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Biodiversity Development Assessment Report

NSW Department of Education

The New Primary School at Warnervale
75 Warnervale Road, Warnervale NSW

13 December 2019

Biodiversity Development Assessment Report

The New Primary School at Warnervale

75 Warnervale Road, Warnervale NSW

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Prepared for:

NSW DEPARTMENT OF EDUCATION
C/- BILLARD LEECE PARTNERSHIP

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SURRY HILLS, NSW 2010

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EXECUTIVE SUMMARY

Kleinfelder was engaged by Billard Leece Partnership, on behalf of the NSW Department of Education, to undertake a Biodiversity Development Assessment Report (BDAR) within Lot 71 DP 7091 Warnervale Road, Warnervale, NSW. This BDAR has been prepared to assess the impacts of the proposed New Primary School at Warnervale, and future expansion options.

This assessment has been conducted in accordance with the Biodiversity Assessment Method (BAM), and additional requirements identified in the SEARs.

*The landscape assessment identified that the Study Area occurs within the Wyong IBRA Sub-region of the Sydney Basin Bioregion (**Section 2**) The Study Area forms part of the mapped Lake Macquarie – Gosford corridor forming linkages across the valley floor and the vegetation within the Study Area forms part of this larger corridor linking corridor. The proposed development does not occur within an area of Outstanding Biodiversity Value (AOBV).*

*The native vegetation assessment (**Section** 3) identified two native vegetation communities, areas of non-native vegetation (Managed Grasslands) and Cleared Land (Managed Gardens and Infrastructure). The two native vegetation communities within the Development Site occurred within five vegetation zones (area of impact due to the proposal indicated):*

- *PCT 1590: Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest:*
    - *Moderate – Good (0.65 ha)*
    - *Cleared (0.49 ha)*
- *PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands:*
    - *Moderate – Good (1.15 ha)*
    - *Managed (0.32 ha)*
    - *Cleared (0.04 ha)*

*Surveys for species credit species within the study area did not identify any species credit species (**Section 4**).*

The proposed redevelopment of The New Primary School at Warnervale has been designed to avoid vegetation and species habitat removal, where possible. The location of buildings and infrastructure within the site has been positioned as far to the north of the site as possible, within already disturbed vegetation.

*The proposal will directly impact on 2.66 ha of native vegetation, and there is the potential for minor indirect impacts on the retained vegetation. The proposal is unlikely to impact on any prescribed matters. Mitigation measures have been recommended to limit the direct and indirect impacts of the proposal (**Section 5.3**).*

As no threatened flora or fauna species or populations, or threatened ecological communities were identified within the Study Area, no further assessment of SAIIs is required.

*One native vegetation zone (Vegetation Zone 2) does not require offsets as its Vegetation Integrity Score was below 17 (**Section 6.2**). Offsets are required for impacts on all other vegetation zones (Vegetation Zone 1, 3, 4 and 5). The offsetting requirement has been calculated based on complete removal of vegetation within each zone (i.e. future vegetation integrity score of zero). A total of 48 ecosystem credits are required for the proposed development; 18 credits to offset impacts on PCT 1590, and 30 credits to offset impacts on PCT 1619 (**Appendix 5**).*

Other biodiversity legislation considered as part of this assessment included the Environment Protection and Biodiversity Conservation Act 1999, State Environmental Planning Policy 44 – Koala habitat protection *and the* Biosecurity Act 2015 *(NSW). These are addressed in **Section 7**. It was concluded as the proposal will only impact on a small area of marginal/foraging habitat for potentially occurring MNES, it is unlikely that there will be a significant impact, and as such a referral to the Commonwealth Minister for the Environment is not considered necessary. Additionally, no Potential Koala habitat was identified within the Study Area, as such, no further assessment under the SEPP is required.*

Abbreviations / Definitions

Accredited person – a person accredited under the accreditation scheme prepared under section 6.10 of the BC Act (also referred to as the assessor)

BAM – Biodiversity Assessment Method

BC Act – NSW *Biodiversity Conservation Act 2016*

BDAR – Biodiversity Development Assessment Report

BSSAR – Biodiversity Stewardship Site Assessment Report

Development Site – Area directly impacted by the proposal, including construction footprint

PCT – Plant Community Type

TEC – Threatened Ecological Community

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1. INTRODUCTION

1.1 SCOPE

Kleinfelder was engaged by Billard Leece Partnership, on behalf of the NSW Department of Education, to undertake a Biodiversity Development Assessment Report (BDAR) within Lot 71 DP 7091 Warnervale Road, Warnervale, NSW. This assessment has been undertaken in accordance with the Biodiversity Assessment Method 2017 (BAM) to support a Development Application for The New Primary School at Warnervale.

The following terms are used throughout this report to describe particular geographical areas:

- Study Area (4.53 ha): Lot 71 DP 7091, 75 Warnervale Road, Warnervale (**Figure 1**).
- Development Site (3.60 ha): the area to be directly impacted due to the proposed development; Part Lot 71 DP 7091.
- Locality: land within a 5 km radius of the study area.

1.2 LOCAL CONTEXT

The Study Area occurs within the Central Coast Council Local Government Area (LGA); within the Wyong area. The northern portion of the allotment is zoned R1 – General Residential, and the southern portion is zoned R2 – Low Density Residential.

The Study Area is bound by Warnervale Road and residential development to the northwest, a native bushland corridor surrounding Warnervale Oval to the north, partially cleared residential development to the east (on adjoining Lot 72), and by native bushland to the west and south (on adjoining Lots 70 and 73) (**Figure 2**). The majority of the Study Area is comprised of native bushland, with the northernmost portion supporting several buildings and managed grassland.

1.3 PROPOSED DEVELOPMENT

This BDAR has been prepared to assess the impacts of the proposed New Primary School at Warnervale, and future expansion options (design shown by the Concept Design in **Appendix 1**). The Development Site includes proposed buildings, associated infrastructure, Asset Protection Zones (APZs), sports fields and potential future expansion areas proposed to occur within Lot 71 (**Figure 1**).

The total disturbance site of the Development Site is 3.60 ha and includes all areas of direct impact, including the construction footprint.

Billard Leece Partnership provided Kleinfelder with surveyed data of the Study Area (Lot 71 DP 7091 boundary). This surveyed Study Area boundary differs slightly from the Land and Property Information (LPI) Cadastre Boundary (**Figure 1**).

Metres
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DATE DRAWN: 2/08/2019 13:36 Version 1
DRAWN BY: GJoyce
DATA SOURCE:
NSW DFSI - 2017
ADW Johnson - 2019
Nearmap - 2019

Development Site Map

NSW Department of Education (c/- Billard Leece Partnership)
Biodiversity Development Assessment Report
New Warnervale Public School
Lot 71 DP7091 Warnervale Rd, Warnervale NSW

FIGURE:
1

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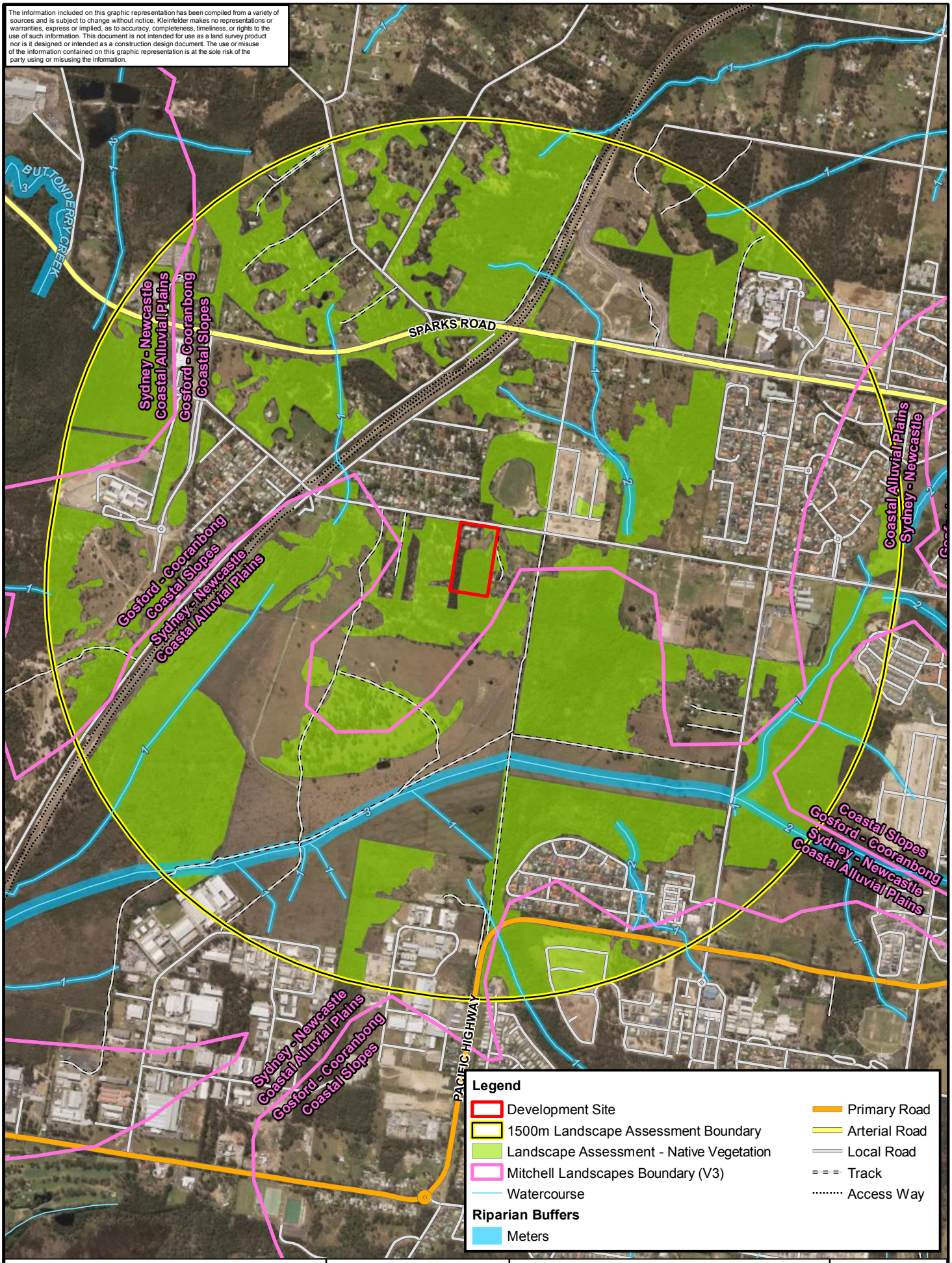

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DATE DRAWN: 22/03/2019 12:44 Version 1

DRAWN BY: GJoyce

DATA SOURCE:
DFSI - 2017
ADW Johnson - 2019
Nearmap - 2019

Development Site Location Map

NSW Department of Education (c/- Billard Leece Partnership)
Biodiversity Development Assessment Report
New Warnervale Public School
Lot 71 DP7091 Warnervale Rd, Warnervale NSW

FIGURE:

2

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1.4 LEGISLATIVE CONTEXT

This project was undertaken in accordance with and/or in consideration of the following Acts and Policies:

- Commonwealth:
  - *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- State:
  - *Biodiversity Conservation Act 2016* (NSW) (BC Act);
  - *Biodiversity Conservation Regulation 2017* (NSW) (BC Regulation);
  - *Environmental Planning and Assessment Act 1979* (EP&A Act);
  - *Biodiversity Conservation (Savings and Transitional) Regulation 2017;*
  - *Biosecurity Act 2015*;
  - *Local Land Services Act 2013* (LLS Act);
  - State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017;
  - State Environmental Planning Policy No. 44 – Koala Habitat Protection;
  - Draft Amendment to State Environmental Planning Policy No. 44 – Koala Habitat Protection;
  - Draft State Environmental Planning Policy (Environment);
  - Biodiversity Assessment Method (2017).
- Local:
  - Wyong Local Environmental Plan 2013 (Wyong LEP 2013;
  - Wyong Shire Development Control Plan 2013 (Wyong DCP 2013);
  - Wyong Shire Council Flora and Fauna Survey Guidelines Version 2.4 (2016);
  - Squirrel Glider Conservation Management Plan: Wyong Shire;
  - Interim Survey Guidelines for Ground Orchids in Wyong Shire.

1.4.1 *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act)

Under the EPBC Act assessment an approval is required for actions that are likely to have a significant impact on matters of national environmental significance. An action includes a project, development, undertaking, activity, or series of activities. When a person proposes to take an action they believe may need approval under the EPBC Act, they must refer the proposal to the Australian Government Minister for the Environment. The Act identifies nine matters of national environmental significance:

1. World Heritage properties;
2. National heritage places;

3. Wetlands of international importance (Ramsar Convention);
4. Listed threatened species and communities;
5. Migratory species listed under international agreements;
6. Great Barrier Reef Marine Park;
7. Commonwealth marine areas;
8. Nuclear actions; and
9. Water resources in respect to CSG and large coal mines.

While this Biodiversity Development Assessment Report (BDAR) is not required to address MNES, the proponent is required to address the EPBC Act as part of their development application to Council. Items 4 and 5 are relevant to the current proposal.

See **Section 7.1** for summary of assessment.

1.4.2 *Biodiversity Conservation Act 2016* (NSW)

1.4.2.1 Biodiversity Assessment Pathway

As per Part 7.9 of the BC Act, all State Significant Development Applications are to be accompanied by a Biodiversity Development Assessment Report (BDAR) unless the Planning Agency Head and the Environment Agency Head determine that the proposed development is not likely to have any significant impact on biodiversity values. Part 7.2 of the BC Act states that a development is *likely to significantly affect threatened species* if:

- Is carried out within an area of Outstanding Biodiversity Value, or
- Exceeds the Biodiversity Offset Scheme (BOS) thresholds, which includes:
  - Clearing of native vegetation, or undertaking a prescribed activity, on land mapped on the NSW Biodiversity Vales Map (BV Map), or
  - Clearing of native vegetation of an area declared by clause 7.2 of the BC Regulation as exceeding the threshold.
- It is likely to significantly affect threatened species or ecological communities, or their habitat, according to the test in section 7.3 (5-part test).

The proposed development does not occur within an area of Outstanding Biodiversity Value (AOBV).

The NSW biodiversity values map was reviewed, and areas of biodiversity value are mapped within the development footprint. Patches of vegetation within the development footprint meet

the Biodiversity Values Map Criteria of; 'Threatened species or communities with potential for serious and irreversible impacts'. While the Development Site is mapped on the Biodiversity Values map, clearing within this area does not trigger the BOS as the proposed development occurs on land which was subdivided prior to the commencement of the BC Act, and is zoned R1 and R2. Part 7.3 Clause 4 of the BC regulation states that *'proposed development (other than subdivision) does not exceed the biodiversity offsets scheme threshold merely because it is to be carried out on a lot included in the Map if the lot was the result of a subdivision carried out before the commencement of the Act and the lot is within land zoned R1 to R4, RU5, B1 to B8 or IN1 to IN3 under an environmental planning instrument.'*

Under clause 7.2 of the BC Regulation, the area of native vegetation clearing threshold for the proposed development is 0.25 ha or more, as the minimum lot size of the Study Area is less than 1 ha. The proposed development will directly impact on approximately 2.69 ha of native vegetation.

As such, it was deemed unlikely that the proposal would "not likely to have any significant impact on biodiversity values", and a BDAR was required for the proposal.

Biodiversity Assessment Method

The proposed development has been assessed under the BAM (2017).

The Biodiversity Accredited Assessor System (BAAS) Case number for the project is, 00013544, and the BAM Calculator number is 00013544/BAAS17039/19/00016916.

1.4.3 *Biosecurity Act 2015* (NSW)

Under the *Biosecurity Act 2015* (NSW) all plants are regulated with a general biosecurity duty "*to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.*" Under the act a biosecurity impact "*is an adverse effect on the economy, environment, or the community that arises, or has the potential to arise, from a biosecurity matter."* This legislation is addressed in **Section 7.2**.

1.4.4 SEPP 44 – Koala Habitat Protection

SEPP 44 encourages the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline.

Under SEPP 44, the identification of Potential Koala habitat and Core Koala habitat is outlined. Potential Koala habitat is defined as areas of native vegetation where the trees of the types outlined in **Table 1** constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.

Table 1: List of SEPP 44 Schedule 2 preferred Koala feed trees

Scientific Name	Common Name
Eucalyptus tereticornis	Forest Red Gum
Eucalyptus microcorys	Tallowwood
Eucalyptus punctata	Grey Gum
Eucalyptus viminalis	Ribbon or Manna Gum
Eucalyptus camaldulensis	River Red Gum
Eucalyptus haemastoma	Broad-leaved Scribbly Gum
Eucalyptus signata	Scribbly Gum
Eucalyptus albens	White Box
Eucalyptus populnea	Bimble Box or Poplar Box
Eucalyptus robusta	Swamp Mahogany

See **Section 7.2** for summary of assessment.

1.4.4.1 Draft Amendment to the Koala Habitat Protection SEPP

The Department are proposing to amend SEPP 44 – Koala Habitat Protection to update the controls to better protect Koala habitat. Key changes to the proposed amended SEPP relate to the:

- Definitions of Koala habitat:
  - The definitions will be revised to clearly articulate the meaning of Koala habitat. Including the identification of additional tree species listed under the SEPP. Additionally, Koala habitat will be include any area where Koalas are present, regardless of tree species present.

- List of tree species:
  - There will be an increase in the number of tree species listed under the SEPP from 10 to 65 tree species.
- List of Councils (update to reflect amalgamations).
- Development Assessment Process:
  - The process will be simplified and streamlined in order to standardise the development assessment process and ensure it is applied consistently across the State.

Additionally, updated guidelines for the preparation of comprehensive plans of management and the preparation and assessment application will be prepared as part of the amendment.

The Explanation of Intended Effect was on public exhibition from 18 November 2016 to 3 March 2017. While the proposed amendments to the SEPP have not been implemented, the implications for the proposed changes in relation to the current Study area have been assessed in **Section 7.2.1**.

2. LANDSCAPE CONTEXT

2.1 LANDSCAPE FEATURES

The landscape features and site context detailed in Section 4 of the BAM (2017) are described in **Table 2**. These landscape features are also shown on **Figure 2**.

Table 2: Landscape features of the Development Footprint

Landscape Feature	Development Footprint
IBRA bioregion	Sydney Basin
IBRA subregion	Wyong
LGA	Central Coast Council (Wyong)
Mitchell Landscapes	Gosford – Cooranbong Coastal Slopes Coastal fall of the Sydney Basin, rolling hills and sandstone plateau outliers of Triassic Narrabeen sandstones, extensive rock outcrop and low cliffs along ridge margins, general elevation 0 to 75 m. Texture-contrast soils on lithic sandstones and shales. Loamy sand alluvium along creeks. Organic sand and mud in lagoons and swamps (DECC 2002).
Rivers, streams and estuaries	There are no mapped water courses within the Study Area.
Wetlands	There are no local or important wetland within, or immediately adjacent to the Study Area.
Connectivity of different areas of habitat	The Study Area forms part of the mapped Lake Macquarie – Gosford corridor forming linkages across the valley floor (Scott 2003). The vegetation within the Study Area forms part of this larger corridor linking corridor
Areas of geological significance and soil hazard features	There are no areas of geological significance (karst, caves, crevices, cliffs or other features) within the Study Area. There are minimal soil hazard features within the Study Area. The Study Area is generally flat, to slightly sloping to the south-west. There are no drainage lines within the study area. Due to clearing along the western boundary of the Study Area, there are areas of exposed soil which have the potential for erosion during heavy rain events.
Areas of outstanding biodiversity value	There are no areas of outstanding biodiversity value mapped within the Study Area.

2.2 SITE CONTEXT

Details of the landscape assessment for the development site, according to the BAM (2017) using the site-based assessment methodology and determined by remote sensing and GIS.

2.2.1 Native Vegetation Cover

The 1,500 m site buffer has an area of 829 ha which has a woody vegetation cover of 332 ha, or 40%. There are native vegetation patches surrounding the development in all directions.

2.3 GEOLOGY AND SOILS

The Study Area is mapped as occurring on the Gorokan Erosional Soil Landscape on the Soil Landscapes of the Gosford-Lake Macquarie 1:100,000 Sheet (Murphy 1993). The Gorokan (gk) soil landscape is described as occurring on undulating low hills on lithic sandstones of the Tuggerah Formation. Soils are moderately deep, and the dominant materials include; loose dark brown loamy sand, yellowish brown hard setting clayey sand, yellowish brown strongly pedal clay and light grey massive clay. This soil landscape occurs over the Narrabeen Group – Clifton Subgroup – Tuggerah Formation geology (Murphy 1993).

3. NATIVE VEGETATION

3.1 METHODOLOGY

Native vegetation at the Development Footprint was assessed in accordance with Section 5 of the BAM (2017).

3.1.1 Data Review

The Vegetation mapping project conducted by Vegetation mapping projects have been conducted within the Wyong portion of the Central Coast Council LGA; by Eco Logical Australia (2016) and Bell (2002). These mapping projects were reviewed to assist with the determination of Plant Community Types (PCTs) within the study area.

Previous ecological studies from surrounding properties were also reviewed to inform the potential for threatened species and ecological communities within the Study Area.

3.1.2 Vegetation Mapping Surveys

Vegetation Mapping and Surveys

Detailed vegetation surveys were conducted across the study area on 19/09/2017.

The boundaries of each of the identified vegetation communities within the study area were mapped using a combination of rapid data points (RDP) and walking transects, using the polygons produced through aerial photo interpretation (API) to assist in targeting survey effort. RDPs involved collecting waypoints over the study area using a hand held Trimble™ GPS unit and recording dominant species, structure and condition. Walking transects involved verifying polygons where homogenous in floristic composition and condition, as well as walking vegetation ecotones and using the recorded tracks to define vegetation community boundaries. The RDPs and survey tracks were then overlaid on an aerial photograph and used to delineate and/or clarify vegetation boundaries.

Linework and Attribution

RDPs and plots were classified and tagged with a PCT by field surveyors. Polygons produced from the API work adopted the PCT of the sample point that they intersected.

Plant Community Type Determination

Each vegetation community identified within the study area was assigned to the closest equivalent PCT from those listed in the BioNet Vegetation Classification database (OEH, 2019). The closest equivalent PCT for each vegetation community was determined through a comparison of the floristic descriptions of PCTs in the database with the plot / transect data collected from the site. In addition to floristic and structural similarity, the landscape position, soil type and other diagnostic features of the vegetation communities on the sites were also compared to the descriptions in the database in order to determine the most suitable PCT. Threatened ecological communities (TECs) as defined in NSW and Commonwealth legislation were also identified if present.

Vegetation Zones

Vegetation zones were identified and delineated on the Development Footprint in accordance with Section 5.3 of the BAM (2017). A vegetation zone is defined in the BAM (2017) as a relatively homogenous area that is the same vegetation type and broad condition.

Assessing Vegetation Integrity (Site Condition)

Following stratification of the Development Footprint into vegetation zones, plots/transects were undertaken to collect site condition data for the composition, structure and function attributes listed in **Table 3** in accordance with Section 5.3 of the BAM (2017). The location of the plots/transects were selected through stratified random sampling to provide a representative sample of the variation in vegetation composition and condition within each vegetation zone.

Table 3: Composition, Structure and Function components of vegetation integrity

Growth form groups used to assess composition and structure	Function attributes
• Tree (TG) • Shrub (SG) • Grass and grass-like (GG) • Forb (FG) • Fern (EG) • Other (OG)	• Number of large trees • Tree regeneration (presence/absence) • Tree stem size class (presence/absence) • Total length of fallen logs • Litter cover • High threat exotic vegetation cover (HTE) • Hollow-bearing trees (HBT)

The number of plots/transects undertaken across the site meets the minimum number of transects required for each vegetation zone area as detailed in Section 5.3.4, Table 4 of the BAM (2017). Five plots were undertaken within the Development Site. The locations of the plots / transects undertaken on Development Footprint are shown on **Figure 3** and the number of plot/transects undertaken within each vegetation zone is outlined in **Section 3.2.2**.

Floristic Identification and Nomenclature

Floristic identification and nomenclature was based on Harden (1992, 1993, 2000 and 2002) with subsequent revisions as published on PlantNet (http://plantnet.rbgsyd.nsw.gov.au).

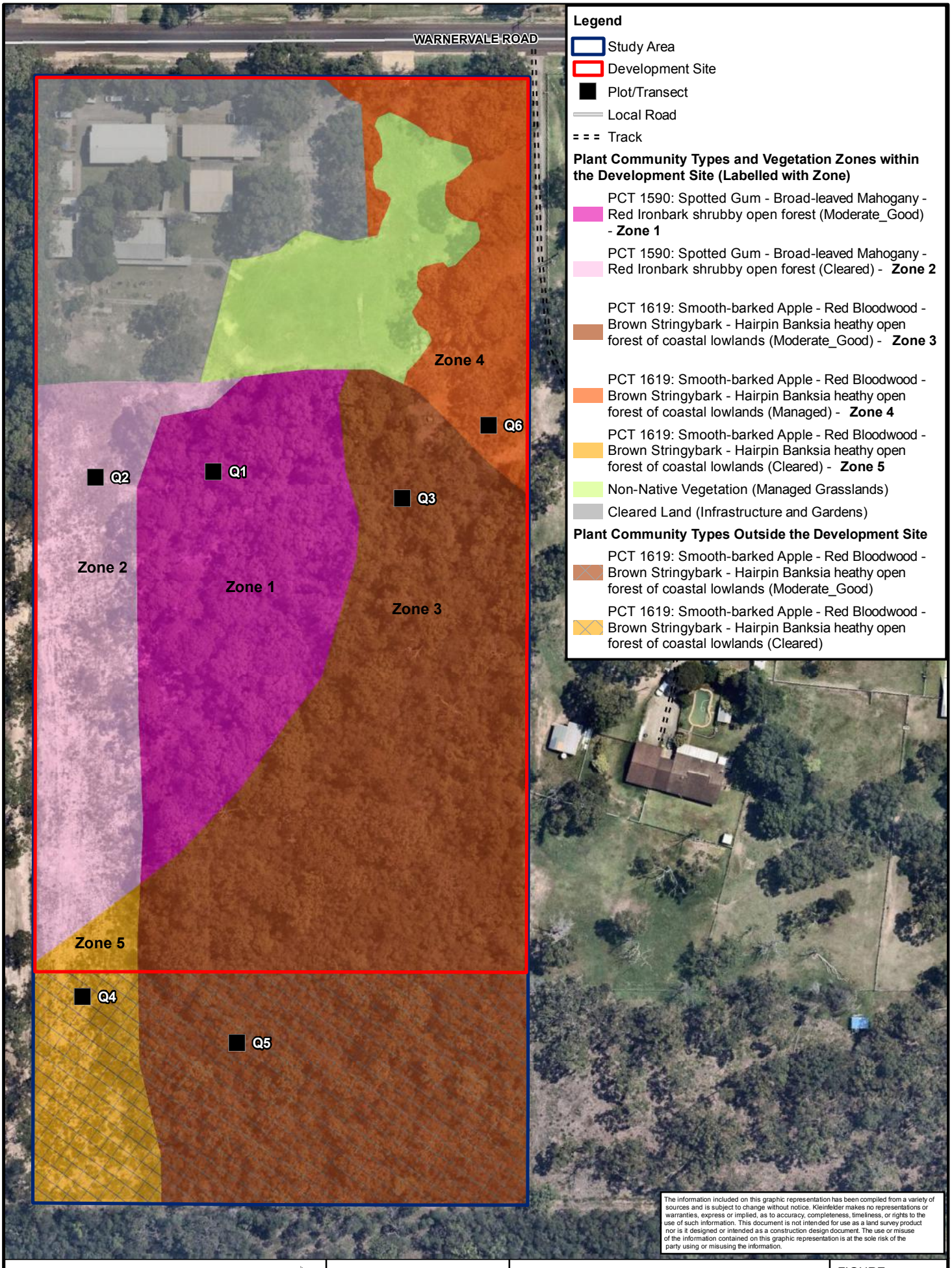
3.2 ASSESSMENT RESULTS

3.2.1 Vegetation Description

The majority of the site consist of remnant native vegetation, including areas of Narrabeen Buttonderry Footslopes Forest and Warnervale Spotted Gum – Red Ironbark Forest. The vegetation along the western boundary has been previously cleared and is currently regenerating, and the northern portion of the site contains managed Narrabeen Buttonderry Footslopes Forest, managed gardens/existing development and exotic grasslands (**Table 4** and **Figure 3**).

Table 4: Plant Community Types within the Development Site

PCT	Vegetation Formation	Vegetation Class	Area (ha)
PCT 1590: Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Hunter-Macleay Dry Sclerophyll Forests	1.14
PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Dry Sclerophyll Forests (Shrubby sub-formation)	Sydney Coastal Dry Sclerophyll Forests	1.52
Non-Native Vegetation (Managed Grasslands)	-	-	0.30
Cleared Land (Managed Gardens &Infrastructure)	-	-	0.65
		Total	**3.60**



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PROJECT REFERENCE: 20192176

DATE DRAWN: 27/03/2019 16:23 Version 1

DRAWN BY: gjoyce

DATA SOURCE:
NSW DFSI - 2017
ADW Johnson - 2019
Nearmap - 2019

Vegetation Zones and Plot Locations

NSW Department of Education (c/- Billard Leece Partnership)
Biodiversity Development Assessment Report
New Warnervale Public School
Lot 71 DP7091 Warnervale Rd, Warnervale NSW

FIGURE:

3

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3.2.2 Vegetation Zones

The vegetation within the Study Area was stratified as per Section 5.3.1 of the BAM; PCT 1590 occurs as two vegetation zones, and PCT 1619 occurs as three vegetation zones. Details on this vegetation zone (including condition class, area, patch size, survey effort and vegetation integrity score) are outlined in **Table 5**, and full descriptions of each vegetation zone are provided in the following sub-sections. **Figure 3** shows the distribution of PCTs and vegetation zones within the Development Footprint. Quadrat data is provided in **Appendix 2**.

3.2.2.1 Vegetation Zone 1

Plate 1: **PCT 1590: Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest – Moderate_Good within the Development Footprint**

Warnervale Spotted Gum – Red Ironbark Forest	
PCT ID	1950
Condition Class	Moderate_Good
Area within Development Site	0.65 ha
Survey Effort	**Required:** 1 plot/transect.
	Conducted: 1 plot/transect.
Floristic description	The canopy of this vegetation is dominated by Corymbia *maculata*, *Eucalyptus eugenioides* and *Eucalyptus fibrosa*, with *Eucalyptus umbra* and *Angophora costata* also occurring. Th midstorey is dominated by a dense layer of *Melaleuca nodosa* with scattered *Allocasuarina littoralis* occurring. There is a sparse shrub layer of *Pimelea linifolia, Phyllanthus hirtellus, Acacia longifolia* subsp*. longifolia* and *Podolobium scandens.*

Warnervale Spotted Gum – Red Ironbark Forest	
	The ground layer is dominated by *Ptilothrix deusta, Entolasia stricta, Xanthorrhoea latifolia, Gahnia melanocarpa, Themeda triandra, Microlaena stipoides* var. *stipoides, Lobelia purpurascens, Cassytha pubescens,* Exotic species occur at the edge of the vegetation zone where and in areas of historical disturbance, including, *Axonopus fissifolius, Paspalum dilatatum, Ligustrum sinense, Conyza bonariensis* and *Asparagus aethiopicus.*
Condition within Development Footprint	This vegetation zone is relatively intact with a native canopy, shrub and ground layer. Some historic disturbance (clearing) is evident within this vegetation zone via the presence of a possible an old track.
Justification for PCT selection	The vegetation within the study area most closely resembles a Dry Sclerophyll Forest within the shrub/grass sub-formation due to the presence of a semi-continuous cover of grasses and a sparse shrub layer. Other Spotted Gum – Ironbark dominated Dry Sclerophyll Forests in the shrub/grass sub-formation which occur within the Wyong IBRA sub-region were considered; a total of 7 PCTs were considered - 1600, 1601, 1602, 1589, 1590, 1592 and 1593. PCT 1600 and 1601 were excluded due to the lineage of these PCT, which is derived from Central Hunter Mapping Project and the Greater Hunter Vegetation mapping Project and is more representative of vegetation community types occurring further to the north-west of the Study Area. Additionally, 1602 was excluded due to the dominance of *E. crebra* within this PCT which is more representative of Central Hunter Spotted Gum – Ironbark Forest. PCT 1593 was excluded as this PCT is described as being dominated by *E. fibrosa*. PCT 1592 was excluded due to the presence of *E. punctata* in this PCT, which is lacking from the Study Area. Additionally, this PCT is more typical of the Lower Hunter Spotted Gum Ironbark Forest occurring to the north-west of the locality. PCT 1590 and 1589 were deemed to be the most floristically aligned PCTs to vegetation within the Study Area. Both PCTs are described as occurring on the Central Coast lowlands / at lower elevations, and both PCTs share floristic similarities within the understorey vegetation within the Study Area (presence of *Themeda triandra, Microlaena stipoides, Daviesia ulicifolia* and *Lobelia purpurascens*). PCT 1590 was determined to be more closely aligned to the vegetation on site to the presence of *E. fibrosa* in the canopy of this PCT where PCT 1589 has *E. punctata* which is not present on site. Additionally, the vegetation mapping project conducted by Eco Logical (2016) lists the Warnervale Spotted Gum – Red Ironbark Forest as being equivalent to PCT 1590.
Status	**BC Act:** Not Listed. The PCT is linked with the *Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions.* The final determination for the *Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions* (NSW TSSC 2019) describes the community as: • Known to occur in the Lower Hunter Valley centred on the Cessnock-Beresfield area and approximately bounded by the towns of Paxton, Branxton, Clarence Town, Beresfield, Mt. Vincent and the Northern boundary of the Watagans National Park. • Occurring principally on Permian and Carboniferous geology. The Permian substrates most commonly supporting the community below to the Dalwood Group, the Maitland Group, and the Greta and Tomago Coal Measures. In the area of Paterson, Seaham and Clarence Town, the community occurs on Carboniferous sediments including the Wallaringa, Mt. Johnstone and Seaham formations. • The community is usually dominated by *Corymbia maculata* (Spotted Gum) and *Eucalyptus fibrosa* (Broad-leaved Ironbark), with *E. punctata* (Grey Gum) occurring less frequently. Other trees species have been recorded, however, none of these species are characteristic of the Lower Hunter Spotted Gum Ironbark Forest. Frequently encountered understory species include *Acacia parvipinnula, Bursaria spinosa, Daviesia ulicifolia, Lissanthe strigosa, Melaleuca nodosa, Persoonia linearis, Aristida vagans Cheilanthes sieberi,*

Warnervale Spotted Gum – Red Ironbark Forest	
	Dianella revoluta, Entolasia stricta, Glycine clandestina, Hardenbergia violacea, Lepidosperma laterale, Lomandra filiformis, Lomandra multiflora, Macrozamia flexuosa, Microlaena stipoides, Panicum simile, Phyllanthus hirtellus, Pomax umbellata and Themeda triandra. This vegetation lacked many of the diagnostic features of the Lower Hunter Spotted Gum Ironbark Forest TEC (LHSGIB) as listed by the NSW Scientific Determination. Justification are listed below: • The vegetation is located outside the core distribution of LHSGIB, which mainly occurs to the north in the Cessnock - Beresfield area. The most southern limit of is described distribution (Northern Border of the Watagans National Park) occurs approximately 30 km to the north/north-west of the Study Area. • Although *C. maculata* and *E. fibrosa* are typically dominant in LHSGIB, the site contains an abundance of other canopy species such as *E. eugenioides, E. umbra* and *A. costata*, which are not diagnostic of LHSGIB. Sub-dominant canopy species which typically occur in LHSGIB such as *E. punctata* and *E. crebra* were not recorded. • LHSGIB generally contains a prominent shrub layer dominated by *Acacia parvipinnula*, however, this species does not occur within the site. • LHSGIB is strongly associated with yellow podsolic and solodic soils of the Lower Hunter soil landscapes of Aberdare, Branxton and Neath. Soils consistent with these characteristics were not recorded within the site. As such the vegetation within the study area has not been classified as the EEC.
	EPBC Act: Not Listed
SAII	No
% Cleared	48%

3.2.2.2 Vegetation Zone 2

Plate 2: PCT 1590: Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest – Cleared within the Development Footprint

Warnervale Spotted Gum – Red Ironbark Forest (Cleared)	
PCT ID	1950
Condition Class	Cleared
Area within Development Site	0.49 ha
Survey Effort	**Required:** 1 plot/transect.
	Conducted: 1 plot/transect.
Floristic description	This vegetation zone is dominated by *Entolasia stricta, Themeda triandra* and *Schoenus apogon.* Other species occurring include, *Juncus continuus, Dichelachne micrantha, Gonocarpus teucrioides, Thysanotus tuberosus, Centella asiatica, Sphaeromorphaea australis, Fimbristylis dichotoma, Glycine tabacina, Lobelia purpurascens* and *Microlaena stipoides* var. *stipoides.* Regenerating canopy and midstorey species, such as *Corymbia maculata, Acacia longifolia* subsp. *longifolia,* and *Hakea sericea.* A number of exotic species also occur within the vegetation zone, including *Hydrocotyle bonariensis, Conyza bonariensis, Hypochaeris radicata, Plantago lanceolata* and *Senna pendula* var. *glabrata.*
Condition within Development Footprint	This vegetation zone has been previously cleared and consists of regenerating native vegetation. The vegetation primarily consists on a dense to sparse ground cover, with juvenile regenerating shrubs, midstorey and canopy scattered throughout.
Justification for PCT selection	This vegetation was determined to be the same PCT as Vegetation Zone 1 but has been modified due to clearing. This was determined through assessment of the adjacent vegetation both within and adjacent to the Study Area (vegetation to the west also dominated by *C. maculata*). Assessing the ecotonal changes in both the vegetation within and adjacent to the Study Area was also used to determine the boundary of this Vegetation Zone and Zone 5 to the south. As such, the justification for PCT selection is as per Vegetation Zone 1.
Status	**BC Act:** Not Listed.
	EPBC Act: Not Listed.
SAII	No
% Cleared	48%

3.2.2.3 Vegetation Zone 3

Plate 3: **PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands – Moderate_Good within the Development Footprint**

Narrabeen Buttonderry Footslopes Forest	
PCT ID	1619
Condition Class	Moderate_Good
Area within Development Site	1.15 ha
Survey Effort	**Required:** 1 plot/transect.
	Conducted: 1 plot/transect.
Floristic description	The vegetation within the study area was dominated by *Angophora costata, Corymbia gummifera*, and *E. capitellata,* with *E. fibrosa* and *E. eugenioides* also occurring. The midstorey is dominated by dense layer of *Allocasuarina littoralis* and *Melaleuca nodosa*. Scattered *Melaleuca decora* also occur. The shrub and ground layers are dominated by *Ptilothrix deusta, Entolasia stricta*, *Microlaena stipoides* var. *stipoides, Gahnia radula, Xanthorrhoea latifolia, Brunoniella australis, Lepidosperma laterale, Lobelia purpurascens, Bossiaea rhombifolia* and *Persoonia levis.* The climber and twining species *Parsonsia straminea* and *Cassytha pubescens* also occur. The orchid species *Cryptostylis subulata* also occurs in large patches within the community. Scattered exotic species occur within the community, including, *Ligustrum sinense*, *Asparagus aethiopicus, Richardia stellaris* and *Lantana camara.*
Condition within Development Footprint	This vegetation zone is relatively intact with a native canopy, shrub and ground layer. Some historic disturbance (clearing) is evident within this vegetation zone via the presence of a constructed track (fill material present). Additionally, the majority of the vegetation zone contains a dense midstorey of Allocasuarina and/or Melaleuca combined with a scattered canopy layer in areas, which suggests historic disturbance in these areas.

Narrabeen Buttonderry Footslopes Forest	
Justification for PCT selection	Due to the structure of the vegetation within the Study Area; a diverse sclerophyll shrub layer (1 – 3 m tall) with an ground layer dominated by sedges and grasses, places it within the shrubby sub-formation of Dry Sclerophyll Forests. Due to the landscape position and location of the site (Coastal lowlands of the Sydney Basin), this vegetation falls with the Sydney Coast Dry Sclerophyll Forest vegetation class. All PCTs within this vegetation class, which are dominated by *Angophora costata* and occur within the Wyong IBRA sub-region on similar topography in the area were considered; a total of 4 PCTs were considered - 1138, 1619, 1621 and 1638. PCT 1138 was ruled out as it is listed as forming of the Kincumber Scribbly Gum Forest in the Sydney Basin Bioregion TEC, which the vegetation on site does not represent this TEC. PCT 1621 was excluded due to the occurrence of *E. pilularis* and *Allocasuarina torulosa* within this PCT, which are not present within this Study Area. PCT 1638 was excluded as the Study Area does not occur within the area in which this PCT is described as occurring "the area bound by Norah Head and Catherine Hill Bay". As such , PCT 1619 was determined to be the best fit as the vegetation on site shares floristic similarities with the PCT, through the dominance of *Angophora costata, Corymbai gummifera, Eucalyptus capitellata, Allocasuarina littoralis, Xanthorrhoea latifolia, Persoonia levis* and *Themeda triandra* and it is in line with the vegetation description of the PCT; "Open forests with a canopy dominated by *Angophora costata* and *Corymbia gummifera*. The mid-storey is typically shrubby and commonly includes grass trees and scrambling climbers. The ground layer is typically dominated by grasses along with graminoids and scattered forbs. Occurs on Coastal lowlands and low ranges of the lower North Coast and Central Coast; mainly on sandy substrates."
Status	**BC Act:** Not Listed.
	EPBC Act: Not Listed.
SAII	No
% Cleared	45%

3.2.2.4 Vegetation Zone 4

Plate 4: **PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands – Moderate_Good- Managed within the Development Footprint**

Narrabeen Buttonderry Footslopes Forest	
PCT ID	1619
Condition Class	Moderate_Good
Area within Development Site	0.32 ha
Survey Effort	**Required:** 1 plot/transect.
	Conducted: 1 plot/transect.
Floristic description	This vegetation zone contains a scattered canopy dominated by *Angophora costata,* and *E. capitellata.* There is a scattered midstorey is dominated by *Melaleuca nodosa* with occasional *Allocasuarina littoralis*. The shrub is largely missing from this vegetation zone due to management (slashing) and ground layers are dominated by *Entolasia stricta*, *Themeda triandra, Imperata cylindrica, Microlaena stipoides* var. *stipoides, Gahnia radula, Lepidosperma laterale, Goodenia paniculata, Phyllanthus hirtellus,* and *Lepyrodia scariosa.* The orchid species *Calochilus robertsonii* occurs within this community. The ground layer is also co-dominated by a number of exotic species including, *Axonopus fissifolius, Andropogon virginicus, Hypochaeris radicata* and *Taraxacum officinale.*
Condition within Development Footprint	This vegetation zone has been previously cleared and consists of regenerating native vegetation. The vegetation primarily consists on a dense to sparse ground cover, with juvenile regenerating shrubs, midstorey and canopy scattered throughout.
Justification for PCT selection	This vegetation was determined to be the same PCT as Vegetation Zone 3 but has been modified due to clearing. This was determined through assessment of the adjacent vegetation

Narrabeen Buttonderry Footslopes Forest	
	both within and adjacent to the Study Area (vegetation to the north and east also dominated by *A. costata*). As such, the justification for PCT selection is as per Vegetation Zone 3.
Status	**BC Act:** Not Listed.
	EPBC Act: Not Listed.
SAII	No
% Cleared	45%

3.2.2.5 Vegetation Zone 5

Plate 5: PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands – Moderate_Good- Cleared within the Development Footprint

Narrabeen Buttonderry Footslopes Forest (Cleared)	
PCT ID	1619
Condition Class	Cleared
Area within Development Site	0.04 ha
Survey Effort	**Required:** 1 plot/transect.
	Conducted: 1 plot/transect. The plot/transect conducted for this vegetation zone occurs outside the portion of the vegetation zone within the Development Site. Due to the small area of the vegetation zone within the Development Site (0.04 ha) the plot/transect was conducted within the Study Area, just to the south of the Development Site. While the plot has not been completed within the vegetation to be directly impacted due to the proposed Development, the plot is still representative of the vegetation zone.

Narrabeen Buttonderry Footslopes Forest (Cleared)	
Floristic description	This vegetation zone is dominated by *Gahnia radula, Entolasia stricta, Persoonia levis, Pimelea linifolia, Schoenus apogon, Sphaeromorphaea australis, Pteridium esculentum* and *Cassytha pubescens.* Regenerating tree and shrub species occur within the zone, including *Eucalyptus capitellata, Allocasuarina littoralis* and *Melaleuca decora.*
Condition within Development Footprint	This vegetation zone has been previously cleared and consists of regenerating native vegetation. The vegetation primarily consists on a dense to sparse ground cover, with juvenile regenerating shrubs, midstorey and canopy scattered throughout.
Justification for PCT selection	This vegetation was determined to be the same PCT as Vegetation Zone 3 but has been modified due to clearing. This was determined through assessment of the adjacent vegetation both within and adjacent to the Study Area (vegetation to the west also dominated by *A. costata*). Assessing the ecotonal changes in both the vegetation within and adjacent to the Study Area was also used to determine the boundary of this Vegetation Zone and Zone 2 to the north. As such, the justification for PCT selection is as per Vegetation Zone 3.
Status	**BC Act:** Not Listed.
	EPBC Act: Not Listed.
SAII	No
% Cleared	45%

3.2.3 Assessment of Patch Size

Vegetation Zones 1, 3 and 4 were assessed as having a patch size of >100 ha as they are intact native vegetation which is connected to larger areas of native vegetation in all directions (gap over the railway corridor is less than 100 m). Due to previous clearing within Vegetation Zones 2 and 5, the Canopy layer is missing from these zones, as such does not represent intact native vegetation and the patch size is zero for these vegetation zones.

3.2.4 Vegetation Integrity Score

The current vegetation integrity score of the vegetation zone is outlined in **Table 5**.

Table 5: Current vegetation integrity score for the vegetation zone

Zone	PCT	Condition class	Area (ha)	Condition scores (Current Score)			Vegetation integrity score
				Composition	Structure	Function	
1	1590	Moderate_Good	0.65	96.1	74.4	53.2	72.5
2	1590	Cleared	0.49	90.1	38.1	1.3	16.4
3	1619	Moderate_Good	1.15	67.3	52.1	52.3	56.8
4	1619	Managed	0.32	45.6	52.7	28.8	41
5	1619	Cleared	0.04	39.3	23.8	9.7	20.9

4. THREATENED SPECIES

4.1 ASSESSING HABITAT SUITABILITY

To inform the assessment of suitable habitat for threatened species and populations within the Study Area, a database search of the NSW Office of Environment and Heritage (OEH) BioNet Atlas and the Department of Environment and Energy (DoTEE) Protected Matters Search Tool (PMST) were conducted. Results are provided in **Appendix 3**.

4.1.1 Habitat Assessment

4.1.1.1 Flora

The vegetation in the north of the study area, mapped as Cleared Land (Infrastructure and Gardens and Non-Native Vegetation (Managed Grasslands) was assessed as not containing suitable habitat for any threatened flora species due to the level of disturbance in these areas. These areas contain existing buildings, and surrounding gardens and the open area in the central-northern portion of the site is dominated by exotic grasses and weeds.

The managed portion of the PCT 1619 (Vegetation Zone 4), while modified in the understorey, does contain patches of native understorey and was assessed as representing marginal habitat for threatened flora species. Additionally, the previously cleared areas represented by Vegetation zone 2 and 5, while they lack the structure of a woodland or forest vegetation type, they are dominated by native species and were also assessed as representing marginal habitat for threatened flora species. These three vegetation zones, along with the Moderate to Good Zones (1 and 3) were all considered suitable habitat for candidate threatened flora species.

4.1.1.2 Fauna

Habitat Assessments

The existing habitat occurs on the edge of a larger patch of bushland which extends to south-east, south and west. The fauna habitat (predominantly canopy trees and shrubs) observed is likely to provide foraging habitat for a range of bird species, the Grey-headed Flying-fox, arboreal mammals, and microchiropteran bat species. A habitat tree survey was conducted and identified a total of 29 habitat trees (hollow-bearing trees and dead stags; see section

below). These habitat trees are unlikely to provide suitable nesting habitat for large forest owls (see below) and are more likely to be used by roosting microchiropteran bats, native parrot species or the Common Brushtail Possum.

Due to the large number of historical records of Squirrel Gliders within the locality and high connectivity of the vegetation, the Squirrel Glider has a high likelihood of occurrence within the site. Due to the lack of midstorey species within the vegetation, however, Squirrel Gliders may utilise the canopy for movement and dispersal..

Three threatened fauna species, Grey-headed Flying-fox (foraging, no camps identified), Eastern Bentwing-bat (foraging) and the Little Bentwing-bat (foraging) were assessed as having a moderate likelihood of occurrence on site. Swift Parrot (foraging), Glossy Black-Cockatoo (foraging) and several other threatened microchiropteran bat species potentially utilise the subject site as part of their foraging range.

Habitat Tree Survey

A survey of trees within the development area was undertaken to locate hollow bearing trees, dead standing stags and trees containing nests was conducted on 18 September 2018. The location of Habitat Trees and the type of feature it contained was recorded using a handheld GPS. For trees with hollows the number and size of hollows was recorded. Hollow size was classified as either small (< 8 cm diameter), medium (8 – 20 cm diameter) or large (> 20 cm diameter) based on the size of the hollow entrance.

A total of 29 hollow-bearing trees and dead stags were identified within the Study Area, of which 18 occur within the Development Site (**Table 6** and **Figure 4**). These habitat trees contain a range of potential hollows sizes. No trees containing nests were identified within the Study area.

Table 6: Habitat trees within the Study Area

No.	Tree / Type	Hollows			Comments	Impact / Retained
		Small (<5 cm)	Medium (5 – 20 cm)	Large (>20 cm)		
1.	Stringybark	2	-	-	-	Impact
2.	Stringybark	1	-	-	European Bee's	Impact
3.	Stringybark	3	-	-	-	Impact
4.	Stringybark	2	-	-	-	Impact
5.	Ironbark	4	3	-	-	Impact
6.	Paperbark	2	-	-	-	Impact

No.	Tree / Type	Hollows			Comments	Impact / Retained
		Small (<5 cm)	Medium (5 – 20 cm)	Large (>20 cm)		
7.	Stringybark	3	-	-	-	Impact
8.	Paperbark	4	-	-	-	Impact
9.	Smooth-barked Apple	2	2	-	-	Retained
10.	Paperbark	-	1	-	-	Retained
11.	Smooth-barked Apple	2	2	-	-	Retained
12.	Smooth-barked Apple	2	2	-	1 Medium with active Stringybark nest built in hollow	Retained
13.	Scribbly Gum	1	1	-	1 Medium with nest built in one hollow.	Retained
14.	Paperbark	2	-	-	-	Retained
15.	Stringybark	4	1	-	-	Retained
16.	Smooth-barked Apple	1	-	-	-	Retained
17.	Smooth-barked Apple	2	-	-	-	Retained
18.	Dead Stag	-	-	2	Trunk only to 5 m	Impact
19.	Dead Stag (Paperbark)	-	2	1	10 m Trunk	Impact
20.	Dead Stag (Stringybark)	4	1	-	-	Impact
21.	Dead Stag	6	-	-	-	Impact
22.	Stringybark	3	1	-	-	Impact
23.	Dead Stag	4	1	-	-	Impact
24.	Spotted Gum	1	1	-	-	Impact
25.	Dead Stag	5	-	-	Multiple long splits	Impact
26.	Smooth-barked Apple	-	-	1	1 burrow at base of tree	Retained
27.	Smooth-barked Apple	-	3	1	-	Retained
28.	Dead Stag (Ironbark)	4	-	-	Flaky bark – possibly microbat habitat.	Impact
29.	Blue Gum / Flooded Gum	-	1	-	-	Impact

Inspection of Large Tree Hollows

The suitability of hollows for nesting large forest owls of interest were assessed according to the hollow characteristics preferred by each species in the central coast and hunter regions (NSW, DEC, 2006; Forest Fauna Surveys, 1999; Kavanagh, 2003; LMCC, 2014). For the Powerful Owl (*Ninox strenua*), preferred hollows are approximately 15–20 m high in trees, of approx. 30–50 cm internal diameter and approx. 1–5 m deep. Nest trees are usually within 100

m of creeklines. For the Masked Owl (*Tyto novaehollandiae*), preferred hollows are approx. 12–20 m high in trees, of approx. 35–50 cm internal diameter and approx. 1–5 m deep. Nest trees within the also tend to be within 100 metres of creeklines, although on occasion have been identified higher in the catchment at great distances from the creekline. For the Barking Owl (*Ninox connivens*), nesting and roosting trees tend to occur near watercourses or wetlands in dense foliage. The nest site is a large open hollow, often vertical or sloping, in the trunk or sometimes a spout of a eucalypt or Melaleuca, usually a live tree though occasionally a dead tree. Nest-hollow entrances are 2-35 m above the ground with a diameter of 20-46 cm and depth of 20-300 cm.

Four trees were identified as containing large hollows (>20 cm), however trees were assessed as being of low suitability due to the height and size of the hollows; and the proximity to watercourses. To further confirm the presence or recent utilisation of hollows by large forest owls, the contents of large hollows were visually inspected.

On 16 January 2019 an ecologist supervised the inspection of the large hollows within the Study Area. Hollows were inspected by a team of two qualified arborists. Photos were taken within each hollow, the photos were then reviewed by the ecologist to determine fauna species that may be utilising the hollow.

Results of the large tree hollow inspections are detailed below in **Table 7**. A Common Ring-tailed Possum (*Pseudocheirus peregrinus*) was observed within Habitat Tree 18 (**Plate 6**). A sample of an egg fragment and nesting material was also collected from a hollow in tree/waypoint 27. The nest and egg fragment were determined to be that of an Australian Wood Duck (*Chenonetta jubata*) (**Plate 7**). No other hollows inspected showed signs of use.

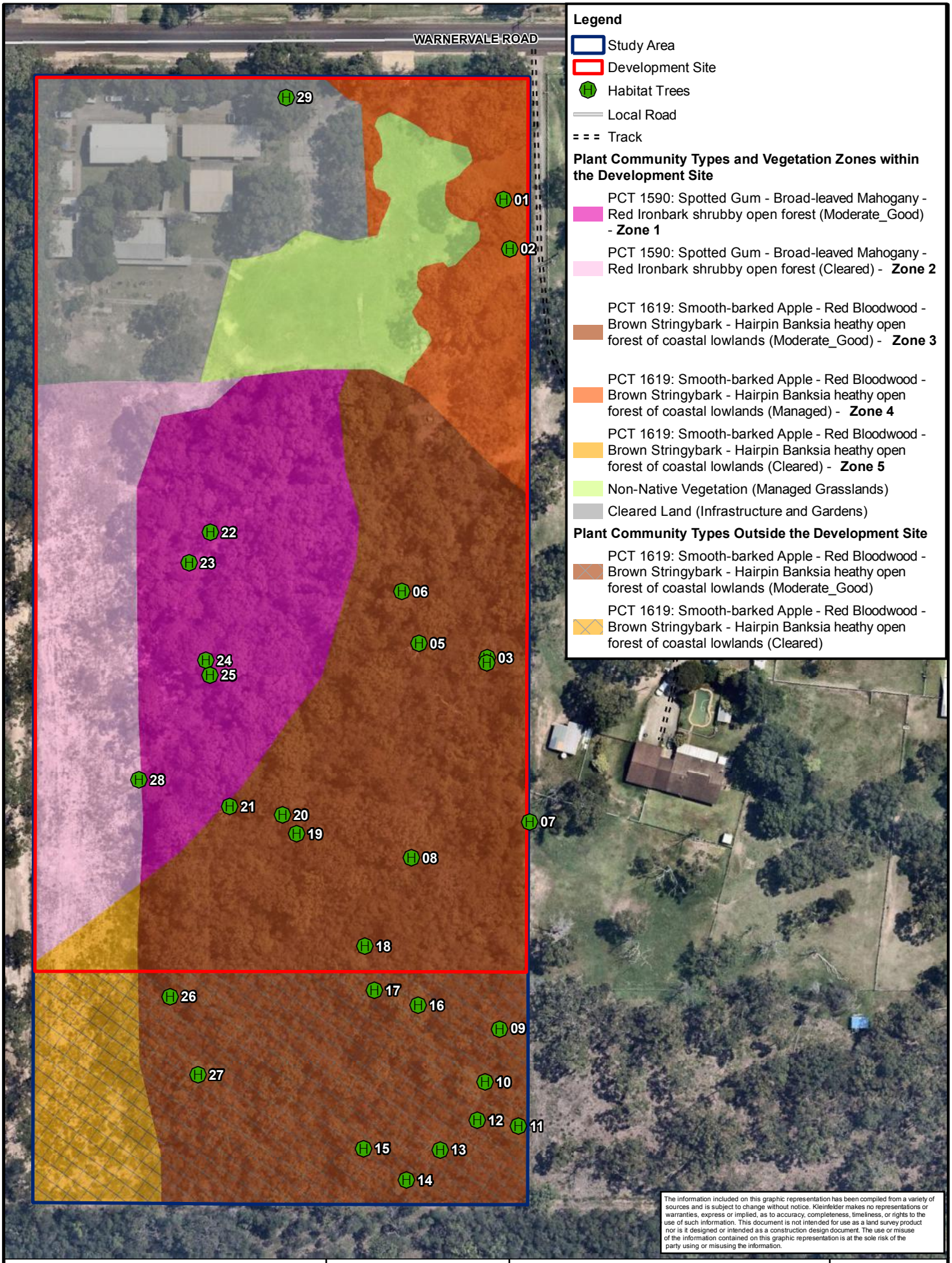
As such, the large hollow bearing trees on site are not assessed as providing potential habitat for threatened Large Forest Owl species.

Table 7: Tree attributes and results of large hollow inspection

No.	Co-ordinates		Tree Species	Comments
18.	6319852.95	356134.76	Dead Stag	Common Ringtail Possum present
19.	6319887.68	356120.46	Dead Stag (Paperbark)	No signs of fauna use
26.	6319847.45	356077.53	Smooth-barked Apple	No signs of fauna use
27.	6319824.12	356081.89	Smooth-barked Apple	Australian Wood Duck nest and egg fragments

Plate 6: **Common Ring-tailed Possum (*Pseudocheirus peregrinus*) found in hollow at Habitat Tree no. 18.**

Plate 7: **Australian Wood Duck (*Chenonetta jubata*) nest and egg fragments found at waypoint no. 27.**



Legend

- Study Area
- Development Site
- Habitat Trees
- Local Road
- Track

Plant Community Types and Vegetation Zones within the Development Site

- PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (Moderate_Good) - **Zone 1**
- PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (Cleared) - **Zone 2**
- PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Moderate_Good) - **Zone 3**
- PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Managed) - **Zone 4**
- PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Cleared) - **Zone 5**
- Non-Native Vegetation (Managed Grasslands)
- Cleared Land (Infrastructure and Gardens)

Plant Community Types Outside the Development Site

- PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Moderate_Good)
- PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Cleared)

Metres
0 5 10 20 30 40 50

N

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PROJECT REFERENCE: 20192176
DATE DRAWN: 27/03/2019 16:40 Version 1
DRAWN BY: gjoyce

DATA SOURCE:
NSW DFSI - 2017
ADW Johnson - 2019
Nearmap - 2019

Habitat Trees

NSW Department of Education (c/- Billard Leece Partnership)
Biodiversity Development Assessment Report
New Warnervale Public School
Lot 71 DP7091 Warnervale Rd, Warnervale NSW

FIGURE:

4

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4.1.2 Ecosystem Credit Species

The following assessment of habitat suitability for ecosystem credit species was conducted in accordance with Section 6.2 of the BAM.

Step 1: Identify threatened species for assessment

A list of predicted ecosystem credit species for the Development Footprint was reviewed in the BAM calculator and is provided in **Appendix 4**.

Step 2: Assessment of the habitat constraints and vagrant species on the subject land

An assessment of the potential for predicted ecosystem credit species to occur within each vegetation zone within the Development Site is provided in **Appendix 4**.

Where woodland habitat features were not present and the habitat was degraded due to clearing, within Zones 2 and 5, ecosystem credit species were determined to not be predicted species and no further assessment required within these vegetation zones. These species included:

- Regent Honeyeater (Foraging) – No feed tree species present due to lack of canopy.
- Gang-gang Cockatoo (Foraging), Speckled Warbler, Brown Treecreeper (eastern subspecies), Varied Sittella, Little Lorikeet, Swift Parrot (Foraging), Black-chinned Honeyeater (eastern subspecies), Turquoise Parrot, Scarlet Robin, Grey-crowned Babbler (eastern subspecies) and Diamond Firetail – No woodland habitat present .
- Glossy-black Cockatoo (Foraging) – No feed tree species present due to lack of Allocasuarina and Casuarina species from these zones.
- Yellow-bellied Glider – No hollow-bearing trees with hollows >25 cm diameter.
- Grey-headed Flying-fox – No foraging species present due to lack of canopy or midstorey.

The following species were deemed to not require further assessment within all vegetation zones due to the lack of habitat constraints across the Study Area:

- Painted Honeyeater – Lack of Mistletoes species.
- White-bellied Sea-Eagle – Site not within 1 km of rivers, lakes, large dams or creeks, wetlands and coastlines.
- Koala – No Koala feed trees present within the Study Area

4.1.3 Species Credit Species

The following assessment of habitat suitability for ecosystem credit species was conducted in accordance with Section 6.3 of the BAM.

Step 1: Identify threatened species for assessment

A list of predicted species credit species for the Development Footprint was reviewed in the BAM calculator and is provided in **Appendix 4**.

In addition to the species identified for assessment by the Threatened Biodiversity Data Collection, two locally occurring threatened orchid species were confirmed as candidate species, as requested by Central Coast Council in the SEARs; *Corunastylis* sp. Charmhaven, and *Thelymitra adorata*.

Step 2: Assessment of the habitat constrains and vagrant species on the subject land & Step 3: Identify candidate species credit species for further assessment

The following species were considered unlikely to occur on the subject land due to the lack of habitat constraints being present:

- *Eucalyptus oblonga* (Endangered Population) – Site not located at Bateau Bay.
- Regent Honeyeater and Swift Parrot – Study Area not within mapped area (Site not within known breeding range).
- White-bellied Sea-Eagle (Breeding) – Living or dead mature trees within suitable vegetation within 1 km of a rivers, lakes, large dams or creeks, wetlands and coastlines.
- Barking Owl (Breeding), Powerful Owl (Breeding) and Masked Owl (Breeding) – No suitable hollows present within the Study Area (see **Section 4.1.1.2**).
- Large-eared Pied Bat and Eastern Cave Bat – Study Area not within 2 km of rocky areas containing caves, overhangs, escarpments, outcrops or crevices, or within 2 km of old mines or tunnels.
- Little Bentwing-bat (Breeding) and Eastern Bentwing-bat (Breeding) – Study Area does not contain caves, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet.
- Southern Myotis – Study Area does not contain hollow-bearing trees within 200 m of riparian zone, or Bridges caves or artificial structures within 200 m of riparian zone.
- Brush-tailed Rock-wallaby – Study Area not within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or clifflines.

- Koala (Breeding) – Study Area does not contain feed trees and does not contain important habitat for the species.

4.2 THREATENED SPECIES SURVEYS

Step 4: Determine presence or absence of candidate species credit species

4.2.2 Candidate Threatened Flora Species

The following candidate threatened flora species were surveyed in the appropriate season, as per the BAM. (**Table 8**).

Table 8: Survey of requirements and timing conducted for candidate flora species

Scientific Name	Common Name	Survey Requirements	Survey Timing
Flora			
Acacia bynoeana	Bynoe's Wattle	September to March	7 December 2018
Angophora inopina	Charmhaven Apple	All year	16 January 2019
Astrotricha crassifolia	Thick-leaf Star-hair	All year	16 January 2019
Callistemon linearifolius	Netted Bottle Brush	September to March	16 January 2019
Corunastylis sp. Charmhaven	-	February to March	22 February 2019
Cryptostylis hunteriana	Leafless Tongue Orchid	November to February	7 December 2018
Cynanchum elegans	White-flowered Wax Plant	All year	16 January 2019
Diuris praecox	Rough Doubletail	July to August	15 August 2018
Genoplesium insigne	Variable Midge Orchid	September to October	28 September 2018
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	All year	28 September 2018
Melaleuca groveana	Grove's Paperbark	All year	16 January 2019
Prostanthera askania	Tranquility Mintbush	September to December	7 December 2018
Rutidosis heterogama	Heath Wrinklewort	All year	7 December 2018
Tetratheca glandulosa	-	July to November	28 September 2018
Tetratheca juncea	Black-eyed Susan	July to December	28 September 2018
Thelymitra adorata	Wyong Sun Orchid	September to October	19 October 2018

4.2.2.1 Survey Methodology

The candidate threatened flora species were surveyed in accordance with the NSW Guide to Surveying Threatened Plants (OEH 2016). All surveys were conducted using systematic parallel transects. Parallel field traverses were separated by 5 to 10 m for orchids, herbs and

forbs, 10 to 15 m for sub-shrubs, and 10 to 20 m for species in all other life forms (shrubs and trees).

For the five orchid species, surveys were conducted when known reference populations were flowering:

- *Corunastylis* sp. Charmhaven was confirmed to be in flower on 21/02/2019 at a local reference population (Email from Danielle Allen).
- *Cryptostylis hunteriana* was confirmed to be flowering 23 November 2018 at local reference population (Email from Daniella Allen).
- A Kleinfelder Ecologist confirmed that *Diuris praecox* was in flower at Glenrock on 14/08/2018.
- *Genoplesium insigne* was confirmed flowering at the end of the week of 10/09/2018 at a local reference population (Email from Danielle Allen).
- *Thelymitra adorata* confirmed to be flowering on 2/10/2018, with surveys to be conducted within two weeks (Email from Daniella Allen).

Surveys were undertaken across the Study Area by suitably qualified ecologist. Survey tracks for each round of targeted surveys are shown on **Figure 5** to **Figure 7**.

4.2.2.2 Threatened Flora Survey Results

No threatened flora species were identified within the Study Area. A list of species identified during the vegetation surveys is provided in **Appendix 2**.

During surveys for *Corunastylis* sp. Charmhaven, the similar species *Genoplesium fimbriatum* was identified. This species is distinguished from the Threatened *Corunastylis* sp. Charmhaven through having green sepals versus reddish lateral sepals, and *Corunastylis* sp. Charmhaven has 6-9 flowers, while *Genoplesium fimbriatum* can have up to 30. The specimens observed within the Study Area had >10 flowers per stem and green lateral sepals.

During the surveys for *Thelymitra adorata*, a non-threatened *Thelymitra* species, *T. pauciflora* was identified within the study area. This species has a different flower structure; anther lobe is tubular in *T. pauciflora* verse a narrow erect or structure in *T. adorata*.

Legend

- Study Area
- Development Site
- Threatened Flora Search Tracks
- Local Road
- Track

Plant Community Types and Vegetation Zones within the Development Site

- PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (Moderate_Good) - **Zone 1**
- PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (Cleared) - **Zone 2**
- PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Moderate_Good) - **Zone 3**
- PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Managed) - **Zone 4**
- PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Cleared) - **Zone 5**
- Non-Native Vegetation (Managed Grasslands)
- Cleared Land (Infrastructure and Gardens)

Plant Community Types Outside the Development Site

- PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Moderate_Good)
- PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Cleared)

Metres
0 10 20 40 60 80 100

N

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PROJECT REFERENCE: 20190632
DATE DRAWN: 27/03/2019 16:59 Version 1
DRAWN BY: gjoyce

DATA SOURCE:
NSW DFSI - 2017
ADW Johnson - 2019
Nearmap - 2019

Flora Survey Effort (August and September 2018)

NSW Department of Education (c/- Billard Leece Partnership)
Biodiversity Development Assessment Report
New Warnervale Public School
Lot 71 DP7091 Warnervale Rd, Warnervale NSW

FIGURE:
5

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Legend

- Study Area
- Development Site
- Threatened Flora Search Tracks
- Local Road
- Track

Plant Community Types and Vegetation Zones within the Development Site

- PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (Moderate_Good) - **Zone 1**
- PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (Cleared) - **Zone 2**
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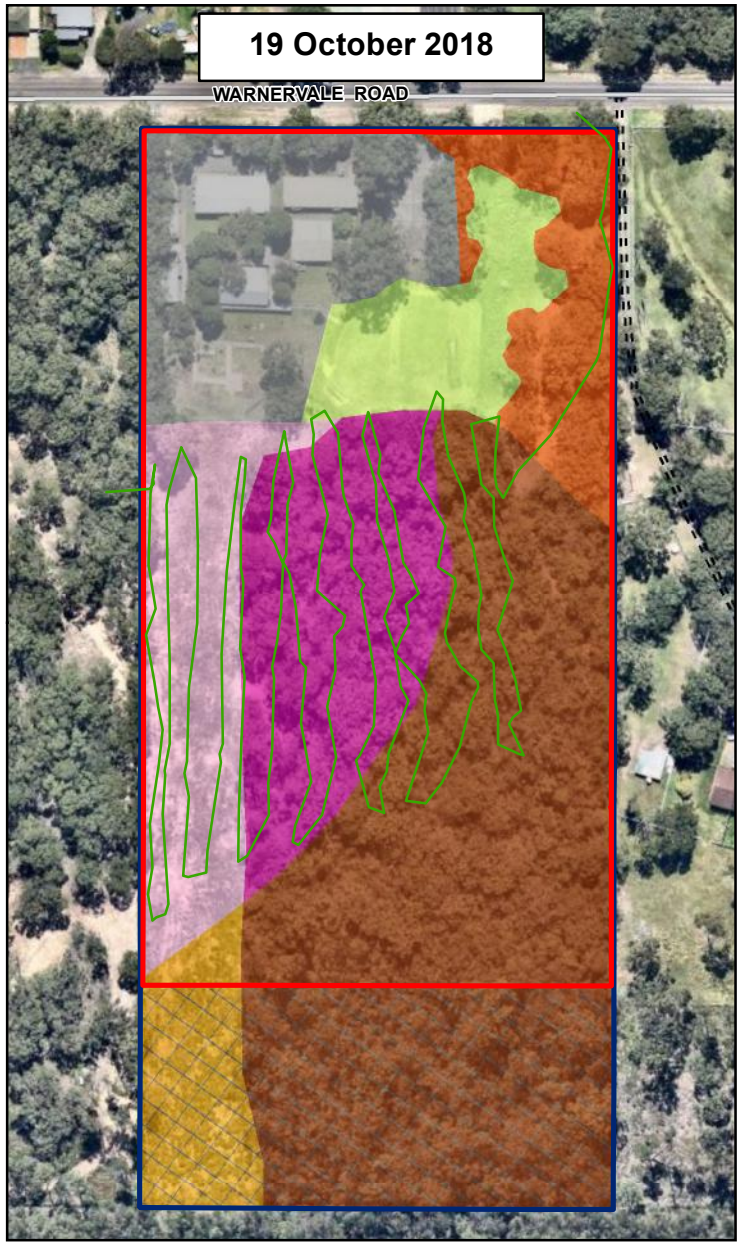
- Non-Native Vegetation (Managed Grasslands)
- Cleared Land (Infrastructure and Gardens)

Plant Community Types Outside the Development Site

- PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Moderate_Good)
- PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Cleared)



Metres
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DATA SOURCE:
NSW DFSI - 2017
ADW Johnson - 2019
Nearmap - 2019

Flora Survey Effort (October and December 2018)

NSW Department of Education (c/- Billard Leece Partnership)
Biodiversity Development Assessment Report
New Warnervale Public School
Lot 71 DP7091 Warnervale Rd, Warnervale NSW

FIGURE:
6

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Legend

- Study Area
- Development Site
- Threatened Flora Search Tracks
- Local Road
- Track

Plant Community Types and Vegetation Zones within the Development Site

- PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (Moderate_Good) - **Zone 1**
- PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (Cleared) - **Zone 2**
- PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Moderate_Good) - **Zone 3**
- PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Managed) - **Zone 4**
- PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Cleared) - **Zone 5**
- Non-Native Vegetation (Managed Grasslands)
- Cleared Land (Infrastructure and Gardens)

Plant Community Types Outside the Development Site

- PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Moderate_Good)
- PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Cleared)

Metres
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DATA SOURCE:
NSW DFSI - 2017
ADW Johnson - 2019
Nearmap - 2019

Flora Survey Effort (January and February 2019)

NSW Department of Education (c/- Billard Leece Partnership)
Biodiversity Development Assessment Report
New Warnervale Public School
Lot 71 DP7091 Warnervale Rd, Warnervale NSW

FIGURE:
7

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4.2.3 Candidate Threatened Fauna Surveys

The following candidate threatened fauna species were surveyed in the appropriate season, as per the BAM (**Table 9**).

Table 9: Survey of threatened fauna species

Species Name	Common Name	Survey Requirements	Survey Timing & Type
Amphibians			
Crinia tinnula	Wallum Froglet	All Year	February Spotlighting
Litoria aurea	Green and Golden Bell Frog	November to March	
Litoria brevipalmata	Green-thighed Frog	October to March	
Uperoleia mahonyi	Mahony's Toadlet	October to March	
Birds			
Burhinus grallarius	Bush Stone-curlew	All Year	February Spotlighting
Callocephalon fimbriatum	Gang-gang Cockatoo (Breeding)	October to January	Bird Surveys November
Calyptorhynchus lathami	Glossy Black-Cockatoo (Breeding)	March to August	Bird Surveys March
Hieraaetus morphnoides	Little Eagle (Breeding)	August to October	Nest survey September
Lophoictinia isura	Square-tailed Kite (Breeding)	September to January	Nest survey September
Pandion cristatus	Eastern Osprey (Breeding)	April to November	Nest survey September
Turnix maculosus	Red-backed Button-quail	All Year	February Spotlighting
Mammals			
Cercartetus nanus	Eastern Pygmy-possum	October to March	November to February Trapping (nest boxes)
Petaurus norfolcensis	Squirrel Glider	All Year	November to December & February Trapping & Spotlighting
Phascogale tapoatafa	Brush-tailed Phascogale	All year	November to December & February Trapping & Spotlighting
Planigale maculata	Common Planigale	All Year	November to December Trapping
Pteropus poliocephalus	Grey-headed Flying-fox	October to December	November to December Searches for camps
Reptiles			
Hoplocephalus bitorquatus	Pale-headed Snake	November to March	February Spotlighting

4.2.3.1 Survey Methodology

Arboreal Mammals

Ten Elliott B traps were placed in trees at heights of 3 m or above, along two transects (20 traps in total) and baited with a mixture of rolled oats, honey, peanut butter and treacle. The trunks of trees containing the traps were sprayed with a mixture of honey and water. Transect 1 was established within the Spotted Gum Ironbark Forest (Zone 1) and Transect 2 was established within the Narrabeen Buttondarry Footslopes Forest (Zone 3).

Traps were established on 27 November 2018 and checked daily for arboreal species for seven consecutive nights (traps collected 4 December 2018; total 140 trap nights).

Additionally, three Eastern Pygmy Possum nesting boxes were established within the site at approximately 1 m high. The boxes were set up on site from 27 November 2018 to 7 February 2018. Boxes were checked for signs of use through the presence of animals or nesting material.

Spotlighting was undertaken with random meanders for one-person hour using high-powered torches within the Study Area, on two separate nights (total 2 person hours) on 7 and 11 February 2019. Nocturnal spotlighting also included searches of blossoming trees to detect Megachiropteran bats.

Terrestrial Mammals

Twenty Elliott A traps were placed along two transects, as above, at regular intervals to capture small terrestrial mammal species (40 traps total). Traps were baited with a mix of rolled oats, honey, peanut butter and treacle and set for seven consecutive nights with checks for captures occurring each morning (timing as per arboreal trapping; total 280 trap nights).

Spotlighting was conducted on 7 and 11 February 2019 throughout the Study Area using high-powered torches. Searches targeted areas, which had been identified during daytime observations, containing signs of recent terrestrial mammal activity such as diggings, droppings or scratch marks.

Birds

Visual and auditory bird surveys was conducted within the site, focusing on the remnant vegetation areas (Zone 1 and 3). Two surveys were conducted within the Study Area, on the

5 and 14 March 2019. Surveys were conducted between 7:50 am and 9:00 am to increase detection of birds in the cooler parts of the day (when activity peaks). Species were identified visually with the aid of binoculars or aurally from call identification.

Amphibians and reptiles

Amphibian and nocturnal reptile surveys were carried out in conjunction with the nocturnal spotlighting for mammals on 7 and 11 February 2019. A total of 13 mm and 16 mm of rainfall was recorded in the 7 days prior to each of the surveys, respectively. Surveys were conducted via a general meander a there are no waterbodies present within the Study Area.

4.2.3.2 Fauna Survey Results

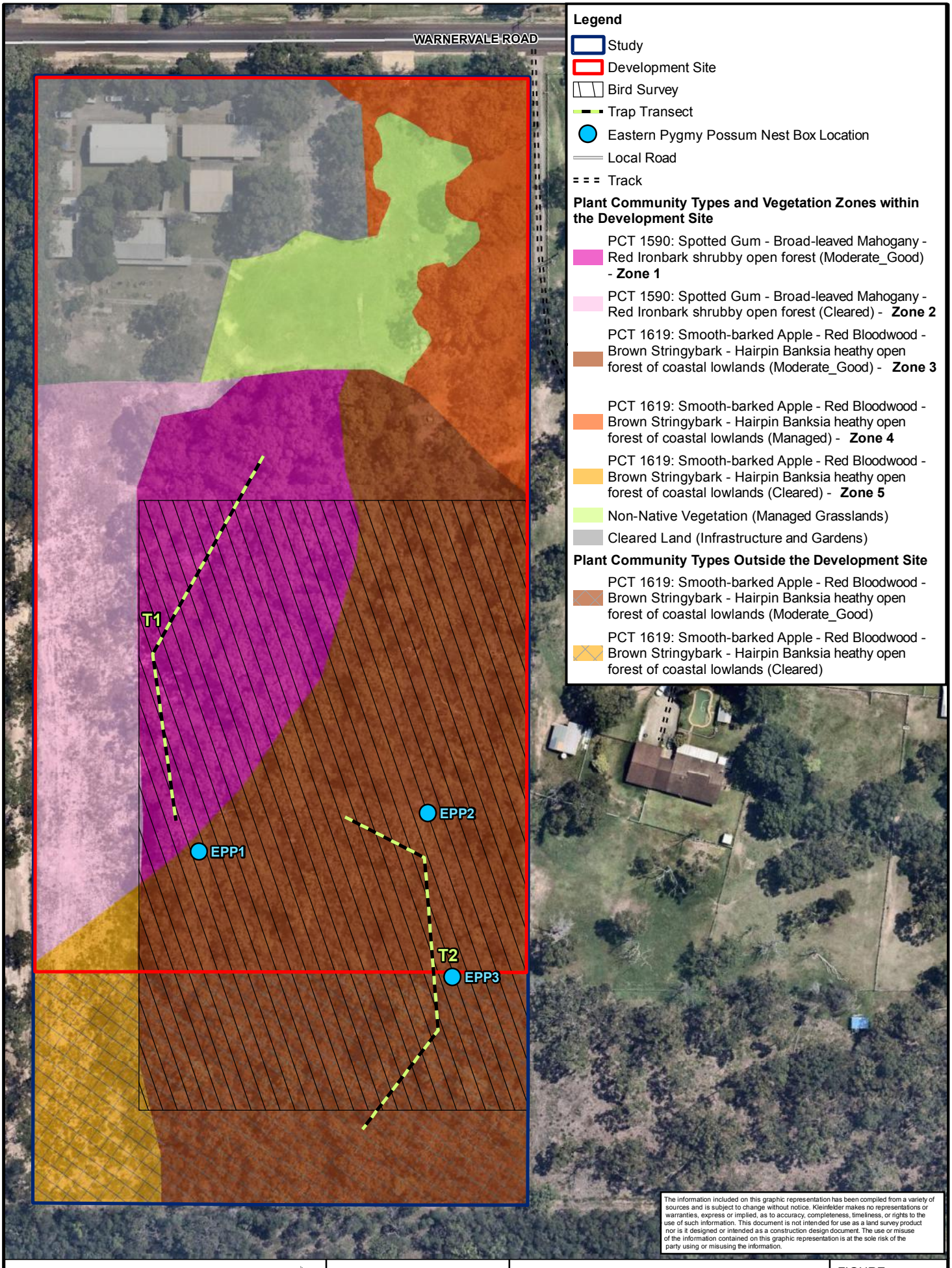
A total of 21 species of fauna were detected within the study area during field surveys (**Appendix 2**). This includes 15 bird, five mammal and one reptile species.

As no fauna species credit species were identified within the Study Area, no further assessment on fauna species credit species is required.

At the request of BCD, further information has been requested regarding the capture and identification of Sugar Gliders. A total of seven Sugar Gliders were captured within arboreal traps on:

- 30/11/18: one individual
- 01/12/18: two individuals
- 02/12/18: two individuals
- 03/12/18: one individual
- 04/12/18: one individual

Each of these animals was carefully examined by an experienced ecologist to ensure that misidentification did not occur, and that the species was not confused with similar species such as the Squirrel Glider, which are larger (up to twice the size of Sugar Gliders), with more prominent facial markings. Squirrel Gliders adults also have a bushier tail and a more pointed face.



Metres
0 5 10 20 30 40 50

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DATA SOURCE:
NSW DFSI - 2017
ADW Johnson - 2019
Nearmap - 2019

Fauna Survey Effort

NSW Department of Education (c/- Billard Leece Partnership)
Biodiversity Development Assessment Report
New Warnervale Public School
Lot 71 DP7091 Warnervale Rd, Warnervale NSW

FIGURE:

8

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5. AVOID AND MINIMISE IMPACTS ON BIODIVERSITY VALUES

5.1 AVOIDING AND MINIMISING IMPACTS DURING PROJECT PLANNING

5.1.1 Avoid and Minimise Impacts on Native Vegetation and Habitat

The proposed redevelopment of The New Primary School at Warnervale has been designed to avoid vegetation and species habitat removal, where possible. The location of buildings and infrastructure within the site has been positioned as far to the north of the site as possible, within already disturbed vegetation.

Billard Leece Partnership, on behalf of the NSW Department of Education, in consultation with Kleinfelder, has undertaken significant steps to avoid, minimise and mitigate impacts, as per the process outlined below:

- Identification of biodiversity values through comprehensive biodiversity surveys in accordance with the BAM (OEH 2017).

- Consultation between the design team and project ecologists to consider direct and indirect impacts and work through an iterative design process, with multiple design footprint versions to achieve a feasible project with the least biodiversity impact.

The initial redevelopment has been positioned with regard to the current Asset Protection Zone (APZ) restrictions form adjoin properties to the west and east. As such, buildings have been placed in the east and central portion of the development area in the north of the site. Future potential expansion has been proposed for the western portion of the site, however, this is only possible if the bushfire hazard to the west of the site is removed. As such, additional APZ setbacks to the south, within the property are required to allow for potential future expansion within the site.

5.1.2 Avoid and Minimise Impacts on Prescribed Biodiversity Impacts

The following are prescribed impacts which need to be considered as per section 8.2 of the BAM

Impact of development on the habitat of threatened species or ecological communities associated with significant geological features, human made structure or non-native vegetation.

No geological significant features, rocky areas, human made structures or non-native vegetation which provides habitat to threatened species or ecological communities were identified within the Study Area.

Impacts of the development on the connectivity of different habitat which facilities movement of threatened species

The Study Area is mapped as forming part of a larger corridor connecting Lake Macquarie to Gosford along the valley floor (lowlands). Locally the vegetation forms part of movement corridor connecting vegetation near Tuggerah Lake, at Tuggerawong, to vegetation in the west, across the rail corridor. Additionally, the vegetation on site provides connectivity to vegetation to the north of the site, surrounding Warnervale Athletic Field. The vegetation within the study area has the potential to contribute to the connectivity of different habitat types and allow the movement of threatened species.

In order to reduce the impact on locally occurring vegetation corridors, the proposed development has been placed as far to the north as possible, within the current APZ restrictions of the site.

Impact of the development on movement of threatened species that maintains their life cycle

The Study Area is unlikely to form part of a movement corridor that maintains the life cycle of threatened species.

Impacts of the development on water, quality, bodies and hydrological processes that sustain threatened species or ecological communities.

The proposal is unlikely to impact on water quality, bodies or hydrological processes. The closest stream is located over 400 m to the east of the Study Area.

Impact of wind turbine strikes on protected animals

Not applicable to the current application.

Impacts of vehicle strikes on threatened species or on animals that are part of a TEC

Not applicable to the current application.

5.2 ASSESSMENT OF IMPACTS

5.2.1 Impacts on Native Vegetation and Habitat

5.2.1.1 Direct Impacts

Within the Development Site, the proposal will impact on all native vegetation (total 2.66 ha of native vegetation). Each vegetation zone equates to one management zone; and the future value of each attribute (composition, structure, and function) and the vegetation integrity score for all management zones will be zero.

Where possible, within the APZ native vegetation will be retained and managed to APZ standards. However, due to the potential hazard this may cause from dropping limbs, and the potential requirement for future expansion into this area, if adjacent bushfire hazards remain, the partial reduction of vegetation scores within the APZ will not be possible.

5.2.1.2 Indirect Impacts

The proposal has the potential for edge effects on the retained vegetation in the south of the Study Area, and also to vegetation to adjacent to the site. Potential indirect impacts include:

- Increased weed invasion due to edge effects.
- Accidental incursions during clearing.
- Increase in dust during clearing works.
- Increase in noise during clearing works and operational phase.

These potential indirect impacts are likely to impact on the adjacent vegetation and habitat for threatened species associated with Vegetation Zone 3.

As the vegetation directly to the west and east of the Study Area have been previously managed, the potential for an increase of indirect impacts on these areas is minimised (i.e. already partially impacted from ongoing management).

5.2.2 Prescribed Impacts

The proposal has the potential to impact on one prescribed impact, impact on connectivity of different areas of habitat that facilitate the movement of threatened species across their range.

The Study Area is mapped as forming part of a larger corridor connecting Lake Macquarie to Gosford along the valley floor (lowlands). Locally the vegetation forms part of movement corridor connecting vegetation near Tuggerah Lake, at Tuggerawong, to vegetation in the west, across the rail corridor. Additionally, the vegetation on site provides connectivity to vegetation to the north of the site, surrounding Warnervale Athletic Field. This corridor has the potential to benefit ecosystem credit species associated with all vegetation zones.

The proposal is unlikely to impact on movement east-west between Tuggerah Lakes and vegetation to the west of the rail corridor, as retained vegetation within the Study Area and existing areas of vegetation to the south will still facilitate fauna movement. The corridor width to the south of the Development Site will be maintained at approximately 200 m wide.

Due to the removal of a small area of vegetation within the Development Site (total of 2.21 ha from those zones containing linking canopy trees - Zone 1, 3 and 4).

5.3 MITIGATING AND MANAGING IMPACTS ON BIODIVERSITY VALUES

A site-specific Management Plan will be prepared prior to commencement of any clearing or construction works to ensure that impacts are minimised. This should include the measures outlined in **Table 10**.

Table 10: Mitigation Measures for the Proposal

Impact	Action and Outcome	Responsibility	Timing
Direct / Prescribed Impacts			
Clearing of native vegetation	• Minimise clearing where possible through retaining vegetation within the APZ and site design. • Identify and clearing mark 'No-Go Zones' (retained vegetation and site boundary). • Install signage along clearing boundary.	Construction site manager	Prior to and during vegetation clearing.
Removal of hollow-bearing trees / habitat trees, resulting in fauna injury and mortality.	• Limit removal of hollow-bearing trees, where possible. • Best practice habitat tree removal procedure be included in management plan and followed during clearing.	Construction site manager and suitably qualified/trained fauna handler.	Prior to and during tree clearing.
Indirect Impacts			
Transfer of weeds and pathogens to and from site.	• Use of appropriate wash down procedures and facilities for vehicles and equipment.	Construction site manager	During vegetation clearing and construction.
Accidental incursions during clearing	• Identify and clearing mark 'No-Go Zones' (retained vegetation and site boundary). • Install signage along clearing boundary.	Construction site manager	During vegetation clearing and construction.
Increase in dust and noise during clearing works	• Limit exposure of bare ground during clearing. • Reduce machinery noise where possible during clearing.	Construction site manager	During vegetation clearing and construction.

6. IMPACT SUMMARY

6.1 SERIOUS AND IRREVERSIBLE IMPACTS

No threatened flora or fauna species, or threatened ecological communities were identified within the Study Area. As such, no further assessment of Serious and Irreversible Impacts is required.

6.2 IDENTIFICATION OF IMPACTS REQUIRING OFFSETS

This section provides an assessment of the impacts requiring offsetting in accordance with Section 10.3 of the BAM (2017).

6.2.1 Impacts on Native Vegetation (Ecosystem Credits)

Of the five native vegetation zones within the Development Site, impacts on four are required to be offset as they are above the vegetation integrity score threshold of $\geq$ 17. One vegetation zone, Zone 2, does not require offsets as its Vegetation Integrity Score was below 17. A summary of the ecosystem credit requirements is provided in **Table 11**.

Table 11: Summary of ecosystem credit requirements

Vegetation Zone	Vegetation Zone Name	Area (ha)	Current Vegetation Integrity Score	Future Vegetation Integrity Score	Credits Required
1	1590 Mod_Good	0.65	72.5	0	18
2	1590 Cleared	0.49	16.4	0	0
3	1619 Mod_Good	1.15	56.8	0	24
4	1619 Managed	0.32	41	0	5
5	1619 Cleared	0.04	20.9	0	1

A total of 48 ecosystem credits are required for the proposed development; 18 credits to offset impacts on PCT 1590, and 30 credits to offset impacts on PCT 1619. The biodiversity credit report is provided in **Appendix 5**.

6.2.2 Impacts on threatened species

No species credits are required.

7. ASSESSMENT OF BIODIVERSITY LEGISLATION

7.1 *ENVIRONMENT AND BIODIVERSITY CONSERVATION ACT 1999*

A database search of relevant threatened species databases and an assessment of the likelihood of occurrence of threatened and migratory species is provided in **Appendix 3**. No threatened ecological communities, or migratory species, listed under the EPBC Act were identified within the Study Area. One threatened species, Grey-headed Flying-fox was observed foraging within the Study Area during spotlighting. No Grey-headed Flying-fox camps were identified within the Study Area. As the proposal will only impact on foraging habitat and considering the highly mobile nature of the species, it is unlikely that the proposal will have a significant impact on this Vulnerable species.

Additionally, there is the potential for the proposal to impact on foraging habitat for the Swift Parrot, and the site was assessed as potential habitat for the Fork-tailed Swift, White-throated Needletail and Black-faced Monarch. As the proposal will only impact on a small area of marginal/foraging habitat for these highly mobile species, it is unlikely there will be a significant impact on these species. As such, a referral to the Commonwealth Minister for the Environment is not considered necessary.

7.2 SEPP 44 – KOALA HABITAT PROTECTION

One Koala feed tree species, *Eucalyptus haemastoma*, was identified within the Study Area. This species only occurs as isolated individuals and does not constitute greater than 15% of the total number of trees in the upper or lower strata within the Study Area. As such, the Study Area does not constitute potential Koala habitat, and no further assessment under the SEPP is required.

7.2.1 Proposed Amendment to SEPP 44

The identification of Koala habitat under the proposed amended SEPP is through two methods, presence of feed trees and presence of Koalas. Based on the proposed updated tree species list under the SEPP, none of the tree species identified within the Study Area are on the updated list. The one tree species, *Eucalyptus haemastoma* (Scribbly Gum), is not proposed

to be listed under the amended SEPP. As such, an assessment under the proposed amended SEPP would conclude that there are no feed trees present within the Study Area.

The second method for identification of Koala habitat is the presence of Koalas. The Explanation of Intended Effect does not outline the proposed amended development assessment process, as such the exact survey requirements are not known. However, for the current assessment, as Potential Koala habitat was not identified, targeted surveys for the species were not conducted. This process may not be compliant with the new guidelines. However, the likelihood of the species occurring within the Study Area, and there for the site being assessed as Koala habitat, is low due to the lack of feed trees and low number of recent records of the species in the locality, with only one record from the past 10 years; 20 2013 approximately 5 km to the south-west of the site, near Wyong. The other eight records in the locality are all greater than 10 years old (ranging from 1916 to 2007).

As such, it is unlikely that the site would be assessed as Koala habitat under the proposed amendment to SEPP 44.

7.3 *BIOSECURITY ACT 2015* (NSW)

Species which require control within the retained vegetation in the Study Area, and which will require control to ensure they are not spread due to works, include the high threat species; *Asparagus aethiopicus* (Ground Asparagus), *Senna pendula* var. *glabrata, Lantana camara* (Lantana) and *Ligustrum sinense* (Small-leaved Privet).

8. REFERENCES

Bell, S.A.J. (2002). *The natural vegetation of the Wyong Local Government Area, Central Coast, New South Wales: Vegetation Community Profiles*. Unpublished Final Report to Wyong Shire Council, December 2002. Eastcoast Flora Survey.

DECC (2002). *Descriptions for NSW (Mitchell) Landscapes, Version 2*. Department of Environment and Climate Change NSW.

Eco Logical Australia (2016). *Wyong Vegetation Map 2016 V1.* Prepared for Wyong Shire Council.

Forest Fauna Surveys (1999) *Distribution of Large Forest Owls in the City of Lake Macquarie*. Report to Lake Macquarie City Council by Forest Fauna Surveys Pty Ltd.

Kavanagh, R. (2003). *Status and conservation of owls and arboreal mammals on the Central Coast of NSW, and field techniques for surveys*. Workshop for Landcare groups and planners from Lake Macquarie, Wyong and Gosford Local Government Areas.

Lake Macquarie City Council (2014). *Large Forest Owl Planning and Management Guidelines*. Retrieved from https://www.lakemac.com.au/

Murphy, C. L. (1993). *Soil Landscapes of the Gosford-Lake Macquarie 1:100,000 Sheet Map and Report,* Department of Conservation and Land Management, Sydney.

NSW Department of Environment and Conservation (DEC) (2006) Recovery Plans for the Large Forest Owls: Powerful Owl (*Ninox strenua*), Sooty Owl (*Tyto tenebricosa*), Masked Owl (*Tyto novaehollandiae*). Retrieved from https://www.environment.nsw.gov.au/research-and-publications/publications-search/recovery-plan-for-the-large-forest-owls

NSW Threatened Species Scientific Committee (2019). *Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions - endangered ecological community listing*. Department of Industry, Planning and Environment Website, Accessed: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Scientific-Committee/Determinations/2019/lower-hunter-spotted-gum-ironbark-forest-

final-determination-EEC.pdf?la=en&hash=45284937A71F0175AF94955070E93778C784AA0F

Office of Environment and Heritage (OEH) (2016). *NSW Guide to Surveying Threatened Plants*. Goulburn Street Sydney, NSW.

Scott, D. (2003) *Key Habitats and Corridors for Forest Fauna: A Landscape Framework for Conservation in North-east New South Wales.* NSW NPWS Occasional Paper 32, NSW National Parks and Wildlife Services, Sydney.

APPENDIX 1. SITE CONCEPT DESIGN

APPENDIX 2. FLORA AND FAUNA SPECIES LIST

Flora Species List

Family	Scientific Name	Common Name	Q1		Q2		Q3		Q4		Q6	
			FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab
Exotic Species												
Araliaceae	*Hydrocotyle bonariensis*	Largeleaf Pennywort			0.1	11						
Asparagaceae	*Asparagus aethiopicus*	Ground Asparagus	0.1	1			0.1	5				
Asparagaceae	*Asparagus virgatus*	Asparagus Fern					0.1	3				
Asteraceae	*Conyza bonariensis*	Flaxleaf Fleabane	0.1	5	0.1	100						
Asteraceae	*Gamochaeta purpurea*	Purple Cudweed			0.1	20						
Asteraceae	*Hypochaeris radicata*	Catsear			0.1	50					0.5	30
Asteraceae	*Sonchus oleraceus*	Common Sowthistle			0.1	10						
Asteraceae	*Taraxacum officinale*	Dandelion									0.5	20
Caesalpinioideae	*Senna pendula* var. *glabrata*				0.1	10						
Iridaceae	*Watsonia meriana*				0.1	1						
Malvaceae	*Sida rhombifolia*	Paddy's Lucerne			0.1	10						
Oleaceae	*Ligustrum sinense*	Small-leaved Privet	0.1	2			0.1	5				
Plantaginaceae	*Plantago lanceolata*	Lamb's Tongues			0.1	50						
Poaceae	*Andropogon virginicus*	Whiskey Grass			0.1	20					0.5	30
Poaceae	*Axonopus fissifolius*	Narrow-leafed Carpet Grass	0.5	10	0.1	10					15	100
Poaceae	*Cenchrus clandestinus*	Kikuyu Grass			0.1	10						

Family	Scientific Name	Common Name	Q1		Q2		Q3		Q4		Q6	
			FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab
Poaceae	*Paspalum dilatatum*	Paspalum	0.1	5	0.1	1					0.5	20
Rubiaceae	*Richardia stellaris*						0.1	5			0.2	5
Verbenaceae	*Lantana camara*	Lantana					0.1	2				
Native Species												
Acanthaceae	*Brunoniella australis*	Blue Trumpet	0.1	20	0.1	10	0.1	20	0.1	20		
Anthericaceae	*Laxmannia gracilis*	Slender Wire Lily			0.1	100					0.2	10
Anthericaceae	*Thysanotus tuberosus*	Common Fringe Lily	0.1	10	0.1	100	0.1	10	0.1	20	0.1	5
Anthericaceae	*Tricoryne elatior*	Yellow Autumn-lily									0.1	5
Apiaceae	*Centella asiatica*	Indian Pennywort	0.1	5	0.1	100						
Apocynaceae	*Parsonsia straminea*	Common Silkpod	0.2	5			0.1	20				
Araliaceae	*Trachymene incisa*	-					0.1	1				
Asteraceae	*Coronidium scorpioides*	Button Everlasting			0.1	10						
Asteraceae	*Cyanthillium cinereum*	Iron Weed	0.1	5			0.1	1				
Asteraceae	*Lagenophora stipitata*	Blue Bottle-daisy	0.2	30								
Asteraceae	*Ozothamnus diosmifolius*	Rice flower			0.1	50						
Asteraceae	*Sphaeromorphaea australis*	Spreading Nut-heads			0.1	100			0.1	20	0.1	1
Casuarinaceae	*Allocasuarina littoralis*	Black She-oak	1	5			1	10	0.1	50	2	1
Convolvulaceae	*Dichondra repens*	Kidney Weed	0.2	20								
Convolvulaceae	*Polymeria calycina*		0.1	5								
Cyperaceae	*Chorizandra cymbaria*											
Cyperaceae	*Cyperus eragrostis*	Umbrella sedge			0.1	10						
Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-sedge			0.1	100						
Cyperaceae	*Gahnia radula*		10	40	0.1	50	40	200	55	100	5	50
Cyperaceae	*Lepidosperma filiforme*											

Family	Scientific Name	Common Name	Q1		Q2		Q3		Q4		Q6	
			FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab
Cyperaceae	*Lepidosperma laterale*		0.2	5	0.1	50	0.2	5			2	20
Cyperaceae	*Ptilothrix deusta*		40	1000	0.1	50	10	500			0.1	10
Cyperaceae	*Schoenus apogon*	Common Bog-rush			20	500			0.1	50	0.2	20
Dennstaedtiaceae	*Pteridium esculentum*	Common Bracken							0.1	10		
Dilleniaceae	*Hibbertia diffusa*	Wedge Guinea Flower			0.1	10						
Dilleniaceae	*Hibbertia empetrifolia*				0.1	10	0.2	10	0.1	10		
Fabaceae (Faboideae)	*Bossiaea rhombifolia*						1	10				
Fabaceae (Faboideae)	*Daviesia ulicifolia*	Gorse Bitter Pea	0.1	5	0.1	10						
Fabaceae (Faboideae)	*Glycine clandestina*		0.2	20			0.1	10			0.1	5
Fabaceae (Faboideae)	*Glycine tabacina*				0.1	100						
Fabaceae (Faboideae)	*Hardenbergia violacea*	Purple Coral Pea			0.1	10			0.1	10		
Fabaceae (Faboideae)	*Mirbelia rubiifolia*	Heathy Mirbelia					0.1	10			0.2	10
Fabaceae (Faboideae)	*Podolobium scandens*	Netted Shaggy Pea	0.2	10	0.1	20						
Fabaceae (Faboideae)	*Pultenaea rosmarinifolia*				0.1	10						
Fabaceae (Mimosoideae)	*Acacia falcata*	Hickory Wattle			0.1	10			0.1	10		
Fabaceae (Mimosoideae)	*Acacia longifolia* subsp. *longifolia*	Sydney golden wattle	0.2	5	0.1	1						

Family	Scientific Name	Common Name	Q1		Q2		Q3		Q4		Q6	
			FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab
Goodeniaceae	*Goodenia heterophylla* subsp. *eglandulosa*				0.1	50						
Goodeniaceae	*Goodenia paniculata*	Branched Goodenia							0.1	10	1	40
Haemodoraceae	*Haemodorum planifolium*		0.1	5	0.1	20						
Haloragaceae	*Gonocarpus micranthus* subsp. *micranthus*								0.1	1		
Haloragaceae	*Gonocarpus teucrioides*	Raspwort	0.2	20	0.1	500	0.1	30	0.1	10	0.2	20
Hypericaceae	*Hypericum gramineum*	Small St. Johns Wort			0.1	100					0.2	30
Iridaceae	*Patersonia sericea*	Silky Purple-flag					0.1	5			0.1	5
Juncaceae	*Juncus continuus*				1	1						
Lauraceae	*Cassytha pubescens*		0.5	20	0.1	100	0.2	10	0.1	20	0.1	1
Lindsaeaceae	*Lindsaea linearis*	Screw fern							1	10		
Lindsaeaceae	*Lindsaea microphylla*	Lacy Wedge Fern					0.1	2				
Lobeliaceae	*Lobelia purpurascens*	Whiteroot	0.5	50	0.1	100	0.1	20			0.2	30
Lomandraceae	*Lomandra filiformis*	Wattle Mat-rush	0.1	1							0.1	5
Lomandraceae	*Lomandra glauca*	Pale Mat-rush					0.1	5				
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush			0.1	20						
Lomandraceae	*Lomandra multiflora* subsp. *multiflora*	Many-flowered Mat-rush	0.1	5	0.1	50	0.1	5	0.1	10		
Myrtaceae	*Angophora costata*	Sydney Red Gum	4	3			10	2			15	2
Myrtaceae	*Corymbia gummifera*	Red Bloodwood					10	2				
Myrtaceae	*Corymbia maculata*	Spotted Gum	25	8	0.1	20						
Myrtaceae	*Eucalyptus capitellata*	Brown Stringybark							0.1	1	20	3
Myrtaceae	*Eucalyptus eugenioides*		35	8	0.1	1	10	3			2	1
Myrtaceae	*Eucalyptus fibrosa*		2	1			10	6				

Family	Scientific Name	Common Name	Q1		Q2		Q3		Q4		Q6	
			FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab
Myrtaceae	*Eucalyptus haemastoma*	Scribbly Gum										
Myrtaceae	*Eucalyptus umbra*	Broad-leaved White Mahogany										
Myrtaceae	*Melaleuca decora*				0.1	50	1	5	0.1	1		
Myrtaceae	*Melaleuca nodosa*		30	25			80	50			10	10
Myrtaceae	*Melaleuca sieberi*											
Orchidaceae	*Caladenia carnea*	Pink Fairy										
Orchidaceae	*Calochilus robertsonii*	Purplish Beard Orchid										
Orchidaceae	*Cryptostylis subulata*	Large Tongue Orchid			0.1	1	0.1	5				
Orchidaceae	*Genoplesium fimbriatum*	Fringed Midge Orchid										
Orchidaceae	*Thelymitra pauciflora*	Slender Sun Orchid										
Phormiaceae	*Dianella caerulea* var. *caerulea*	Blue Flax-Lily	0.1	5	0.1	50	0.1	5	0.1	10	0.1	5
Phyllanthaceae	*Glochidion ferdinandi*	Cheese Tree					0.5	10			0.1	1
Phyllanthaceae	*Phyllanthus hirtellus*	Thyme Spurge	0.2	30			0.2	20			0.2	20
Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry	0.1	5			0.1	10			0.1	5
Pittosporaceae	*Pittosporum undulatum*	Mock Orange					0.1	1				
Poaceae	*Aristida vagans*	Threeawn Speargrass	0.1	5							0.1	10
Poaceae	*Austrostipa pubescens*				0.1	50	0.1	5			0.1	5
Poaceae	*Cynodon dactylon*	Couch	0.1	5	0.1	10						
Poaceae	*Dichelachne micrantha*	Shorthair Plumegrass	0.1	10	1	20	0.1	5			0.2	20
Poaceae	*Echinopogon caespitosus*	Bushy Hedgehog-grass									0.1	20
Poaceae	*Entolasia stricta*	Wiry Panic	10	200	35	50	10	50	10	100	5	50
Poaceae	*Eragrostis brownii*	Brown's Lovegrass	0.1	5							0.2	20
Poaceae	*Imperata cylindrica*	Blady Grass									1	30

Family	Scientific Name	Common Name	Q1		Q2		Q3		Q4		Q6	
			FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab
Poaceae	*Microlaena stipoides* var. *stipoides*	Weeping Grass	5	50	0.1	100	5	500			1	100
Poaceae	*Panicum effusum*	Hairy Panic			0.1	100						
Poaceae	*Panicum simile*	Two-colour Panic	0.1	5	0.1	100					0.5	40
Poaceae	*Poa labillardierei* var. *labillardierei*	Tussock	0.2	5							0.5	10
Poaceae	*Rytidosperma pilosum*		0.1	20	0.1	20					0.2	30
Poaceae	*Rytidosperma setaceum*	Smallflower Wallaby Grass			0.1	20						
Poaceae	*Themeda triandra*	Kangaroo Grass	5	50	15	500					15	50
Polygalaceae	*Comesperma ericinum*	Pyramid Flower	0.1	5	0.1	50						
Polygonaceae	*Rumex brownii*	Swamp Dock			0.1	10						
Proteaceae	*Banksia spinulosa*	Hairpin Banksia					0.1	2	0.1	1		
Proteaceae	*Grevillea humilis* subsp. *humilis*	Linear-leaf Grevillea	0.2	10			0.1	10				
Proteaceae	*Hakea sericea*	Needlebush	0.1	1	0.1	10						
Proteaceae	*Persoonia levis*	Broad-leaved Geebung					0.2	5	5	5		
Pteridaceae	*Cheilanthes sieberi*	Poison Rock Fern	0.1	10			0.1	20				
Restionaceae	*Lepyrodia scariosa*								0.1	10	5	50
Rubiaceae	*Opercularia diphylla*				0.1	50	0.1	20	0.1	20		
Stylidiaceae	*Stylidium graminifolium*	Grass Trigger-plant	0.1	5							0.1	5
Thymelaeaceae	*Pimelea linifolia*	Slender Rice Flower	1	20	0.1	50	0.1	10	0.1	100	0.2	10
Xanthorrhoeaceae	*Xanthorrhoea latifolia*		10	30			1	10				

Fauna Species List

Scientific Name	Common Name	Status
Birds		
Cacatua galerita	Sulphur-crested Cockatoo	-
Calyptorhynchus funereus	Yellow-tailed Black-cockatoo	-
Chenonetta jubata	Australian Wood Duck	-
Corvus coronoides	Australian Raven	-
Cracticus torquatus	Grey Butcher Bird	-
Dacelo novaeguineae	Laughing Kookaburra	-
Eolophus roseicapilla	Galah	-
Eopsaltria australis	Little Yellow Robin	-
Eurostopodus mystacalis	White Throated Nightjar	-
Grallina cyanoleuca	Magpie Lark	-
Gymnorhina tibicen	Australian Magpie	-
Manorina melanocephala	Noisy Miner	-
Ocyphaps lophotes	Crested pigeon	-
Platycercus eximius	Eastern Rosella	-
Trichoglossus moluccanus	Rainbow Lorikeet	-
Mammals		
Antechinus stuartii	Brown Antechinus	-
Mus musculus	House Mouse	Introduced
Petaurus breviceps	Sugar Glider	-
Pseudocheirus peregrinus	Ringtail Possum	
Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable (BC Act & EBC Act)
Reptiles		
Amphibolurus muricatus	Jacky Dragon	-

APPENDIX 3. THREATENED SPECIES DATABASE SEARCH

A list of threatened species, populations and ecological communities that have been reported or modelled to occur from within a five-kilometre radius of the study area was obtained from the following databases:

- NSW Office of Environment and Heritage (OEH) BioNet Atlas: (http://www.bionet.nsw.gov.au/); and
- Department of Environment and Energy (DoTEE) Protected Matters search tool: (www.environment.gov.au/erin/ert/epbc/index.html).

An assessment was then made of the likelihood of the threatened species, populations, and / or ecological communities reported or modelled to occur in the locality occurring within the study area or using the habitat within the study area as an essential part of a foraging range.

This assessment was conducted prior to field surveys and is based on the potential for the species to occur based on habitat requirements. The table below summarises the likelihood of threatened species and EPBC Act listed migratory species occurring within the study area based on the habitat requirements of each species. A brief definition of the likelihood of occurrence criteria is provided below:

- High – species known from the area (OEH Wildlife Atlas records), suitable habitat (such as roosting and foraging habitat) present within the site;
- Moderate – species may be known from the area, potential habitat is present within the site;
- Low – species not known from the area and/or marginal habitat is present within the site; and
- Nil – habitat requirements not met for this species within the site.

An assessment of the likelihood of threatened species, populations and ecological communities occurring within the study area (assessment conducted prior to field surveys)

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence
		BC Act	EPBC Act				
Flora							
1.	*Angophora inopina* Charmhaven Apple	V	V	2657	OEH Atlas / BioNet / PMST	Occurs most frequently in four main vegetation communities: (i) *Eucalyptus haemastoma–Corymbia gummifera–Angophora inopina* woodland/forest; (ii) *Hakea teretifolia–Banksia oblongifolia* wet heath; (iii) *Eucalyptus resinifera–Melaleuca sieberi–Angophora inopina* sedge woodland; (iv) *Eucalyptus capitellata–Corymbia gummifera–Angophora inopina* woodland/forest.	Low
2.	*Astrotricha crassifolia* Thick-leaf Star-hair	V	V	-	BioNet	Occurs in dry sclerophyll woodland on sandstone.	Low
3.	*Caladenia tessellata* Thick Lip Spider Orchid	E	V	2	OEH Atlas / BioNet / PMST	Generally found in grassy sclerophyll woodland on clay loam or sandy soils.	Low
4.	*Callistemon linearifolius* Netted Bottle Brush	V	-	4	OEH Atlas / BioNet	Grows in dry sclerophyll forest on the coast and adjacent ranges.	Low
5.	*Corunastylis sp.* Charmhaven	CE	CE	96	OEH Atlas / PMST	It occurs within low woodland to heathland with a shrubby understorey and ground layer. Dominants include Black She-oak (*Allocasuarina littoralis*), Prickly Tea-tree (*Leptospermum juniperinum*), Prickly-leaved Paperbark (*Melaleuca nodosa*), Narrow-leaved Bottlebrush (*Callistemon linearis*) and Zig-zag Bog-rush (*Schoenus brevifolius*).	**Moderate - Low**

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence
		BC Act	EPBC Act				
6.	*Cryptostylis hunteriana* Leafless Tongue Orchid	V	V	3	OEH Atlas / BioNet / PMST	Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. The larger populations typically occur in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black Sheoak (*Allocasuarina littoralis*); appears to prefer open areas in the understorey of this community.	**Low - Moderate**
7.	*Cynanchum elegans* White- flowered Wax Plant	E	E	-	OEH Atlas / PMST / BioNet	Occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree *Leptospermum laevigatum* – Coastal Banksia *Banksia integrifolia* subsp. *integrifolia* coastal scrub; Spotted Gum *Corymbia maculata* aligned open forest and woodland; and Bracelet Honeymyrtle *Melaleuca armillaris* scrub to open scrub.	Low
8.	*Darwinia glaucophylla* -	V	-	-	BioNet	Occurs in sandy heath, scrub and woodlands often associated with sandstone rock platforms or near hanging swamps and friable sandstone shallow soils.	Nil
9.	*Diuris bracteata* -	E	Ex	-	BioNet	Dry sclerophyll woodland and forest with a predominantly grassy understorey.	Low
10.	*Diuris praecox* Newcastle Doubletail	V	V	-	BioNet	Grows on hills and slopes of near-coastal districts in open forests which have a grassy to fairly dense understorey.	Low
11.	*Eucalyptus camfieldii* Camfield's Stringybark	V	V	7	OEH Atlas / BioNet / PMST	Found from Tomago to the Royal National Park and in this range it is found in scattered, small, clustered populations. Preferred soil types are sandy coastal or sandstone soils.	Low
12.	*Hibbertia procumbens* Spreading Guinea Flower	E	-	-	BioNet	Majority of known populations occur within *Banksia ericifolia–Angophora hispida–Allocasuarina distyla* scrub/heath on skeletal sandy soils. May also be found associated with 'hanging swamp' vegetation communities on sandy deposits.	Nil

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence
		BC Act	EPBC Act				
13.	*Melaleuca groveana* Grove's Paperbark	V	-	-	BioNet	Grows in heath and shrubland, often in exposed sites, in low coastal hills, escarpment ranges and tablelands on outcopping granite, rhyolite and sandtone on rocky outcrops and cliffs. It also occurs in dry srubby open forest and woodlands.	Low
14.	*Prostanthera askania* Tranquility Mintbush	E	E	1	OEH Atlas, BioNet	Occurs adjacent to, but not immediately in, drainage lines on flat to moderately steep slopes formed on Narrabeen sandstone and alluvial soils derived from it. Occurs in moist sclerophyll forest and warm temperate rainforest communities, and the ecotone between them.	Low
15.	*Prostanthera junonis* Somersby Mintbush	E	E	-	BioNet	The species is restricted to the Somersby Plateau. It occurs on both the Somersby and Sydney Town soil landscapes on gently undulating country over weathered Hawkesbury sandstone within open forest/low woodland/open scrub. It occurs in both disturbed and undisturbed sites.	Nil
16.	*Rutidosis heterogama* Heath Wrinklewort	V	V	172	OEH Atlas, BioNet, PMST	Grows in heath on sandy soils and moist areas in open forest, and has been recorded along disturbed roadsides.	**Moderate - Low**
17.	*Senna acclinis* Rainforest Cassia	E	-	-	BioNet	Grows on the margins of subtropical, littoral and dry rainforests.	Nil
18.	*Tetratheca glandulosa* -	V	-	-	BioNet	Vegetation structure varies from heaths and scrub to woodlands/open woodlands, and open forest. Vegetation communities correspond broadly to Benson & Howell's Sydney Sandstone Ridgetop Woodland (Map Unit 10ar).	Nil
19.	*Tetratheca juncea* Black-eyed Susan	V	V	117	OEH Atlas, BioNet, PMST	Grows in sandy, occasionally swampy heath and in dry sclerophyll forest; chiefly in coastal districts from Bulahdelah to Lake Macquarie.	**Low - Moderate**

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence
		BC Act	EPBC Act				
20.	*Thelymitra adorata* Wyong Sun-Orchid	CE	CE	80	OEH Atlas / PMST	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.	**Moderate - Low**
Amphibians							
1.	*Helioporus australiacus* Giant Burrowing Frog	V	V	-	BioNet / PMST	Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. Spends more than 95% of its time in non-breeding habitat in areas up to 300 m from breeding sites. Whilst in non-breeding habitat it burrows below the soil surface or in the leaf litter.	Low
2.	*Litoria brevipalmata* Green-thighed Frog	V	-	3	OEH Atlas / PMST / BioNet	Occur in a range of habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath, typically in areas where surface water gathers after rain. It prefers wetter forests in the south of its range, but extends into drier forests in northern NSW and southern Queensland.	Low
3.	*Litoria aurea* Green and Golden Bell Frog	E	V	5	OEH Atlas / PMST / BioNet	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available.	Low
4.	*Mixophyes iteratus* Giant Barred Frog	E	E	1	OEH Atlas / PMST / BioNet	Found along freshwater streams with permanent or semi-permanent water, generally (but not always) at lower elevation. Moist riparian habitats such as rainforest or wet sclerophyll forest are favoured for the deep leaf litter that they provide for shelter and foraging, as well as open perching sites on the forest floor. However, will also sometimes occur in other riparian habitats, such as those in drier forest or degraded riparian remnants, and even occasionally around dams.	Low

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence
		BC Act	EPBC Act				
5.	*Mixophyes balbus* Stuttering Frog	E	V	-	OEH Atlas / PMST / BioNet	Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Outside the breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor.	Low
Birds							
1.	*Anthochaera phrygia* Regent Honeyeater	CE	CE	-	PMST / BioNet	Inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes.	Low
2.	*Burhinus grallarius* Bush Stone-curlew	E	-	-	BioNet	Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Largely nocturnal, being especially active on moonlit nights.	Low
3.	*Callocephalon fimbriatum* Gang-gang Cockatoo	V	-	1	OEH Atlas	In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas.	Low
4.	*Calyptorhynchus lathami* Glossy Black-Cockatoo	V	-	16	OEH Atlas	Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of she-oak species, particularly Black She-oak, Forest She-oak, or Drooping She-oak occur. **Marginal foraging habitat due to presence of *Allocasuarina littoralis in the south-east portion of the site.***	**Low - Moderate**
5.	*Lathamus discolor* Swift Parrot	CE	CE	13	OEH Atlas, PMST	This migratory species has been recorded on the mainland from a variety of habitat types including dry and wet sclerophyll forest, forested wetlands, coastal swamp forests and heathlands.	**Low - Moderate**

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence
		BC Act	EPBC Act				
6.	*Hieraaetus morphnoides* Little Eagle	V	-	3	OEH Atlas	Occupies open eucalypt forest, woodland or open woodland. Sheoak or *Acacia* woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter.	Low
7.	*Lophoictinia isura* Square-tailed Kite	V	-	-	BioNet	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. Breeding is from July to February, with nest sites generally located along or near watercourses, in a fork or on large horizontal limbs.	Low
8.	*Ninox connivens* Barking Owl	V	-	3	OEH Atlas	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas.	Low
9.	*Ninox strenua* Powerful Owl	V	-	33	OEH Atlas	The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine, Black She-oak, Blackwood, Rough-barked Apple, Cherry Ballart and a number of eucalypt species. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old.	**Low - Moderate**
10.	*Tyto novaehollandiae* Masked Owl	V	-	13	OEH Atlas	Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.	**Low - Moderate**

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence
		BC Act	EPBC Act				
Mammals							
1.	*Cercatetus nanus* Eastern Pygmy-possum	V	-	1	OEH Atlas	Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest.	Low
2.	*Chalinolobus dwyeri* Large-eared Pied Bat	V	V	2	OEH Atlas / PMST	Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (Petrochelidon ariel), frequenting low to mid-elevation dry open forest and woodland close to these features.	Low
3.	*Macropus parma* Parma Wallaby	V	-	-	BioNet	Preferred habitat is moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest.	Low
4.	*Miniopterus australis* Little Bentwing-bat	V	-	22	OEH Atlas / BioNet	Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally, found in well-timbered areas.	**Moderate**
5.	*Miniopterus schreibersii oceanensis* Eastern Bentwing-bat	V	-	42	OEH Atlas / BioNet	Forages in forested habitats. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures.	**Moderate**
6.	*Myotis macropus* Southern Myotis	V	-	16	OEH Atlas / BioNet	Generally, roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface.	**Low - Moderate**

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence
		BC Act	EPBC Act				
7.	*Petaurus norfolcensis* Squirrel Glider	V	-	79	OEH Atlas	Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. **Marginal roosting and breeding habitat due to a low density of hollows and lack of old growth forest. Typically require an intact midstorey containing foraging resources such as *Banksia sp*, which is not present within the study area. However, there are many records in close proximity of the site and it is possible that the site may be used opportunistically when desired food species are flowering or producing sap.**	**High**
8.	*Petrogale penicillata* Brush-tailed Rock-wallaby	E	V	-	BioNet / PMST	Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. Browses on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees.	Nil
9.	*Phascogale tapoatafa* Brush-tailed Phascogale	V	-	-	BioNet	Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest. Agile climber foraging preferentially in rough barked trees of 25 cm DBH or greater.	Low
10.	*Phascolarctos cinereus* Koala	V	V	2	OEH Atlas / PMST	Found in a variety of forest types with suitable feed tree species.	Low
11.	*Planigale maculata* Common Planigale	V	-	-	BioNet	Inhabit rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover, and usually close to water.	Low

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence
		BC Act	EPBC Act				
12.	*Pteropus poliocephalus* Grey-headed Flying-fox	V	V	24	OEH Atlas, PMST	Occurs across a wide range of habitat types along the eastern seaboard of Australia, depending on food availability. Fruit from myrtaceous trees and rainforest trees form the major components of their diet. **Potential foraging within canopy gums. No camps present.**	**Moderate**
13.	*Vespadelus troughtoni* Eastern Cave Bat	V	-	2	OEH Atlas	A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals.	Low
Reptiles							
1.	*Hoplocephalus bitorquatus* Pale-headed Snake	V	-	1	BioNet	Highly cryptic species that can spend weeks at a time hidden in tree hollows. Found mainly in dry eucalypt forests and woodlands, cypress forest and occasionally in rainforest or moist eucalypt forest.	Low
2.	*Hoplocephalus stephensii* Stephens' Banded Snake	V	-	1	OEH Atlas	Rainforest and eucalypt forests and rocky areas up to 950 m in altitude. Stephens' Banded Snake is nocturnal, and shelters between loose bark and tree trunks, amongst vines, or in hollow trunks limbs, rock crevices or under slabs during the day.	Low
Migratory Species							
1.	*Apus pacificus* Fork-tailed Swift	-	M	2	OEH Atlas / PMST	Forages aerially over a very wide range of habitats includes both vegetated and non- vegetated areas. **Potential aerial foraging habitat above the study area.**	**Low - Moderate**

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence
		BC Act	EPBC Act				
2.	*Cuculus optatus* Oriental Cuckoo	-	M	-	PMST	Occurs at rainforest edges, leafy trees in paddocks, river flats, roadsides and mangroves **Not known from the Hunter region.**	Nil
3.	*Hirundapus caudacutus* White-throated Needletail	-	M	12	OEH Atlas, PMST	Forages in high open spaces over varied habitat types. **Potential aerial foraging habitat above study area.**	**Low - Moderate**
4.	*Monarcha melanopsis* Black-faced Monarch	-	M	-	PMST	Found in rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating. **Marginal habitat within the study area.**	**Low - Moderate**
5.	*Monarcha trivirgatus* Spectacled Monarch	-	M	-	PMST	Inhabits the understorey of mountain/ lowland rainforests, thickly wooded gullies and waterside vegetation including mangroves. **No suitable habitat within the study area.**	Nil
6.	*Motacilla flava* Yellow Wagtail	-	M	-	PMST	Typically inhabits inundated fields, saltmarsh and wetlands and occasionally coastal areas. **No suitable habitat within the study area.**	Nil
7.	*Myiagra cyanoleuca* Satin Flycatcher	-	M	-	PMST	Found in tall forests, preferring wetter habitats such as heavily forested gullies, but not rainforests. **No suitable habitat within the study area.**	Nil
8.	*Rhipidura rufifrons* Rufous Fantail	-	M	-	PMST	Found in rainforest, dense wet forests, swamp woodlands and mangroves, preferring deep shade, and is often seen close to the ground. **Marginal habitat within the study area.**	Low

* Legal Status: V = Vulnerable, E = Endangered, CE = Critically Endangered under TSC Act and EPBC Act; M = Migratory under EPBC Act.

Source: OEH Atlas = Atlas of NSW Wildlife (OEH), PMST = Protected Matter Search Tool (Australian Government).

APPENDIX 4. PREDICTED AND CANDIDATE SPECIES

Assessment of ecosystem credit species within each vegetation zone

Scientific Name	Common Name	Associated PCT / Vegetation Zone	Confirmed Predicted Species	Justification
Anthochaera phrygia	Regent Honeyeater (Foraging)	Zone 1 - 1590 (Moderate_Good)	Yes	-
		Zone 2 – 1590 (Cleared)	No	Habitat degraded – no feed tree species present due to lack of canopy
Callocephalon fimbriatum	Gang-gang Cockatoo (Foraging)	Zone 1 – 1590 (Moderate_Good) / Zone 3 – 1619 (Moderate_Good) / Zone 4 – 1619 (Managed)	Yes	-
		Zone 2 – 1590 (Cleared) / Zone 5 – 1619 (Cleared)	No	Habitat degraded – No woodland habitat present
Calyptorhynchus lathami	Glossy Black-Cockatoo (Foraging)	Zone 1 – 1590 (Moderate_Good) / Zone 3 – 1619 (Moderate_Good) / Zone 4 – 1619 (Managed)	Yes	-
		Zone 2 – 1590 (Cleared) / Zone 5 – 1619 (Cleared)	No	Habitat degraded – no feed tree species present due to lack of Allocasuarina and Casuarina species from these zones
Chthonicola sagittata	Speckled Warbler	Zone 1 – 1590 (Moderate_Good) / Zone 3 – 1619 (Moderate_Good) / Zone 4 – 1619 (Managed)	Yes	-
		Zone 2 – 1590 (Cleared) / Zone 5 – 1619 (Cleared)	No	Habitat degraded – No woodland habitat present
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	Zone 1 – 1590 (Moderate_Good) / Zone 3 – 1619 (Moderate_Good) / Zone 4 – 1619 (Managed)	Yes	-
		Zone 2 – 1590 (Cleared) / Zone 5 – 1619 (Cleared)	No	Habitat degraded – No woodland habitat present
Daphoenositta chrysoptera	Varied Sittella	Zone 1 – 1590 (Moderate_Good) / Zone 3 – 1619 (Moderate_Good) / Zone 4 – 1619 (Managed)	Yes	-
		Zone 2 – 1590 (Cleared) / Zone 5 – 1619 (Cleared)	No	Habitat degraded – No woodland habitat present

Scientific Name	Common Name	Associated PCT / Vegetation Zone	Confirmed Predicted Species	Justification
Dasyurus maculatus	Spotted-tailed Quoll	All Zones	Yes	-
Falsistrellus tasmaniensis	Eastern False Pipistrelle	All Zones	Yes	-
Glossopsitta pusilla	Little Lorikeet	Zone 1 – 1590 (Moderate_Good) / Zone 3 – 1619 (Moderate_Good) / Zone 4 – 1619 (Managed)	Yes	-
		Zone 2 – 1590 (Cleared) / Zone 5 – 1619 (Cleared)	No	Habitat degraded – No woodland habitat present
Grantiella picta	Painted Honeyeater	All Zones	No	Habitat Constraint Absent – lack of Mistletoes species
Haliaeetus leucogaster	White-bellied Sea-Eagle (Foraging)	All Zones	No	Habitat Constraint Absent – Site not within 1 km of rivers, lakes, large dams or creeks, wetlands and coastlines
Hieraaetus morphnoides	Little Eagle	All Zones	Yes	-
Kerivoula papuensis	Golden-tipped Bat	All Zones	Yes	-
Lathamus discolor	Swift Parrot (Foraging)	Zone 1 – 1590 (Moderate_Good) / Zone 3 – 1619 (Moderate_Good) / Zone 4 – 1619 (Managed)	Yes	-
		Zone 2 – 1590 (Cleared) / Zone 5 – 1619 (Cleared)	No	Habitat degraded – No woodland habitat present
Lophoictinia isura	Square-tailed Kite (Foraging)	All Zones	Yes	-
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	Zone 1 – 1590 (Moderate_Good) / Zone 3 – 1619 (Moderate_Good) / Zone 4 – 1619 (Managed)	Yes	-
		Zone 2 – 1590 (Cleared) / Zone 5 – 1619 (Cleared)	No	Habitat degraded – No woodland habitat present
Miniopterus australis	Little Bentwing-bat (Foraging)	All Zones	Yes	-
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat (Foraging)	All Zones	Yes	-

Scientific Name	Common Name	Associated PCT / Vegetation Zone	Confirmed Predicted Species	Justification
Mormopterus norfolkensis	Eastern Freetail-bat	All Zones	Yes	-
Neophema pulchella	Turquoise Parrot	Zone 1 – 1590 (Moderate_Good) / Zone 3 – 1619 (Moderate_Good) / Zone 4 – 1619 (Managed)	Yes	-
		Zone 2 – 1590 (Cleared) / Zone 5 – 1619 (Cleared)	No	Habitat degraded – No woodland habitat present
Ninox connivens	Barking Owl (Foraging)	All Zones	Yes	-
Ninox strenua	Powerful Owl (Foraging)	All Zones	Yes	-
Pandion cristatus	Eastern Osprey (Foraging)	Zone 3 – 1619 (Moderate_Good) / Zone 4 – 1619 (Managed) / Zone 5 – 1619 (Cleared)	Yes	-
Petaurus australis	Yellow-bellied Glider	Zone 1 – 1590 (Moderate_Good) / Zone 3 – 1619 (Moderate_Good) / Zone 4 – 1619 (Managed)	Yes	-
		Zone 2 – 1590 (Cleared) / Zone 5 – 1619 (Cleared)	No	Habitat Constraint Absent – No hollow-bearing trees with hollows >25 cm diameter
Petroica boodang	Scarlet Robin	Zone 1 – 1590 (Moderate_Good) / Zone 3 – 1619 (Moderate_Good) / Zone 4 – 1619 (Managed)	Yes	-
		Zone 2 – 1590 (Cleared) / Zone 5 – 1619 (Cleared)	No	Habitat degraded – No woodland habitat present
Phascolarctos cinereus	Koala (Foraging)	All Zones	No	Habitat Constraint Absent – No Koala feed trees present within the Study Area
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	Zone 1 – 1590 (Moderate_Good) / Zone 3 – 1619 (Moderate_Good) / Zone 4 – 1619 (Managed)	Yes	-
		Zone 2 – 1590 (Cleared) / Zone 5 – 1619 (Cleared)	No	Habitat degraded – No woodland habitat present
Pseudomys gracilicaudatus	Eastern Chestnut Mouse	Zone 3 – 1619 (Moderate_Good) / Zone 4 – 1619 (Managed) / Zone 5 – 1619 (Cleared)	Yes	-

Scientific Name	Common Name	Associated PCT / Vegetation Zone	Confirmed Predicted Species	Justification
Pteropus poliocephalus	Grey-headed Flying-fox (Foraging)	Zone 1 – 1590 (Moderate_Good) / Zone 3 – 1619 (Moderate_Good) / Zone 4 – 1619 (Managed)	Yes	-
		Zone 2 – 1590 (Cleared) / Zone 5 – 1619 (Cleared)	No	Habitat degraded – No foraging species present due to lack of canopy or midstorey
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	All Zones	Yes	-
Scoteanax rueppellii	Greater Broad-nosed Bat	All Zones	Yes	-
Stagonopleura guttata	Diamond Firetail	Zone 1 – 1590 (Moderate_Good)	Yes	-
		Zone 2 – 1590 (Cleared)	No	Habitat degraded – No woodland habitat present
Tyto novaehollandiae	Masked Owl (Foraging)	All Zones	Yes	-

Assessment of species credit species within each PCT

Scientific Name	Common Name	Associated PCT	Confirmed Candidate Species	Justification
Flora				
Acacia bynoeana	Bynoe's Wattle	1619	Yes	-
Angophora inopina	Charmhaven Apple	1619	Yes	-
Astrotricha crassifolia	Thick-leaf Star-hair	1619	Yes	-
Callistemon linearifolius	Netted Bottle Brush	1590 and 1619	Yes	-
Corunastylis sp. Charmhaven	-	Habitat assessed as within both 1590 (marginal) and 1619 (moderate – low)	Yes	Additional Candidate Species Added (as requested by Council in SEARs)
Cryptostylis hunteriana	Leafless Tongue Orchid	1590 and 1619	Yes	-
Cynanchum elegans	White-flowered Wax Plant	1590	Yes	-
Diuris praecox	Rough Doubletail	1619	Yes	-
Eucalyptus oblonga	*Eucalyptus oblonga* population at Bateau Bay, Forresters Beach and Tumbi Umbi in the Wyong local government area	1619	**No**	Geographic Limitation – Study Area not located at Bateau Bay
Genoplesium insigne	Variable Midge Orchid	1619	Yes	-
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	1590 and 1619	Yes	-
Melaleuca groveana	Grove's Paperbark	1619	Yes	-
Prostanthera askania	Tranquility Mintbush	1619	Yes	-
Rutidosis heterogama	Heath Wrinklewort	1590 and 1619	Yes	-
Tetratheca glandulosa	-	1619	Yes	-
Tetratheca juncea	Black-eyed Susan	1590 and 1619	Yes	-
Thelymitra adroata	Wyong Sun Orchid	Habitat assessed as within 1590	Yes	Additional Candidate Species Added (as requested by Council in SEARs)

Scientific Name	Common Name	Associated PCT	Confirmed Candidate Species	Justification
Amphibians				
Crinia tinnula	Wallum Froglet	1619	Yes	-
Litoria aurea	Green and Golden Bell Frog	1590 and 1619	Yes	-
Litoria brevipalmata	Green-thighed Frog	1590 and 1619	Yes	-
Uperoleia mahonyi	Mahony's Toadlet	1619	Yes	-
Birds				
Anthochaera phrygia	Regent Honeyeater (Breeding)	1590	**No**	Habitat Constraint Absent - Study Area not within mapped area (Site not within known breeding range)
Burhinus grallarius	Bush Stone-curlew	1590 and 1619	Yes	-
Callocephalon fimbriatum	Gang-gang Cockatoo (Breeding)	1590 and 1619	Yes	-
Calyptorhynchus lathami	Glossy Black-Cockatoo (Breeding)	1590 and 1619	Yes	-
Haliaeetus leucogaster	White-bellied Sea-Eagle (Breeding)	1590 and 1619	**No**	Habitat Constraint Absent - Living or dead mature trees within suitable vegetation within 1 km of a rivers, lakes, large dams or creeks, wetlands and coastlines
Hieraaetus morphnoides	Little Eagle (Breeding)	1590 and 1619	Yes	-
Lathamus discolor	Swift Parrot (Breeding)	1590 and 1619	**No**	Habitat Constraint Absent - Study Area not within mapped area (Site not within known breeding range)
Lophoictinia isura	Square-tailed Kite (Breeding)	1590 and 1619	Yes	-
Ninox connivens	Barking Owl (Breeding)	1590 and 1619	**No**	Habitat Constraint Absent – No suitable hollows present within the Study Area
Ninox strenua	Powerful Owl (Breeding)	1590 and 1619	**No**	Habitat Constraint Absent – No suitable hollows present within the Study Area

Scientific Name	Common Name	Associated PCT	Confirmed Candidate Species	Justification
Pandion cristatus	Eastern Osprey (Breeding)	1619	Yes	-
Turnix maculosus	Red-backed Button-quail	1590	Yes	-
Tyto novaehollandiae	Masked Owl (Breeding)	1590 and 1619	**No**	Habitat Constraint Absent – No suitable hollows present within the Study Area
Mammals				
Cercartetus nanus	Eastern Pygmy-possum	1590 and 1619	Yes	-
Chalinolobus dwyeri	Large-eared Pied Bat	1619	**No**	Habitat Constraint Absent – Study Area not within 2 km of rocky areas containing caves, overhangs, escarpments, outcrops or crevices, or within 2 km of old mines or tunnels
Miniopterus australis	Little Bentwing-bat (Breeding)	1590 and 1619	**No**	Habitat Constrain Absent – Study Area does not contain caves, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat (Breeding)	1590 and 1619	**No**	Habitat Constrain Absent – Study Area does not contain caves, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet
Myotis macropus	Southern Myotis	1590 and 1619	**No**	Habitat Constraint Absent – Study Area does not contain hollow-bearing trees within 200 m of riparian zone, or Bridges caves or artificial structures within 200 m of riparian zone
Petaurus norfolcensis	Squirrel Glider	1590 and 1619	Yes	-
Petrogale penicillata	Brush-tailed Rock-wallaby	1619	**No**	Habitat Constraint Absent – Study Area not within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or clifflines
Phascogale tapoatafa	Brush-tailed Phascogale	1590 and 1619	Yes	-

Scientific Name	Common Name	Associated PCT	Confirmed Candidate Species	Justification
Phascolarctos cinereus	Koala (Breeding)	1590 and 1619	**No**	Habitat Constraint Absent – Study Area does not contain >15% feed trees and does not contain important habitat for the species
Planigale maculata	Common Planigale	1590 and 1619	Yes	-
Pteropus poliocephalus	Grey-headed Flying-fox	1590 and 1619	Yes	-
Vespadelus troughtoni	Eastern Cave Bat	1590	**No**	Habitat Constraint Absent – Study Area not within 2 km of rocky areas containing caves, overhangs, escarpments, outcrops or crevices, or within 2 km of old mines or tunnels
Reptiles				
Hoplocephalus bitorquatus	Pale-headed Snake	1590 and 1619	Yes	-

BAM Predicted Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00013544/BAAS17039/19/00016916	The New Primary School Warnervale	04/07/2019
Assessor Name	**Report Created**	**BAM Data version ***
	02/08/2019	12
Assessor Number	**Assessment Type**	**BAM Case Status**
	Major Projects	Finalised
	Assessment Revision	**Date Finalised**
	0	02/08/2019

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Threatened species reliably predicted to utilise the site. No surveys are required for these species. Ecosystem credits apply to these species.

Common Name	Scientific Name	Vegetation Types(s)
Barking Owl	Ninox connivens	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Black-chinned Honeyeater (eastern subspecies)	Melithreptus gularis gularis	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Brown Treecreeper (eastern subspecies)	Climacteris picumnus victoriae	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Diamond Firetail	Stagonopleura guttata	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest

Eastern Bentwing-bat	Miniopterus schreibersii oceanensis	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Eastern Chestnut Mouse	Pseudomys gracilicaudatus	1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Eastern False Pipistrelle	Falsistrellus tasmaniensis	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Eastern Freetail-bat	Mormopterus norfolkensis	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Eastern Osprey	Pandion cristatus	1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Gang-gang Cockatoo	Callocephalon fimbriatum	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Glossy Black-Cockatoo	Calyptorhynchus lathami	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Golden-tipped Bat	Kerivoula papuensis	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Greater Broad-nosed Bat	Scoteanax rueppellii	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands

Grey-crowned Babbler (eastern subspecies)	Pomatostomus temporalis temporalis	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Grey-headed Flying-fox	Pteropus poliocephalus	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Koala	Phascolarctos cinereus	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
Little Bentwing-bat	Miniopterus australis	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Little Eagle	Hieraaetus morphnoides	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Little Lorikeet	Glossopsitta pusilla	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Masked Owl	Tyto novaehollandiae	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Powerful Owl	Ninox strenua	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Regent Honeyeater	Anthochaera phrygia	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest

Scarlet Robin	Petroica boodang	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Speckled Warbler	Chthonicola sagittata	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Spotted-tailed Quoll	Dasyurus maculatus	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Square-tailed Kite	Lophoictinia isura	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Swift Parrot	Lathamus discolor	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Turquoise Parrot	Neophema pulchella	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Varied Sittella	Daphoenositta chrysoptera	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Yellow-bellied Glider	Petaurus australis	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands

Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands

Threatened species not within the area of these PCT's

Common Name	Scientific Name	Vegetation Types(s)
Koala	Phascolarctos cinereus	1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
Painted Honeyeater	Grantiella picta	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
White-bellied Sea-Eagle	Haliaeetus leucogaster	1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest
		1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands

BAM Candidate Species Report

Proposal Details

Assessment Id 00013544/BAAS17039/19/00016916	Proposal Name The New Primary School Warnervale	BAM data last updated * 04/07/2019
Assessor Name	Report Created 02/08/2019	BAM Data version * 12
Assessor Number	Assessment Type Major Projects	BAM Case Status Finalised
	Assessment Revision 0	Date Finalised 02/08/2019

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

List of Species Requiring Survey

Name	Presence	Survey Months
Acacia bynoeana Bynoe's Wattle	No (surveyed)	Jan Feb Mar Sep Oct Nov Dec
Angophora inopina Charmhaven Apple	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Astrotricha crassifolia Thick-leaf Star-hair	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Burhinus grallarius Bush Stone-curlew	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Callistemon linearifolius Netted Bottle Brush	No (surveyed)	Jan Feb Mar Sep Oct Nov Dec

Calyptorhynchus lathami Glossy Black-Cockatoo	No (surveyed)	Jan Feb **Mar** **Apr** **May** **Jun** **Jul** **Aug** Sep Oct Nov Dec
Cercartetus nanus Eastern Pygmy-possum	No (surveyed)	**Jan** **Feb** **Mar** Apr May Jun Jul Aug Sep **Oct** **Nov** **Dec**
Grevillea parviflora subsp. parviflora Small-flower Grevillea	No (surveyed)	**Jan** **Feb** **Mar** **Apr** **May** **Jun** **Jul** **Aug** **Sep** **Oct** **Nov** **Dec**
Crinia tinnula Wallum Froglet	No (surveyed)	**Jan** **Feb** **Mar** **Apr** **May** **Jun** **Jul** **Aug** **Sep** **Oct** **Nov** **Dec**
Cryptostylis hunteriana Leafless Tongue Orchid	No (surveyed)	**Jan** **Feb** Mar Apr May Jun Jul Aug Sep Oct **Nov** **Dec**
Cynanchum elegans White-flowered Wax Plant	No (surveyed)	**Jan** **Feb** **Mar** **Apr** **May** **Jun** **Jul** **Aug** **Sep** **Oct** **Nov** **Dec**
Diuris praecox Rough Doubletail	No (surveyed)	Jan Feb Mar Apr May Jun **Jul** **Aug** Sep Oct Nov Dec
Genoplesium insigne Variable Midge Orchid	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug **Sep** **Oct** Nov Dec
Hoplocephalus bitorquatus Pale-headed Snake	No (surveyed)	**Jan** **Feb** **Mar** Apr May Jun Jul Aug Sep Oct **Nov** **Dec**
Litoria aurea Green and Golden Bell Frog	No (surveyed)	**Jan** **Feb** **Mar** Apr May Jun Jul Aug Sep Oct **Nov** **Dec**
Melaleuca groveana Grove's Paperbark	No (surveyed)	**Jan** **Feb** **Mar** **Apr** **May** **Jun** **Jul** **Aug** **Sep** **Oct** **Nov** **Dec**

Litoria brevipalmata Green-thighed Frog	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Lophoictinia isura Square-tailed Kite	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Uperoleia mahonyi Mahony's Toadlet	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Pandion cristatus Eastern Osprey	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Petaurus norfolcensis Squirrel Glider	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Phascogale tapoatafa Brush-tailed Phascogale	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Planigale maculata Common Planigale	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Prostanthera askania Tranquility Mintbush	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Pteropus poliocephalus Grey-headed Flying-fox	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Rutidosis heterogama Heath Wrinklewort	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Tetratheca glandulosa Tetratheca glandulosa	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Tetratheca juncea Black-eyed Susan	No (surveyed)	Jan Feb Mar Apr May Jun **Jul Aug Sep Oct Nov Dec**
Callocephalon fimbriatum Gang-gang Cockatoo	No (surveyed)	**Jan** Feb Mar Apr May Jun Jul Aug Sep **Oct Nov Dec**
Turnix maculosus Red-backed Button-quail	No (surveyed)	**Jan Feb Mar Apr May Jun** **Jul Aug Sep Oct Nov Dec**
Hieraaetus morphnoides Little Eagle	No (surveyed)	Jan Feb Mar Apr May Jun Jul **Aug Sep Oct** Nov Dec
Corunastylis sp. Charmhaven (NSW896673) Corunastylis sp. Charmhaven (NSW896673)	No (surveyed)	Jan **Feb Mar** Apr May Jun Jul Aug Sep Oct Nov Dec
Thelymitra adorata Wyong Sun Orchid	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug **Sep Oct** Nov Dec

List of Species Not On Site

Name
Chalinolobus dwyeri Large-eared Pied Bat
Lathamus discolor Swift Parrot
Miniopterus australis Little Bentwing-bat
Miniopterus schreibersii oceanensis Eastern Bentwing-bat
Myotis macropus Southern Myotis
Haliaeetus leucogaster White-bellied Sea-Eagle
Ninox connivens Barking Owl
Ninox strenua Powerful Owl
Petrogale penicillata Brush-tailed Rock-wallaby
Phascolarctos cinereus Koala

Tyto novaehollandiae Masked Owl
Vespadelus troughtoni Eastern Cave Bat
Anthochaera phrygia Regent Honeyeater
Eucalyptus oblonga - endangered population Eucalyptus oblonga population at Bateau Bay, Forresters Beach and Tumbi Umbi in the Wyong local government area

APPENDIX 5. LIKE-FOR-LIKE BIODIVERSITY CREDIT REPORT

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id 00013544/BAAS17039/19/00016916	Proposal Name The New Primary School Warnervale	BAM data last updated * 04/07/2019
Assessor Name	Assessor Number	BAM Data version * 12
Proponent Names NSW Department of Education	Report Created 02/08/2019	BAM Case Status Finalised
Assessment Revision 0	Assessment Type Major Projects	Date Finalised 02/08/2019

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Nil

Nil

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

BAM Biodiversity Credit Report (Like for like)

Predicted Threatened Species Not On Site

Name
Grantiella picta / Painted Honeyeater
Haliaeetus leucogaster / White-bellied Sea-Eagle

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	Not a TEC	1.1	18.00
1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Not a TEC	1.5	30.00

1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest

Like-for-like credit retirement options

Class	Trading group	HBT	IBRA region
Hunter-Macleay Dry Sclerophyll Forests This includes PCT's: 715, 904, 922, 1178, 1215, 1588, 1589, 1590, 1591, 1592, 1593, 1600, 1601, 1602, 1608, 1612, 1626, 1748	Hunter-Macleay Dry Sclerophyll Forests - < 50% cleared group (including Tier 7 or higher).	Yes	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Like for like)

1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands

Like-for-like credit retirement options

Class	Trading group	HBT	IBRA region
Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787	Sydney Coastal Dry Sclerophyll Forests - < 50% cleared group (including Tier 7 or higher).	No	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

No Species Credit Data

APPENDIX 6. STAFF CONTRIBUTIONS

The following staff were involved in the compilation of this report.

Name	Qualification	Title/Experience	Contribution
Adam Blundell	BEnvSc (Hons)	Principal Ecologist	Fauna Surveys
Dan Pedersen	BSCEngTech GIFireE, BDAP-A	Senior Ecologist/ Botanist Bushfire Consultant	Fauna Surveys
Daniel O'Brien	BEnvSc & Mgt (Hons) / PhD (in progress)	Senior Ecologist	Report Review
David Russell	BSc	Senior Ecologist	Flora Surveys
Elise Connolly	Dip Cons Lnd Mgmt, Adv Dip Env Mgmt	Ecologist (Botanist)	Flora Surveys
Gayle Joyce	BSc Forestry (Hons)	GIS Specialist	GSI data management and Figure preparation
Luke O'Brien	BEnvSc&Mgt	Ecologist	Hollow inspection
Yann Buissiere	BEnvSc & Mgt	Ecologist (Botanist)	Flora Surveys
Samara Schulz	BEnvSc & Mgt (Hons)	Senior Ecologist	Flora surveys, BAM calculations and report writing

APPENDIX 7. LICENSING

Kleinfelder employees involved in the current study are licensed or approved under the *Biodiversity Conservation Act 2016* (License Number: SL100730, Expiry: 31 March 2020) and the *Animal Research Act 1985* to harm/trap/release protected native fauna and to pick for identification purposes native flora and to undertake fauna surveys.