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NEWCASTLE OFFICE

26 June 2018
Document Ref: NCA18R79323

Attention: Michael Cashell

Billard Leece Partnership

Delivered by email: michaelc@blp.com.au

Subject: Preliminary Ecological Assessment for Proposed development of Lot 71 DP 7091, Warnervale Road, Warnervale NSW

Kleinfelder have undertaken a site visit on Monday 4 June 2018 to inform the development potential of Lot 71 DP 7091, 75 Warnervale Road, Warnervale NSW. This preliminary assessment has identified some potential ecological constraints of the land which are detailed in the accompanying report. However, from our initial assessment there were limited ecological constraints to development of the land provided the majority of the proposed development is undertaken in the partly cleared northern section of the lot and that consideration is given to retaining connectivity of habitat for the threatened Squirrel Glider (*Petaurus norfolcensis*) which has previously been recorded in close proximity to the lot.

The native vegetation mapped (predominantly Narrabeen Buttonderry Footslopes Forest – equivalent to Plant Community Type (PCT) 1628 and a small patch of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (PCT 1590)) do not constitute a threatened ecological community under either the NSW *Biodiversity Conservation Act 2016* or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*

Two threatened orchid species (*Corunastylis sp.* Charmhaven and *Thelymitra adorata* (Wyong Sun Orchid)), which are known to occur in the locality have a moderate to low likelihood of occurrence within the study area. Additionally, several other threatened flora species identified during the desktop assessment as requiring survey were identified as having a moderate likelihood of occurrence within the study area.

The fauna habitat observed is considered to be of moderate value with a low density of habitat trees observed. Several threatened fauna species were assessed as having a moderate level of likelihood of occurrence on site, including the Squirrel Glider, Grey-headed Flying-fox and two species of threatened microchiropteran bats. There is also the potential for several other threatened species such as the Powerful Owl, Masked Owl, Swift Parrot and Glossy Black-Cockatoo to use the site for opportunistic foraging or as part of a larger home range.

Future surveys at the appropriate time of year will be required to determine whether the target species credit species associated with these PCTs are present on the site.

Sincerely,

Kleinfelder Australia Pty Ltd

Kristy Peters B.ParkMgt/BSc (Hons)

Senior Ecologist
kpeters@kleinfelder.com

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1. PROJECT OVERVIEW

Kleinfelder understand that Billard Leece Partnership require a Preliminary Ecological Assessment to determine the feasibility of potential development of Lot 71 DP 7091, 75 Warnervale Road, Warnervale (**Figure 1**). This assessment will inform the Secretary's Environmental Assessment Requirements (SEARs).

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

- Locality – land within a 5 kilometre radius of the study area (**Figure 1**);
- Study area – Lot 71 DP 7091, 75 Warnervale Road, Warnervale NSW (**Figure 2**).

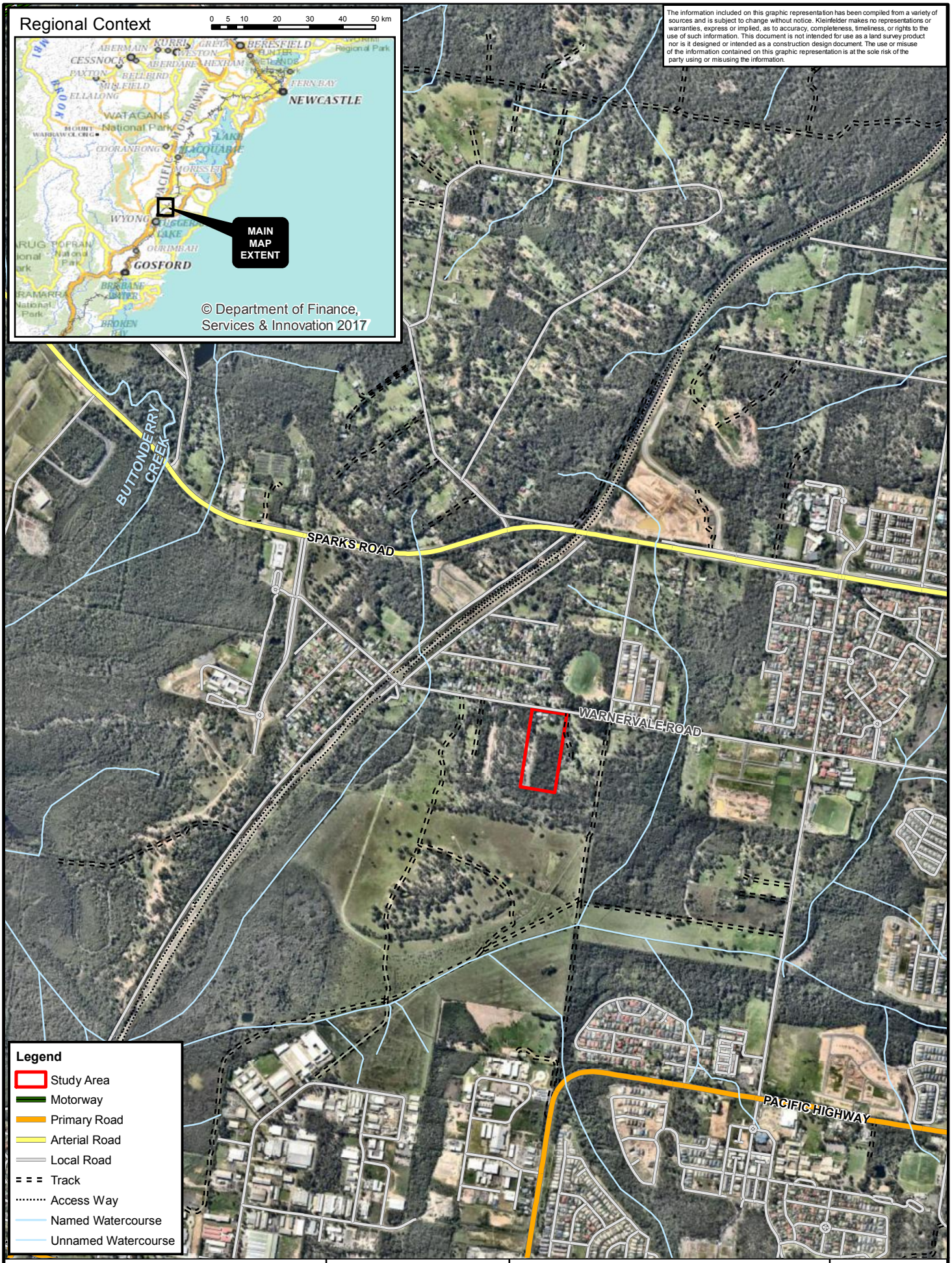
1.1 SCOPE OF WORKS

This assessment forms part of a staged approach to assessing the biodiversity impacts of the proposed development of a primary school on the lot. Stage 1 (this report) is the Preliminary Ecological Assessment which identifies key constraints within the site, and Stage 2 will be a full ecological assessment in accordance with the SEARs, once they have been prepared. The proposed development is to be considered as a State Significant Development.

This constraints assessment involved a desktop flora and fauna assessment in conjunction with a site walkover, for the purpose of informing the client of any ecological constraints and possible solutions. This report identifies flora, fauna and threatened species likely to occur within the study area based on species and/or habitats detected during the site visit and threatened flora and fauna records from the locality. A preliminary likelihood of occurrence assessment for identified threatened flora and fauna has been provided (**Appendix 1**), as well as a brief description of vegetation and fauna habitat occurring on the site.

1.2 LOCAL CONTEXT

The study area is bound by Warnervale Road and residential development to the northwest, a native bushland corridor surrounding Warnervale Oval to the northeast, by mainly cleared residential development to the east, and by native bushland to the south and west (**Figure 2**). The majority of the Lot is comprised of native bushland, with the northernmost portion supporting several buildings and managed grassland. The northern portion of the allotment is zoned R1 – General Residential, and the southern portion is zoned R2 – Low Density Residential.



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PROJECT REFERENCE: 20190632

DATE DRAWN: 13/06/2018 10:13 Version 1

DRAWN BY: GJoyce

DATA SOURCE:
NSW DFSI - 2017
Nearmap - 2018

Locality

Billard Leece Partnership
Preliminary Ecological Assessment
Proposed development of Lot 71 DP 7091
Warnervale Road, Warnervale NSW

FIGURE:

1

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Metres
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PROJECT REFERENCE: 20190632

DATE DRAWN: 26/06/2018 10:05 Version 2

DRAWN BY: gjoyce

DATA SOURCE:
NSW DFSI - 2017
Nearmap - 2018

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Study Area

Billard Leece Partnership
Preliminary Ecological Assessment
Proposed development of Lot 71 DP 7091
Warnervale Road, Warnervale NSW

FIGURE:

2

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1.3 RELEVANT LEGISLATION AND GUIDELINES

This constraints assessment was undertaken in accordance with and/or in consideration of the following Acts, Policies and Guidelines:

- Commonwealth:
  - *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- State:
  - *Biodiversity Conservation Act 2016 (NSW) (BC Act);*
  - *Biodiversity Conservation Regulation 2017;*
  - *Biodiversity Conservation (Savings and Transitional) Regulation 2017;*
  - *National Parks and Wildlife Act 1974* (NP&W Act);
  - *Environmental Planning and Assessment Act 1979* (EP&A Act);
  - *Biosecurity Act 2015*;
  - *Biodiversity Assessment Method (2017)*;
  - *State Environmental Planning Policy 44 - Koala Habitat Protection* (SEPP 44).
- Local:
  - Wyong Shire Council Development Control Plan 2013 (Wyong DCP 2013);
  - Wyong Local Environmental Plan 2013 (Wyong LEP 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.

2. STAGE 1 METHODOLOGY

2.1 DESKTOP ASSESSMENT

A list of target flora and fauna species required to be surveyed as part of a future Biodiversity Development Assessment Report (BDAR) (i.e. species credit species), based on the two PCTs mapped in the study area was obtained from the NSW BioNet database. To supplement this preliminary 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 also obtained from the following databases:

- NSW Office of Environment and Heritage (OEH) Atlas of NSW Wildlife: (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).

2.1.1 Likelihood of Occurrence

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 (refer to **Appendix 1**). This assessment was based on available habitat requirement data for each threatened species, populations, and ecological communities using the following sources:

- Harden, G.J. (ed) (1992, 1993, 2000, 2002). Flora of New South Wales Volume 1-4. NSW University Press: Sydney;
- OEH threatened species website database:
- http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/index.aspx;
- Van Dyke, S. and Strahan, R. (eds) (2008). The Complete Book of Australian Mammals. Reed New Holland Publishers, Australia;
- Cogger, H.A (ed) (2000). Reptiles and Amphibians of Australia. Reed New Holland Publishers, Australia; and
- Higgins, P. J. et al. (1990-2007). Handbook of Australian, New Zealand & Antarctic Birds. Volumes 1 to 7. Oxford University Press Publishers, Melbourne.

2.2 FIELD SURVEYS

2.2.1 Site Inspection

Our Senior Botanist, Samara Schulz, attended the site on Monday 4 June 2018 and conducted a site walkover to identify potential threatened species habitat and map plant community types (PCTs) occurring on the land.

2.2.2 Flora Survey

2.2.2.1 Floristic Identification and Nomenclature

Floristic identification and nomenclature was based on Harden (1992, 1993, 2000 and 2002) with subsequent revisions as published on PlantNet (The NSW Plant Information Network System). If a plant was unable to be identified using these references or a specimen was potentially rare or threatened, a sample was sent to the National Herbarium of New South Wales.

2.2.2.2 Vegetation Community Mapping

The identification of vegetation communities was based on dominant species present in the overstorey, midstorey, shrub and ground layers. The species association recorded in the study area were compared to descriptions of vegetation communities mapped by Bell (2002) and Eco Logical Australia (2016). Prior to the commencement of field surveys, this mapping and the accompanying vegetation community profiles were reviewed to assess vegetation communities occurring in the locality.

2.2.3 Fauna Habitat Assessment

Fauna habitat values observed during inspections of the study area were recorded. Attributes considered important to fauna include: hollow-bearing trees, nests, fallen timber/hollow logs, abundance of nectar and fruit resources, water bodies, vegetation cover and structural complexity, fallen timber, and leaf litter. Suitability of habitat for threatened fauna species occurring in the locality was also assessed during the survey.

2.3 SURVEY LIMITATIONS

This survey does not fulfil the requirements of a Biodiversity Development Assessment Report (BDAR) as required by the NSW BC Act or a Flora, Fauna and Threatened Species Assessment as required by Wyong Shire Council's Flora and Fauna Survey Guidelines (2012). Additional field survey and assessment will be required as part of Stage 2 works, and receipt of the SEARs.

This survey and preliminary report also does not fulfil the requirements of a Commonwealth significant impact assessment of relevant Matters of National Environmental Significance (namely, 'Listed threatened species and ecological communities' and 'Migratory species' which have the potential to occur on the study area). The likelihood of the species identified during the desktop assessment have been considered as part of the Assessment of Likelihood of Occurrence in **Appendix 1**. Additional field survey and impact assessment will be required as part of Stage 2 works.

3. RESULTS

3.1 DATABASE REVIEW

A search of the relevant databases returned a total of 20 threatened flora species and 30 threatened fauna species that will require future survey at appropriate times of the year (refer to **Section 4.3**) to satisfy the requirements of the Biodiversity Assessment Method (BAM 2017) and Wyong Shire Council threatened species guidelines.

The list of target threatened species recorded in the database searches and a preliminary assessment of likelihood of occurrence is provided in **Appendix 1**.

3.2 FIELD SURVEYS

3.2.1 Flora

3.2.2 Vegetation Communities

Two native vegetation communities (in various states of modification) were identified within the study area. These communities are briefly outlined below and mapped in **Figure 3**.

3.2.2.1 Narrabeen Buttonderry Footslopes Forest

The native vegetation present across the majority of the study area was mapped as Narrabeen Buttonderry Footslopes Forest (Unit 28, Bell (2002) and E-28, ELA (2016)). The PCT Equivalent (as per ELA, 2016) is PCT 1628 - Turpentine - Smooth-barked Apple - Broad-leaved Mahogany shrubby open forest on sandstone ranges of the Central Coast. PCT 1628 occurs on sandstones on the coastal ranges of the Central Coast from the Hawkesbury north to about Wollombi, at altitudes up to 450 m, and is associated with Hunter, Pittwater, Wyong, and Yengo Sub-regions.

The vegetation within the study area was dominated by *Angophora costata* (Smooth-barked Apple), *Eucalyptus fibrosa* (Red Ironbark), *E. capitellata* (Brown Stringybark), *Corymbia gummifera* (Red Bloodwood), *Allocasuarina littoralis* (Black She-oak), *Melaleuca nodosa* (Prickly-leaved Paperbark), *Entolasia stricta* (Wiry Panic), *Ptilothrix deusta* and *Xanthorrhoea latifolia.*

On the site, this community has been modified to various extents across the Lot (**Figure 3**). The portion of this community in the south-east is relatively intact with a native canopy, shrub and groundlayer observed (**Plate 1**; total 1.85 ha), while in the north-east it occurs as canopy trees over a managed understorey (**Plate 2**), and in the south-west as a previously slashed area with natural regeneration (totaling approximately 0.57 ha).

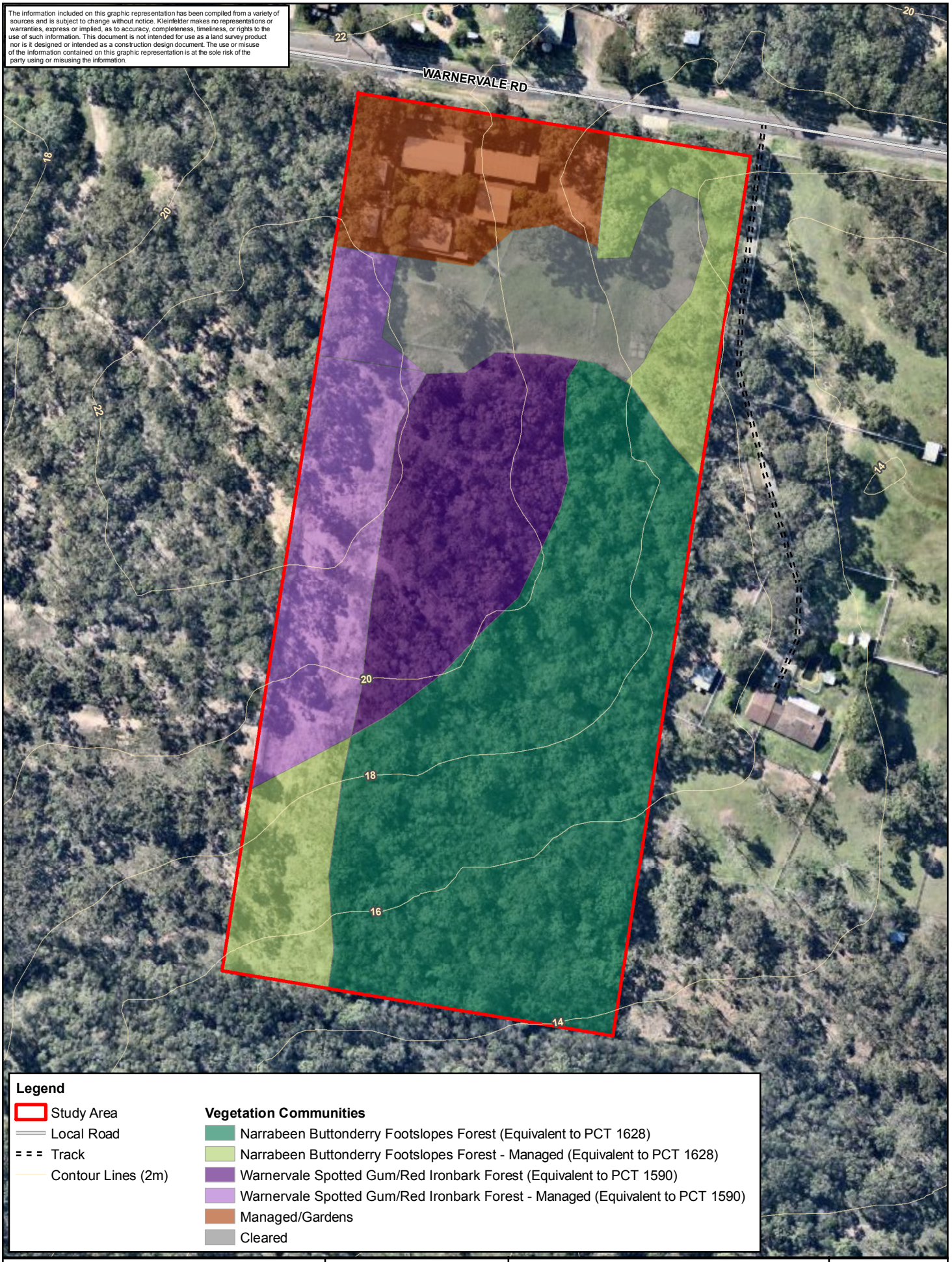
3.2.2.2 Warnervale Spotted Gum – Red Ironbark Forest

The north-west portion of vegetation within the study area was dominated by *C. maculata,* (Spotted Gum), *E. fibrosa, M. nodosa, and E. stricta.* This community has been mapped as Warnervale Spotted Gum – Red Ironbark Forest (Unit W-15c, ELA (2016)). The PCT Equivalent (as per ELA, 2016) is PCT 1590: Spotted Gum – Broad-leaved Mahogany – Red Ironbark Shrubby Open Forest. Approximately 0.65 ha of the community occurs in a relatively undisturbed state (**Plate 3**), with one portion (totalling approximately 0.58 ha) consisting of previously slashed vegetation with natural regeneration occurring.

Plate 1: **Narrabeen Buttonderry Footslopes Forest in the south-east of study area.**

Plate 2: **Narrabeen Buttonderry Footslopes Forest in the north-east of study area.**

Plate 3: **Warnervale Spotted Gum – Red Ironbark Forest in the north-west of study area.**



Legend

- Study Area
- Local Road
- Track
- Contour Lines (2m)

Vegetation Communities

- Narrabeen Buttonderry Footslopes Forest (Equivalent to PCT 1628)
- Narrabeen Buttonderry Footslopes Forest - Managed (Equivalent to PCT 1628)
- Warnervale Spotted Gum/Red Ironbark Forest (Equivalent to PCT 1590)
- Warnervale Spotted Gum/Red Ironbark Forest - Managed (Equivalent to PCT 1590)
- Managed/Gardens
- Cleared

Metres
0 10 20 40 60 80 100
N

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PROJECT REFERENCE: 20190632
DATE DRAWN: 26/06/2018 10:05 Version 2
DRAWN BY: gjoyce
DATA SOURCE:
NSW DFSI - 2017
Nearmap - 2018

Vegetation Communities

Billard Leece Partnership
Preliminary Ecological Assessment
Proposed development of Lot 71 DP 7091
Warnervale Road, Warnervale NSW

FIGURE:
3

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3.2.3 Fauna Habitat

The native vegetation within the study area is considered to provide moderate fauna habitat. The term moderate has been used because approximately 45% of the study area has been previously cleared, over a largely disturbed, exotic ground cover, or has a native understorey which is subject to regular management (brushcutting). The study area does contain the following habitat features:

- Feed tree species for a range of fauna species: including *Corymbia maculata* (Spotted Gum), *Eucalyptus fibrosa* (Red Ironbark) and *C. gummifera* (Red Bloodwood) likely to be utilised as a source of nectar when flowering by local fauna. The less modified remnant vegetation in the southern portion of the site extends off-site to the south-east and around to the west, providing continuous foraging and nesting habitat, as well as a corridor for local fauna;
- Dense midstorey habitat in the undisturbed portion of the site which is likely to be used by a range of locally common bird and mammal species for nesting and foraging;
- Low numbers of hollow-bearing trees and dead stags (present but not at high density).

The NSW Wildlife Atlas contains records of several threatened fauna species (which are target species credit species under the BAM) occurring in close proximity to the site, namely the Squirrel Glider, Powerful Owl, Eastern Bentwing-bat, Little Bentwing-bat, Grey-headed Flying-fox, and Little Eagle. The study area contains suitable foraging and marginal roosting/breeding habitat for these species.

4. CONSTRAINTS ASSESSMENT

4.1 OUTCOMES OF THE FIELD SURVEYS

4.1.1 Native Vegetation

Approximately 2.4 ha of Narrabeen Buttonderry Footslopes Forest occurs on the study area, the majority of which is intact with a reasonably diverse shrub and ground layer present. Smaller areas (approximately 1.2 ha) of Warnervale Spotted Gum – Red Ironbark Forest occur in the northern section of the lot. These communities do not constitute a threatened ecological community under either the NSW BC Act or the Commonwealth EPBC Act.

Native vegetation also extends off site to the south-east, south and west. A future development proposal will also need to consider any potential indirect impacts on this habitat.

4.1.2 Fauna and Fauna Habitat

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 not completed at this preliminary stage, however, it was noted that some hollow-bearing trees and dead stags do occur, albeit at low densities. These habitat trees are unlikely to provide suitable nesting habitat for large forest owls and are more likely to be used by roosting microchiropteran bats, native parrot species or the Common Brushtail Possum. The existing habitat occurs on the edge of a larger patch of bushland which extends to south-east, south and west. The small amount of clearing and modification for a bushfire Asset Protection Zone is unlikely to cause further fragmentation or isolation of habitat.

Four threatened fauna species, the Squirrel Glider, Grey-headed Flying-fox, Eastern Bentwing-bat and the Little Bentwing-bat were assessed as having a moderate likelihood of occurrence on site. There is also the potential for the Powerful Owl, Masked Owl, Swift Parrot, Glossy Black-Cockatoo and several other threatened microchiropteran bat species to utilise the subject site as part of a foraging range, however, future development of the site is considered unlikely to significantly impact on any locally occurring populations of these species. Future surveys at the appropriate time of year (see **Section 4.3**) will be required to determine whether this species (and any of the other target threatened species) are present on the site.

4.2 ASSESSMENT REQUIREMENTS UNDER THE BC ACT

The *Biodiversity Conservation Act 2016* (BC Act) will be applicable to the proposed State Significant Development to be lodged under Part 4 of the *Environmental Planning and Assessment Act 1979.* Under the BC Regulation, for the purposes of the proposed development, there are four potential triggers for the development to be assessed under the Biodiversity Offset Scheme (BOS). These triggers and the potential for the proposal to exceed one, or more, and therefore require assessment under the BOS is outlined below:

1. **Clearing on land mapped on the Biodiversity Land Values Map (Section 7.3 of the BC Regulation).**

   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*.'

   The study aera is mapped on the Biodiversity Values map, however, as the proposed development occurs on land which was subdivided prior to the commencement of the BC Act, and is zoned R1 and R2, the proposal does no exceeded this threshold.

2. **Clearing native vegetation above the thresholds (outlined in Section 7.2 of the BC Regulation).**

   The allotment proposed for development has a minimum lot size of 450 m^2, as such according to Section 7.2, an area of native vegetation clearing of 0.25 ha or more exceeds the clearing threshold and the BOS would be triggered.

   The total clearing area of the final design of the proposal will dictate if the clearing thresholds are exceeded.

3. **Impacting the prescribed biodiversity features listed under Section 6.1 of the BC Regulation.**

   This section prescribes a range of features, which if impacted on, trigger the BOS. Further survey work within the study area will be required to determine if any of these prescribed features occur within the study area.

4. **Significant impact on a threatened species (determined through a 5-part test set out in the BC Act).**

If none of the above triggers are exceeded by the proposed development, then assessments of significance (5-part test) would be conducted for all species known or likely to occur within the study area. If the proposal was deemed to have a significant impact on any threatened species, populations or ecological communities, then the BOS would be triggered. Further survey work within the study area would be required to inform these assessments.

4.2.1 Considerations

A future development application should consider the following implications of potential offsetting requirements under both the Biodiversity Offsets Scheme (if triggerd) and relevant Wyong Shire Council planning and management guidelines:

- If the BOS is triggered ecological impacts of the proposal on native vegetation and threatened species (both ecosystem and species credit species) must be offset in accordance with the BAM, including the potential removal of:
    - Threatened species habitat; and,
    - Hollow-bearing trees.
- Additionally, there may be a local requirement to offset the loss of sensitive species in the Wyong LGA such as the Squirrel Glider and threatened orchid habitat (should any of the target species be found to occur within the development footprint) in accordance with the Wyong Shire Council Interim Survey Guidelines for Ground Orchids in Wyong Shire and the Squirrel Glider Conservation Management Plan: Wyong Shire.

Offsetting the loss of habitat at the ecosystem and species level can be achieved under the BAM either by 1) the creation of ecosystem and species credits from an on-site or off-site offset (i.e. establishment of a Biodiversity Stewardship Site Agreement); 2) purchase of available credits from the market; or 3) by paying into the Biodiversity Conservation Trust Fund.

4.3 RECOMMENDED FIELDWORK

Preliminary data relating to the PCTs occurring on the site was entered into the BioNet database to produce a list of target species credit species that will require survey as part of Stage 2 (**Table 1**). Some additional orchid species (highlighted in bold in **Table 1**) which are known to occur within 5 km of the study area have been included as it is envisaged that Wyong Shire Council may request surveys for these species be conducted in accordance with their

local guidelines. These surveys recommended in the following table would comply with the requirements of the BAM of the BOS is triggered.

Table 1: Preliminary list of target threatened species requiring future survey as per the BAM and Wyong Shire Council guidelines

Species Class	Recommended Fieldwork Period	Methods
Flora		
Angophora inopina *Astrotricha crassifolia* *Caladenia tessellata* *Cynanchum elegans* *Darwinia glaucophylla* *Eucalyptus camfieldii* *Melaleuca groveana* *Rutidosis heterogama* *Senna acclinis*	All year	Targeted threatened species search Habitat assessment
Diuris bracteata *Diuris praecox* *Tetratheca juncea* *Tetratheca glandulosa*	August	
Callistemon linearifolius *Prostanthera junonis* *Prostanthera askania* ***Thelymitra adorata* (Wyong Sun Orchid)**	September – November	
Cryptostylis hunteriana *Hibbertia procumbens*	December - February	
***Corunastylis* sp. Charmhaven**	February – May	
Fauna		
Large Forest Owls Barking Owl Masked Owl Powerful Owl	June – August	Owl call playback Spotlighting Stag watching Hollow-bearing tree survey
Woodland Birds Glossy Black-Cockatoo Swift Parrot Regent Honeyeater		Bird survey
Woodland Birds Little Eagle	August	Bird survey
Bats Grey-headed Flying-fox Cave-dwelling microchiropteran bats	November - February	Spotlighting Anabat recording Harp trapping
Amphibians Giant Barred Frog Giant Burrowing Frog		Diurnal and nocturnal amphibian survey Call playback

Species Class	Recommended Fieldwork Period	Methods
Green and Golden Bell Frog Green-thighed Frog Red-crowned Toadlet Stuttering Frog		Spotlighting
Reptiles Pale-headed Snake Stephens' Banded Snake		Reptile survey Spotlighting
Woodland Birds Bush Stone-curlew Gang-gang Cockatoo Square-tailed Kite	October – January	Spotlighting (Bush Stone-curlew) Bird survey
Mammals Brush-tailed Rock-wallaby Brush-tailed Phascogale Common Planigale Eastern Pygmy-possum Koala Parma Wallaby Squirrel Glider		Scat searches Trapping (terrestrial and arboreal) Remote cameras Call playback Spotlighting

5. 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.

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Wyong Shire Council 2016, *Flora and Fauna Survey Guidelines*, Version 2.4, Wyong, NSW.

The Royal Botanic Gardens and Domain Trust 2014, *PlantNET - The Plant Information Network System*, Version 2.0, The Royal Botanic Gardens and Domain Trust, Sydney, http://plantnet.rbgsyd.nsw.gov.au

APPENDIX 1. ASSESSMENT OF LIKELIHOOD OF OCCURRENCE

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:

- Known – species identified within the site during surveys;
- 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

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

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence
		BC Act	EPBC Act				
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**
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

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence
		BC Act	EPBC Act				
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
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

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence
		BC Act	EPBC Act				
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**
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

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence
		BC Act	EPBC Act				
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
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

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence
		BC Act	EPBC Act				
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**
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**

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence
		BC Act	EPBC Act				
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**
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.**	**Moderate**
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
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**

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence
		BC Act	EPBC Act				
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**
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**

No.	Species	Legal Status*		No. of Records	Source#	Habitat Preferences	Likelihood of occurrence
		BC Act	EPBC Act				
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; Ex = Extinct under TSC Act and EPBC Act; M = Migratory under EPBC Act. # Source: OEH Atlas = Atlas of NSW Wildlife (OEH), BioNet = BioNet PCT database; PMST = Protected Matter Search Tool (Australian Government).