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Considered for referral assessment (✓)**
					Suitable habitat present (✓)	**Nearby and / or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Acacia bynoeana BIONET PMST	E1	V	Erect or spreading shrub to 0.3m high growing in heath and dry sclerophyll open forest on sandy soils. Often associated with disturbed areas such as roadsides. *Distribution limits N-Newcastle S-Berrima.*	x	Sub-optimal	✓	2003	Low	✓
Angophora inopina BIONET PMST	V	V	Small tree in open sclerophyll forest growing on deep sandy soils with associated lateritic outcrops. *Distribution limits N-Wyee S-Gorokan with a disjunct population near Karuah.*	x	Sub Optimal	✓	✓	Moderate	✓
Caladenia tessellata PMST	E1	V	Terrestrial orchid. Clay-loam or sandy soils. LHCCREMS guidelines suggest the species grows in Map Unit 34 – Coastal Sand Wallum Woodland - Heath. Flowers in September – November. *Distribution limits N-Swansea S-south of Eden.*	x	x	-	-	x	x

Scientific name DATABASE SOURCE	***BC Act***	***EPBC Act***	**Growth form and habitat requirements** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Considered for referral assessment (✓)**
					Suitable habitat present (✓)	**Nearby and / or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Corunastylis sp. Charmhaven BIONET PMST	CE	CE	Terrestrial orchid currently only known from the Wyong and Lake Macquarie LGAs of NSW in the Ruttley's Road Wyee, Gorokan/Charmhaven area. It occurs within low woodland to heathland with a shrubby understorey and ground layer. Dominants include *Allocasuarina littoralis, Leptospermum juniperinum, Melaleuca nodosa, Callistemon linearis* and *Schoenus brevifolius*. Flowers likely in Feb-Mar.	x	x	-	-	x	x
Cryptostylis hunteriana BIONET PMST	V	V	Saprophytic orchid. Grows in swamp heath on sandy soils. *Distribution limits N-Gibraltar Range S-south of Eden.*	x	Sub-Optimal	3 records within 2km <1km SE	2017	Low	✓
Cynanchum elegans PMST	E1	E	Climber or twiner to 1m. Grows in rainforest gullies, scrub & scree slopes. *Distribution limits N-Gloucester S-Wollongong.*	x	x	-	-	x	x
Diuris praecox BIONET PMST	V	V	Terrestrial orchid. Grows in sclerophyll forest near the coast. *Distribution limits N-Nelson Bay S-Ourimbah.*	x	x	-	-	x	x
Eucalyptus camfieldii BIONET PMST	V	V	Stringybark to 10m high. Grows on coastal shrub heath and woodlands on sandy soils derived from alluviums and Hawkesbury sandstone. *Distribution limits N-Norah Head S-Royal NP.*	x	x	-	-	x	x
Eucalyptus parramattensis subsp. *decadens* BIONET PMST	V	V	Red gum to 15m high. Grows in dry open forest on sandy to clay soils often in lowly elevated moist sites. *Distribution limits N-Port Macquarie S-Kurri Kurri.*	x	x	-	-	x	x

Scientific name DATABASE SOURCE	***BC Act***	***EPBC Act***	**Growth form and habitat requirements** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Considered for referral assessment (✓)**
					Suitable habitat present (✓)	**Nearby and / or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Euphrasia arguta PMST	E4a	CE	An annual herb to 35cm tall, flowers October to January. Grows in grassy areas near rivers. *Recorded from Bathurst to Walcha area.* Considered extinct until recent rediscovery in 2008 near Nundle.	x	x	-	-	x	x
Genoplesium baueri PMST	E1	E	A terrestrial orchid that grows in sparse sclerophyll forest and moss gardens over sandstone. Flowers Feb–Mar. *Distribution limits N – Hunter Valley S – Nowra.*	x	x	-	-	x	x
Genoplesium insigne BIONET PMST	E1	CE	Called *Corunastylis insignis* in *EPBC Act.* Terrestrial orchid. Found in *Themeda* patches among shrubs and sedges in heathland and forest. *Known from Ruttley's road Wyee to Lake Haven.* Occurs in vegetation dominated by Scribbly Gum, Red Bloodwood, Smooth-barked Apple and Black She-oak at Charmhaven. Flowers Sept-Oct.	x	Sub-optimal	3x records within 2km	2018	Low	✓
Grevillea parviflora subsp. *parviflora* BIONET PMST	V	V	Open to erect shrub to 1m. Grows in woodland on light clayey soils. *Distribution limits N-Cessnock S-Appin.*	x	Sub-optimal	None within 3km	2008	x	x
Melaleuca biconvexa BIONET PMST	V	V	Tall shrub. Grows in wetlands adjoining perennial streams and on the banks of those streams, generally within the geological series known as the Terrigal Formation. *Distribution limits N-Port Macquarie S-Jervis Bay.*	x	x	-	-	x	x
Persicaria elatior BIONET PMST	V	V	Herb to 90cm tall which grows in damp places especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance. *Varied distribution from SE NSW to QLD.*	x	x	-	-	x	x

Scientific name DATABASE SOURCE	***BC Act***	***EPBC Act***	**Growth form and habitat requirements** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Considered for referral assessment (✓)**
					Suitable habitat present (✓)	**Nearby and / or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Persoonia hirsuta BIONET PMST	E1	E	Erect to decumbent shrub. Grows in dry sclerophyll forest and woodland on Hawkesbury sandstone with infrequent fire histories. *Distribution limits N-Glen Davis S-Hill Top.*	x	x	-	-	x	x
Prostanthera askania BIONET PMST	E1	E	Erect shrub. Grows in sclerophyll forest on ridges in or adjacent to Rainforest. *Distribution limits Strickland SF region.*	x	x	-	-	x	x
Prostanthera cineolifera BIONET PMST	E1	E	Erect shrub to 4m high. Grows in woodland on sandstone ridges, usually in skeletal soils. *Known populations nearby to Walcha, Scone and St Albans.*	x	x	-	-	x	x
Rhizanthella slateri PMST	V	E	Underground orchid that is poorly known. Grows in sclerophyll forests. Usually only seen if the soil is disturbed. Flowers in Oct – Nov.	x	x	-	-	x	x
Rutidosis heterogama BIONET PMST	V	V	Erect herb to 30cm. Grows mostly in heath, often along roadsides. *Distribution limits N-Maclean S-Hunter Valley.*	x	Sub-optimal	x	x	x	x
Syzygium paniculatum PMST	V	V	Small tree. Subtropical and littoral rainforest on sandy soil. *Distribution limits N-Forster S-Jervis Bay.*	x	x	-	-	x	x
Tetratheca juncea BIONET PMST	V	V	Prostrate shrub to 1m high. Dry sclerophyll forest and heath. *Distribution limits N-Bulahdelah S-Port Jackson.*	x	Low	✓	2018	Low	✓

Scientific name DATABASE SOURCE	***BC Act***	***EPBC Act***	**Growth form and habitat requirements** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Considered for referral assessment (✓)**
					Suitable habitat present (✓)	**Nearby and / or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Thelymitra adorata PMST	E4a	CE	Currently known from a few localised occurrences in the area bounded by the towns of Wyong, Warnervale and Wyongah on the New South Wales Central Coast, Occurs from 10-40 m a.s.l. in grassy woodland or occasionally derived grassland in well-drained clay loam or shale derived soils. The vegetation type in which the majority of populations occur (including the largest colony) is a Spotted Gum - Ironbark Forest with a diverse grassy understorey and occasional scattered shrubs.	x	x	-	-	x	x
Thesium australe PMST	V	V	Erect herb to 0.4m high. Root parasite. Themeda grassland or woodland often damp. *Distribution limits N-Tweed Heads S-south of Eden.*	x	x	-	-	x	x

BIONET	- Denotes species listed within 10km of the development footprint on the *Atlas of NSW Wildlife*
PMST	- Denotes species listed within 10km of the development footprint in the *EPBC Act* habitat search
TBE	- Denotes additional species considered by *Travers bushfire & ecology* to have potential habitat based on regional knowledge and other records
V	- Denotes vulnerable listed species under the relevant Act
E or E1	- Denotes endangered listed species under the relevant Act
E4a or CE	- Denotes critically endangered listed species under the relevant Act
NOTE:	1. This field is not considered if no suitable habitat is present within the development footprint 2. 'records' refer to those provided by the *Atlas of NSW Wildlife* 3. 'nearby' or 'recent' records are species specific accounting for home range, dispersal ability and life cycle

Table A1.2 provides an assessment of potential habitat within the development footprint for nationally listed threatened fauna species recorded within 10 km on *BioNet* (DPIE) or indicated to have potential habitat present within 10km on the *EPBC Act* Protected Matters Tool.

Table A1.2 – Nationally Threatened fauna habitat assessment

Common name ***Scientific name*** Database source	***BC Act***	***EPBC Act***	**Preferred habitat** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Refer to Appendix 2. Considered for referral assessment (✓)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Giant Burrowing Frog *Heleioporus australiacus* BIONET PMST	V	V	Inhabits open forests and riparian forests along non-perennial streams, digging burrows into sandy creek banks. *Distribution limit: N-Near Singleton S-South of Eden.*	x	x	-	-	x	x
Green and Golden Bell Frog *Litoria aurea* BIONET PMST	E	V	Prefers the edges of permanent water, streams, swamps, creeks, lagoons, farm dams and ornamental ponds. Often found under debris. *Distribution limit: N-Byron Bay S-South of Eden.*	x	x	-	-	x	x
Pale-headed Snake *Hoplocephalus bitorquatus* BIONET	V	-	Occurs in a range of habitats from rainforest to open woodland. Usually occurs in hollow trees and beneath loose bark along watercourses. Partly arboreal and may use hollows in trees. *Distribution limit: N-Border Ranges National Park. S-Sydney.*	x	x	-	-	x	x

Common name ***Scientific name*** Database source	***BC Act***	***EPBC Act***	**Preferred habitat** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Refer to Appendix 2. Considered for referral assessment (✓)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
White-throated Needletail [MS] *Hirundapus caudacutus* BIONET PMST	-	V	Airspace over forests, woodlands, farmlands, plains, lakes, coasts, towns; companies often forage along favoured hilltops and timbered ranges. Breeds Siberia, Himalayas, east to Japan. Summer migrant to eastern Australia. *Distribution limit: N-Tweed Heads. S-South of Eden.*	x	✓	✓	✓	✓	✓
Swift Parrot *Lathamus discolour* BIONET PMST	E	E	Inhabits eucalypt forests and woodlands with winter flowering eucalypts. *Distribution limit: N-Border Ranges National Park. S-South of Eden.*	x	Marginal	✓	x	✓	✓
Painted Honeyeater *Grantiella picta* BIONET PMST	V	V	A nomadic bird occurring in low densities within open forest, woodland and scrubland feeding on mistletoe fruits. Inhabits primarily Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. *Distribution limit: N-Boggabilla. S-Albury with greatest occurrences on the inland slopes of the Great Dividing Range.*	x	x	-	-	x	x
Spotted-tailed Quoll *Dasyurus maculatus* BIONET PMST	V	E	Dry and moist open forests containing rock caves, hollow logs or trees. *Distribution limit: N-Mt Warning National Park. S-South of Eden.*	x	Marginal	✓	x	Unlikely	✓

Common name ***Scientific name*** Database source	***BC Act***	***EPBC Act***	**Preferred habitat** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Refer to Appendix 2. Considered for referral assessment (✓)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Koala *Phascolarctos cinereus* BIONET PMST	V	V	Inhabits both wet and dry eucalypt forest on high nutrient soils containing preferred feed trees. *Distribution limit: N-Tweed Heads. S-South of Eden.*	x	Marginal	x	✓	Unlikely	✓
Long-nosed Potoroo *Potorous tridactylus* BIONET PMST	V	V	Coastal heath and dry and wet sclerophyll forests with a dense understorey. *Distribution limit: N-Mt Warning National Park. S-South of Eden.*	x	x	-	-	x	x
Brush-tailed Rock-wallaby *Petrogale penicillata* PMST	E	V	Found in rocky gorges with a vegetation of rainforest or open forests to isolated rocky outcrops in semi-arid woodland country. *Distribution limit: N-North of Tenterfield. S-Bombala.*	x	x	-	-	x	x
Grey-headed Flying-fox *Pteropus poliocephalus* BIONET PMST	V	V	Found in a variety of habitats including rainforest, mangroves, paperbark swamp, wet and dry open forest and cultivated areas. Forms camps commonly found in gullies and in vegetation with a dense canopy. *Distribution limit: N-Tweed Heads. S-Eden.*	x	✓	✓	✓	✓	✓

Common name ***Scientific name*** Database source	***BC Act***	***EPBC Act***	**Preferred habitat** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Refer to Appendix 2. Considered for referral assessment (✓)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Large-eared Pied Bat *Chalinolobus dwyeri* BIONET PMST	V	V	Warm-temperate to subtropical dry sclerophyll forest and woodland. Roosts in caves, tunnels and tree hollows in colonies of up to 30 animals. *Distribution limit: N-Border Ranges National Park. S-Wollongong.*	x	Marginal	✓	✓	Low	✓
Corbens Long-eared Bat *Nyctophilus corbeni* PMST	V	V	Inhabits a variety of vegetation types, including mallee, bulloak (*Allocasuarina leuhmanni*)and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. Roosts in tree hollows, crevices, and under loose bark. Slow flying agile bat, utilising the understorey to hunt non-flying prey - especially caterpillars and beetles - and will even hunt on the ground. *Distribution limit: Central NSW west of the ranges.*	x	x	-	-	x	x

BIONET	Denotes species listed within 10km of the development footprint on the *BioNet* search (Atlas of NSW Wildlife) managed by BIONET
PMST	Denotes species listed within 10km of the development footprint in the *Protected Matters Search Tool* managed by DAWE
TBE	Denotes additional species considered by *Travers bushfire & ecology* to have potential habitat based on regional knowledge and other records
V	Denotes vulnerable listed species under the relevant Act
E or E1	Denotes endangered listed species under the relevant Act
E4a or CE	Denotes critically endangered listed species under the relevant Act

Common name ***Scientific name*** Database source	***BC Act***	***EPBC Act***	**Preferred habitat** ***Distribution limit***	**Recorded on site (✓)**	**If not recorded on site**				**Refer to Appendix 2. Considered for referral assessment (✓)**
					Suitable habitat present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	

NOTE:	1. This field is not considered if no suitable habitat is present within the development footprint 2. 'records' refer to those provided by the *Atlas of NSW Wildlife* 3. 'nearby' or 'recent' records are species specific accounting for home range, dispersal ability and life cycle
Unlikely	Represents such a low margin but not enough to 100% rule it one. A test of significance is required.
Not likely	Means 0% change of occurring, despite there being potential habitat. A test of significance is not applied to these species.

Table A1.3 provides an assessment of potential habitat within the development footprint for nationally *protected* migratory fauna species recorded within 10 km on the *EPBC Act* Protected Matters Tool. Nationally *threatened* migratory species are considered in Table A1.2.

Table A1.3 – Migratory fauna habitat assessment

Common name ***Scientific name***	**Preferred habitat** ***Migratory breeding***	**Suitable habitat present (✓)**	**Recorded on site (✓)**	**Comments**
Oriental Cuckoo (*Cuculus optatus*)	Mainly inhabits forests, occurring in coniferous, deciduous and mixed forest. It feeds mainly on insects and their larvae, foraging for them in trees and bushes as well as on the ground.	x	x	-
Fork-tailed Swift (Apus pacificus)	Aerial: over open country, from semi-arid deserts to coasts, islands; sometimes over forests, cities. Breeds Siberia, Himalayas, east to Japan south east Asia. Summer migrant to east Australia. Mass movements associated with late summer low pressure systems into east Australia. Otherwise uncommon.	✓	x	-
Rainbow Bee-eater (*Merops ornatus*)	Open woodlands with sandy, loamy soil; sandridges, sandspits, riverbanks, road cuttings, beaches, dunes, cliffs, mangroves, rainforest, woodlands, golf courses. *Breeding resident in northern Australia. Summer breeding migrant to south east and south west Australia.*	x	x	-
Black-faced Monarch (*Monarcha melanopsis*)	Rainforests, eucalypt woodlands; coastal scrubs; damp gullies in rainforest, eucalypt forest; more open woodland when migrating. *Summer breeding migrant to coastal south east Australia, otherwise uncommon*.	x	x	-
Spectacled Monarch (*Monarcha trivirgatus*)	Understorey of mountain / lowland rainforest, thickly wooded gullies, waterside vegetation, mostly well below canopy. *Summer breeding migrant to south-east Qld and north-east NSW down to Port Stephens from Sept / Oct to May. Uncommon in southern part of range.*	x	x	-
Satin Flycatcher (*Myiagra cyanoleuca*)	Heavily vegetated gullies in forests, taller woodlands, usually above shrub-layer; during migration, coastal forests, woodlands, mangroves, trees in open country, gardens. *Breeds mostly south-east Australia and Tasmania over warmer months, winters in north east Qld.*	x	x	-
Rufous Fantail (*Rhipidura rufifrons*)	Undergrowth of rainforests / wetter eucalypt forests / gullies; monsoon forests, paperbarks, sub-inland and coastal scrubs; mangroves, watercourses; parks, gardens. On migration, farms, streets buildings. *Breeding migrant to south-east Australia over warmer months. Altitudinal migrant in north-east NSW in mountain forests during warmer months.*	x	x	-
Yellow Wagtail (*Motacilla flava*)	The yellow wagtail typically forages in damp grassland and on relatively bare open ground at edges of rivers, lakes and wetlands, but also feeds in dry grassland and in fields of cereal crops.	x	x	-

National - Significant Impact Criteria

A2

Under the *EPBC Act* an action will require approval from the Australian Government Environment Minister if the action has, will have, or is likely to have, a significant impact on a matter of national environmental significance. The following significant impact criteria were sourced from the *EPBC Act* Policy Statement 1.1 (May 2006):

CRITICALLY ENDANGERED AND ENDANGERED SPECIES

Significant impact criteria

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- Lead to a long-term decrease in the size of a population;
- Reduce the area of occupancy of the species;
- Fragment an existing population into two or more populations;
- Adversely affect habitat critical to the survival of a species;
- Disrupt the breeding cycle of a population;
- Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;
- Introduce disease that may cause the species to decline; or
- Interfere with the recovery of the species.

>> What is a population of a species?

A 'population of a species' is defined under the *EPBC Act* as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:
- a geographically distinct regional population, or collection of local populations; or
- a population, or collection of local populations, that occurs within a particular bioregion.

>> What is habitat critical to the survival of a species or ecological community?

'Habitat critical to the survival of a species or ecological community' refers to areas that are necessary:
- For activities such as foraging, breeding, roosting, or dispersal;
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- To maintain genetic diversity and long term evolutionary development; or
- For the reintroduction of populations or recovery of the species or ecological community.

Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the Minister under the *EPBC Act.*

VULNERABLE SPECIES

Significant impact criteria

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of an important population of a species;
- reduce the area of occupancy of an important population;
- fragment an existing important population into two or more populations;
- adversely affect habitat critical to the survival of a species;
- disrupt the breeding cycle of an important population;
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;
- introduce disease that may cause the species to decline; or
- interfere substantially with the recovery of the species.

>> What is an important population of a species?

An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- Key source populations either for breeding or dispersal;
- Populations that are necessary for maintaining genetic diversity; and/or
- Populations that are near the limit of the species range.

CRITICALLY ENDANGERED AND ENDANGERED ECOLOGICAL COMMUNITIES

Significant impact criteria

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

- Reduce the extent of an ecological community;
- Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines;
- Adversely affect habitat critical to the survival of an ecological community;
- Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns;
- Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting;
- Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:
  - assisting invasive species, that are harmful to the listed ecological community, to become established; or
  - causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community; or
- Interfere with the recovery of an ecological community.

MIGRATORY SPECIES

Significant impact criteria

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;
- Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or
- Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

>> What is important habitat for a migratory species?

An area of 'important habitat' for a migratory species is:
a) Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or
b) Habitat that is of critical importance to the species at particular life-cycle stages; and/or
c) Habitat utilised by a migratory species which is at the limit of the species range; and/or
d) Habitat within an area where the species is declining.

>> What is an ecologically significant proportion?

Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore, what is an 'ecologically significant proportion' of the population varies with the species (each circumstance will need to be evaluated). Some factors that should be considered include the species' population status, genetic distinctiveness and species specific behavioural patterns (for example, site fidelity and dispersal rates).

>> What is the population of a migratory species?

'Population', in relation to migratory species, means the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries including Australia.

Plot data sheets

A3

180D14E Gosford Road WYEE

BAM Site – Field Survey Form

Site Sheet no:

Survey Name	Zone ID	Recorders
180D14E		RS

Date	Zone	Datum	Plot ID	Plot dimensions	Photo #
24/9/2020	__		Q1	50 x 20	8562 8563

Easting	Northing	IBRA region	Midline bearing from 0 m
_ _ _ _ _ _	_ _ _ _ _ _ _		

Vegetation Class		Confidence: H M L
Plant Community Type	Lmac MU31 PCT1636	EEC: / Confidence: H M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed cover		

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	0	
50 – 79 cm	4	
30 – 49 cm	14	
20 – 29 cm	5	
10 – 19 cm	3	
5 – 9 cm	5	
< 5 cm	1	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	2, 3, 4, 3 = 12	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	90	60	15	15	35	0	1	5	2	2	1	1	1	1	1	0	0	0	0	0
Average of the 5 subplots	43					2					1									

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet 1 of 1	Survey Name	Plot Identifier	Recorders
Date 24/9/2020	180D14E	Q1	RS

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
	E. haemastoma	N	~~25~~	8	T	
	Corymbia gummifera	N	15	7	T	
	Allocasuarina littoralis	N	2	3	T	
	Acacia longifolia var longif	N	1	1	S	
	Pimelea linifolia	N	1	2	S	
	Epacris pulchella	N	0.5	1	S	
	Photo 8564 - Caesia parviflora	N	1	3	G	
	Matchheads - Conesperma ericinum	N	1	2	G	
	Austrodanthonia tenuior	N	1	3	G	
	Dianella caerulea	N	1	2	G	
	Imperata cylindrica var major	N	4	30	G	
	Xanthorrhoea latifolia ssp latif	N	2	3	G	
	Entolasia stricta	N	5	25	G	
	Panicum simile	N	1	2	G	
	Lomandra obliqua	N	4	25	G	
	Aristida ramosa	N	4	25	G	
	Lomandra filiformis	N	3	10	G	
	Anisopogon avenaceus	N	3	5	G	
	Lepidosperma laterale	N	1	2	G	
	Aristida vagans	N	3	10	G	
	Pratia purpurascens	N	1.5	5	G	
	Patersonia sericea	N	1	3	G	
	Phyllanthus hirtellus	N	0.1	1	G	
	Eragrostis brownii	N	3	20	G	
	Billardiera scandens	N	2	4	~~G~~ V	
	Calochilus sp. Red Bearded Orchid	N	1	10	G	
	Cynodon dactylon	?	4	20	G	
	Cyathochaeta diandra	N	2	5	G	
	Photo 8565		1	10	G	
	8566		0.5	5		
	8567 callistemon					
	8568 Hibbertia?					
	Leptospermum trinervium	N				
	Mirbelia rubiifolia	N	2	3	G	
	Melaleuca nodosa	N				
	Whisky Grass	E				
	Acacia suaveolens	N	2	2	S	
	Pittosporum undulatum	N	3	1	S	
	Lambertia formosa	N	2	1	S	
	Pink Spider Flower	N	2	2	S	
	~~Canna lily~~ Watsonia meriana	E	4	25	G	
	Ptilotrix deusta	N	1	3	G	
	Photo 8569	N?	1	3	G	
	Eragrostis brownii					

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 1 of 1

		Survey Name	Zone ID	Recorders			
Date: 27/10/2020		18ODI4E		RS			
Zone: __	Datum:	Plot ID:	Q2	Plot dimensions:	20x50	Photo #:	8665 SW 8666 NE
Easting: _____	Northing: _____	IBRA region:	In m	Midline bearing from 0 m:	Magnetic °		
Vegetation Class						Confidence: H M L	
Plant Community Type			Sw Sclerophyll Forest.	EEC: tick	✓ trees only	Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed cover		

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm	II (2)	x
30 – 49 cm	IIII (5)	x
20 – 29 cm	II (2)	x
10 – 19 cm		x
5 – 9 cm	I (1)	x
< 5 cm		n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	nil Ø Tally space	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	20%					5%					1%					Ø				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)	3	O	Managed Land with remnat Trees, Shrubs gone, GL Exotic
Cultivation (inc. pasture)	—	—	
Soil erosion	1	O	wet spots, muddy, coloured runoff
Firewood / CWD removal	—	—	
Grazing (identify native/stock)	—	—	
Fire damage	—	—	
Storm damage	—	—	
Weediness	3	O	Lots of Meri, Pine saplings,
Other	—	—	

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet 2 of 2	Survey Name	Plot Identifier	Recorders
Date 27/10/20	180D14E	Q2	RS

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
	1 Melaleuca quin	N	4	10		
	2 Aug floribunda	N	2	1		
Ticks ++++	3 Euc Robusta	N	6	8		
	4 Pinus radiata (lots juv)	E	4	4		
	5 Acacia longifolia var. longifolia	N	2	3		
	6 Callistemon linearifolius	N	1	1		
	7 Erythrina x Sykesii (juv)	E	1	1		
	8 Kunzea ambigua	N	1	2		
	9 Watsonia meriana	E	30i.	120+		
	10 Imperata cylindrica	N	2	20		
	11 Cynodon dactylon	N	6	60		
	12 Pimelea linifolia	N	3	10		
	13 Juncus usitatus	N	2	10		
	14 Whisky Grass = Andropogon virginicus	E	3	30		
	15 Axonopus fissifolius	E	2	20		
	16 Pittosporum undulatum	N	1	1		
	17 Centella asiatica	N	1	20		
	18 ~~Panicum~~ Cenchrus clandestinum	E	3	25		
	19 Plantago lanceolata	E	1	10		
	20 Eragrostis brownii	N	1	10		
	21 Beloskion tetraphyllum	N	1	5		
	22 Buffalo Grass	E	1	20		
	23 Leptospermum juniperinum	N	2	2		
	24 Shoenus melanostachys	N	2	10		
	25 Gahnia clarkei	N	6	6		
	26 Dodonaea triquetra	N	2	2		
	27 Entolasia marginata	N	3	10		
	28 Dianella caerulea	N	1	2		
	29 Pratia purpurascens	N	1	20		
	30 Entolasia stricta	N	4	25		
	31 Glycine clandestina	N	0.5	1		
	32 Drosera peltata	N	0.2	4		
	33 Viola hederacea	N	2	20		
	34 Cassytha glabella	N	1	3		
	35 Lepyrodia scariosa	N	2	5		
	36 Schoenus (turbinata?)	N	1	2		
	37 Goodenia hederacea	N	1	3		
	38 Photo 8667	?	2	8		
	39 Juncus planifolius	N	1	4		
	40 Paspalum urvillei	E	2	4		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 1 of 2

		Survey Name	Zone ID	Recorders			
Date	27/10/2020	180114E		RS			
Zone	Datum	Plot ID	Q3	Plot dimensions	20 x 20	Photo #	8594 8592
Easting	Northing	IBRA region	In m	Midline bearing from 0 m		Magnetic °	
Vegetation Class						Confidence: H M L	
Plant Community Type				EEC: tick		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed cover		

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm	1	x
30 – 49 cm	1	x
20 – 29 cm	1	x
10 – 19 cm		
5 – 9 cm		
< 5 cm		n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	4 Tally space	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	2					0					0					0				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² plot: Sheet 1 of 2	Survey Name	Plot Identifier	Recorders
Date 27/10/2020	180914E	Q3 (20x20)	RS

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
	1 E haemastoma	N				
	2 C gummifera	N				
	3 Melia azedarach	N				
	4 Allocas lifloralis	N				
	5 Persoonia levis	N				
	6 Petrophile Pulchella ~~Eucalyptus sideroxylon~~ o leaves	N				
	7 Pittosporum undulatum	N				
	8 Pimelea linifolius	N				
	9 Glochidion ferdinandi	N				
	10 Acacia longifolia subsp longifolia	N				
	11 Entolasia stricta	N				
	12 Themeda australis	N				
	13 Panicum simile	N				
	14 Anisopogon avenaceus	N				
	15 Pratia purpurascens	N				
	16 Cenchrus clandestina	E				
	17 Doryanthes excelsa (2x Juvenile)	N				
	18 Blue flax lily = Dianella caerulea var caerulea	N				
	19 Andropogon virginicus	E				
	20 Imperata cylindrica	N				
	21 Mirbelia	N				
	22 Eragrostis brownii	N				
	23 Lepto Juniperinum	N				
	24 Lantana camara	E				
	25 Ozothamnus diosmifolius	N				
	26 Watsonia meriana	E				
	27 Entolasia stricta	N				
	28 Callistemon linearifolius	N				
	29 Richardia	E				
	30 Taraxacum officinale	E				
	31 Trifolium repens	E				
	32					
	33					
	34					
	35					
	36					
	37					
	38					
	39					
	40					

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 1 of 2

		Survey Name	Zone ID	Recorders			
Date	26/5/21	180014 Wyee		CJP			
Zone	Datum	Plot ID		Plot dimensions	20 x 50	Photo #	✓
Easting	Northing	IBRA region	In m	Midline bearing from 0 m	Magnetic °		
Vegetation Class						Confidence: H M L	
Plant Community Type				EEC: tick		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed cover		

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
< 5 cm		n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0	Tally space

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	5	7	4	5	7	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	5.6																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400m² plot: Sheet 2 of 2	Survey Name	Plot Identifier	Recorders
Date 26/5/2021	180D14 Wyee	Q4	CJ

GF	Top 3 natives in each GF: Full species name mandatory. All others where practicable	N	E	HTE	Cover %	Abund	voucher
	1 Watsonia meriana			✓	1	20	
	2 Paspalum urvillii		✓		2	50	
	3 Eucalyptus sp. (seedling)	✓			1	2	
	4 Goodenia bellidifolia	✓			0.1	100	
	5 Melaleuca quinquenervia	✓			0.1	20	
	6 Centella asiatica	✓			0.1	10	
	7 Andropogon virginicus			✓	2	50	
	8 Leptospermum juniperinum	✓			0.1	8	
	9 Isolepis levynsiana		✓		2	40	
	10 Cyperus brevifolius	✓	✓		0.5	20	
	11 Cyperus eragrostis		✓		0.1	10	
	12 Lantana camara			✓	0.1	3	
	13 Eragrostis brownii	✓			0.1	3	
	14 seeded turf (indet)		✓		5	1000	
	15 Bidens pilosa			✓	0.1	3	
	16 Gahnia clarkei	✓			0.1	1	
	17 Sannantha pluriflora	✓			0.1	2	
	18 Senecio madagascariensis			✓	0.1	3	
	19 Axonopus fissifolius			✓	1	10	
	20 Juncus usitatus	✓		✓	2	20	
	21 Cynodon dactylon	✓			1	10	
	22 Pinus radiata			✓	0.1	2	
	23 Schoenus apogon	✓			3	500	
	24						
	25						
	26						
	27						
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GF Code: see growth form definitions in Appendix 1 N: native, E: exotic, HTE: high threat exotic GF – circle code of 'top 3'
Cover: 0.1, 0.2, 0.3..... 1, 2, 3 ..... 10, 15, 20, 25 .....100% (foliage cover): ***Note:*** *0.1% cover = 63 x 63 cm or a circle 71 cm across, 0.5% cover = 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10m.* **Abundance:** 1, 2, 3...10, 20, 30....100, 200...1000...