

The New Primary School at Warnervale

SSDA RFI Responses

Prepared for
Schools Infrastructure NSW

9 April 2020

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Document Control

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Table of Contents

Document Control	2
Table of Contents	3
1.0 Summary of RFIs Received	4
Appendix A	11
Biodiversity – BDAR Report <i>by Kleinfelder</i>	11
Appendix B	12
Biodiversity – Payment Report <i>by Kleinfelder</i>	12
Appendix C	13
Biodiversity – Vegetation Management Plan (VMP) <i>by Kleinfelder</i>	13
Appendix D	14
Traffic Engineering – Response <i>by Stantec</i>	14
Appendix E	15
Architectural – GFA Plans <i>by BLP</i>	15
Appendix F	16
Architectural – Elevations <i>by BLP</i>	16

1.0 Summary of RFIs Received

Below is a summary of the RFI's issued from DPIE 20/03/2020.

Item No.	Requested by	Discipline	Description	Response	Reference
1	DPIE	Planning	You are requested to submit additional information that effectively addresses the issues identified by Council in their comments (copy enclosed) on the RtS under the subheadings Ecology and Transport/Traffic Engineering.	Noted. The project team has provided updates to the relevant reports and drawings as requested.	Refer to Appendices

2	Central Coast Council	Biodiversity	<p>Point 1.</p> <p>Council maintains that retirement of Squirrel Glider species credits are required. The local records are not only “historical”. A Squirrel Glider was recorded on the adjacent site to the south via remote camera in 2019. A Squirrel Glider was also recorded on the adjacent lot to the west in 2017. The habitat is similar and continuous across all these sites.</p> <p>The following statement in the BDAR also indicates that Squirrel Glider use of the site is acknowledged:</p> <p>“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”.</p> <p>The Lake Macquarie Squirrel Glider Planning Management Guidelines specify that “To confirm the absence of squirrel gliders, it is desirable to undertake trapping on at least two separate occasions for at least 5 - 7 consecutive nights with the period between surveys being a minimum of 1 month”. In this case there was only one trapping period.</p> <p>Central Coast Council’s Flora and Fauna Guidelines specify in relation to Squirrel Gliders that they are to be “Surveyed outside winter and preferably August-September or February-March”. The surveys on the site consisted of a single survey period in November-December.</p> <p>The BAM Stage 1 Operational Manual states in relation to determining whether a species credit species is present:</p>	<p>SINSW acknowledges Central Council’s concerns around the Squirrel Gliders being present on the site, therefore it will be assumed for the purpose of the BDAR that they are present on the site.</p> <p>It should be reiterated that the original surveys conducted on this site did not indicate Squirrel Gliders were present.</p> <p>The following sections of the BDAR have been updated to address Squirrel Glider:</p> <ul style="list-style-type: none"> - <i>Exec. Summary, Section 4.2.3, Section 4.3 (new section, including Figure 9), Section 6.2.2 (new section) and Appendix 5 (updated Credit Report).</i> 	<p>Refer to Appendix A BDAR Report</p> <p>Appendix B Payment Report</p>
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			<p>“If there are existing records of a species on the subject land, and the current survey doesn’t detect the species (or the population has changed), then evidence to justify the change should be provided in the BAR”.</p> <p>This is relevant to the site. There is no evidence that the population has changed, just that no Squirrel Gliders were caught during the single survey period undertaken. Due the recent records surrounding the site, there is evidence that the populations still occurs, despite the lack of detection via trapping. Indeed the BDAR recognises a high likelihood of occurrence on the site. The BAM Stage 1 Operational Manual also states assuming species presence may be appropriate where the target species is cryptic and therefore difficult to identify via survey.</p> <p>As a result of the above considerations, presence of Squirrel Gliders should be assumed for the purpose of the BDAR.</p>		
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3	Central Coast Council	Biodiversity	<p>Point 2.</p> <p>A corridor of canopy trees and glider poles is proposed through the western side of the site. Council's preferred location, based on existing vegetation and connectivity to Warnervale Oval, was the eastern side. It is however recognised that the western proposal may need to be accepted due to design constraints which preclude the eastern corridor.</p> <p>Where glider poles are proposed, there should also be associated plantings of suitable understorey species around the poles to provide shelter for fauna, in addition to the proposed planting of canopy trees detailed in the VMP. This requirement should be added to the VMP</p>	<p>Noted. The western proposal for the glider poles will be undertaken with understorey planting.</p> <p>The following section of the VMP has been updated to address the additional planting requirement:</p> <ul style="list-style-type: none"> - Section 4.2.4.2 	Refer to Appendix C VMP
4	Central Coast Council	Biodiversity	In relation to Points 3, 4 and 5, Council notes that a Vegetation Management Plan has been provided. Council notes the VMP specifies a 5 year monitoring and maintenance period with annual reports to be provided to Council.	Noted.	
5	Central Coast Council	Transport/Traffic Engineering	<p>Point 6</p> <p>Public (parent/carer) car parking around schools is a major issue on the Central Coast as a higher percentage of students arrive and depart by private transport than in metropolitan areas. It is not anticipated that providing additional car parking spaces will encourage more parents to drive students to school, rather this will simply accommodate the potential demand and relocate parking demand from Warnervale Road.</p>	<p>Stantec Response:</p> <p>It is understood that majority of the students typically travel to/from school via private transport.</p> <p>As shown within Section 6.3 of the Transport and Accessibility report, the pick-up and drop off assessment was undertaken using the travel patterns of the existing Warnervale Public School, with 74% of students being driven to and from school. Additional details noted below for Point 15 and 16.</p> <p>The proposed parking provisions and its methodology was presented to Council during past consultations and are in line with the Central Coast Development Control Plans, in particular: "Bus standing areas, parent drop-off and set down are to be provided subject to a Transport Management Plan based on anticipated mode split."</p>	Refer to Appendix D Stantec Response

6	Central Coast Council	Transport/Traffic Engineering	<p>Point 7</p> <p>The provision of kerbside drop-off and pick-up directly adjacent to the school and relocating the staff carpark to the west is still considered to provide a better road safety outcome and will only require minimal re-design of the carpark layout. Council still considers that the turning head at the southern end of the carpark is necessary and could be deleted to create additional car parking. It has not been demonstrated how the turning head will eliminate conflict points within the carpark</p>	<p>Stantec Response:</p> <p>As noted previously, Council's recommended option has been considered in the earlier stages of this project.</p> <p>However, a trade-off has been made in retaining the current design due to design constraints. Nonetheless, it is expected that the current design is able to provide a similar road safety outcome for the following reasons:</p> <ul style="list-style-type: none"> • Staff parking is highly secured and fenced off from the rest of the carpark, with two security control points for staff access only in the entry and exit locations. This ensures that students will go around this staff carpark area via a designated safe route. • Staff is expected to enter and exit the carpark outside the typical school peak period, minimising disruptions to the pick-up and drop-off. <p>An Operational Transport and Access Management Plan (OTAMP) is typically prepared prior to the commencement of the school, in consultation with Council and Transport for NSW. This should also involve a detailed pedestrian analysis including the identification of safe route options to ensure that students and staff are able to access and leave the school in a safe and efficient manner during school start and finish.</p> <p>Austrorads Guide to Traffic Management – Part 6 states the following: " From the Safe System perspective roundabouts act predominantly by reducing severity of impacts because:</p>	Refer to Appendix D Stantec Response
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				<ul style="list-style-type: none"> • Entry and circulating speeds of traffic are moderated by horizontal deflections; • Of the reduction in the number of conflict points; • Of the relative simplicity of decision-making at the point of entry." <p>As such, the internal roundabout within the car park is required to facilitate the relatively high number of movements generated from pick-up and drop off.</p>	
7	Central Coast Council	Transport/Traffic Engineering	<p>Point 8 The proposed boundary re-alignment will result in the western carpark becoming a Council asset. This is not supported.</p> <p>This remains an issue as the car park is required for the development and its dedication to Council is not supported</p>	The DoE intend to continue discussions with Council on this matter.	
8	Central Coast Council	Transport/Traffic Engineering	Points 9 - 13 are noted	Noted.	
9	Central Coast Council	Transport/Traffic Engineering	<p>Point 14</p> <p>Figure 3 indicates sight distance of 20m, however in accordance with AS 2890.1 "Off-street car parking" 35m of SSD is required for driveway exits.</p>	Updated figure is attached within Stantec's Appendix.	Refer to Appendix D Stantec Response
10	Central Coast Council	Transport/Traffic Engineering	<p>Points 15 and 16</p> <p>Arrivals during the PM peak is an existing issue at schools on the Central Coast. The proposed set-down and pick up area will not cope with this number of vehicles. Staff management of this area will not prevent queuing out onto Warnervale Road creating significant delays to non-school traffic.</p>	<p>Stantec Response:</p> <p>The times used for parking restrictions within the Transport and Accessibility report dated 05 August 2019 are obtained from both Austroads1 and Transport for NSW2 and should be adhered to, with or without staff management.</p> <p>Table 6-3 of the report shows that the provision of 16 short-term parking and eight temporary pick up/drop off spaces will satisfy the expected parking demands (for 460 students)of the new Warnervale school. The following advantages of having a supervisor/staff management to assist</p>	Refer to Appendix D Stantec Response

				<p>children in and out of the vehicle, as part of the 'Drop-off and Pick-up initiative3', are referenced from NSW Centre for Road Safety:</p> <ul style="list-style-type: none"> • Provides a designated zone at a school access point for drivers to stop and drop off or pick up their children. • Relieves traffic congestion around the school by ensuring cars do not park illegally. • Provides adult supervision for students being dropped off and picked up from school by car. • Reinforces road safety messages and safe passenger behaviour to parents and children. 	
11	DPIE	Architectural	A plan showing the Gross Floor Area of the development.	Noted.	Refer to Appendix E GFA Plans
12	DPIE	Architectural	Amended elevations which show the natural ground level	Noted.	Refer to Appendix F Elevations
13	DPIE	Biodiversity	A schedule showing the number and species of trees proposed for removal, including in the vegetated part of the site, and the proposed number of replacement trees and their species	<p>The Landscape package that was included in the SSD application has indicated planting zones and includes a referencing planting schedule. At this stage of the project quantities have not yet been nominated. This will be provided in the next phase of the project during Detailed Design.</p> <p>Note: Tree planting is also discussed in the VMP; Section 4.2.4.2 and Section 4.2.6.</p>	Refer to Appendix C VMP & Landscape SSDA Package

Billard Leece Partnership
The New Primary School at Warnervale

Appendix A

Biodiversity – BDAR Report *by Kleinfelder*



Biodiversity Development Assessment Report



NSW Department of Education

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

6 April 2020

Biodiversity Development Assessment Report

The New Primary School at Warnervale

75 Warnervale Road, Warnervale NSW

Kleinfelder Document Number: NCA19R93323

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Prepared for:

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Document Control:

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3.0	Draft Update	31 July 2019	S. Schulz	-
4.0	Final Draft	02 August 2019	S. Schulz	-
5.0	Updated as part of Response to Submissions	13 December 2019	G. Whyte	S. Schulz
6.0	Updated as part of RFI	6 April 2020	S. Schulz	-

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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**).*

No threatened flora or fauna species or populations, or threatened ecological communities were identified within the Study Area, and no SALLs were identified. Upon request from Council, the Squirrel Glider has been assumed to be present within the Study Area.

*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. Impacts on 2.12 ha of Squirrel Glider habitat within the Development Site generates a total of 64 species credits (**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

Contents

EXECUTIVE SUMMARY	III
1. INTRODUCTION	1
1.1 SCOPE	1
1.2 LOCAL CONTEXT	1
1.3 PROPOSED DEVELOPMENT	2
1.4 LEGISLATIVE CONTEXT	5
1.4.1 <i>Environment Protection & Biodiversity Conservation Act 1999 (EPBC Act)</i>	5
1.4.2 <i>Biodiversity Conservation Act 2016 (NSW)</i>	6
1.4.3 <i>Biosecurity Act 2015 (NSW)</i>	7
1.4.4 SEPP 44 – Koala Habitat Protection	8
2. LANDSCAPE CONTEXT	10
2.1 LANDSCAPE FEATURES	10
2.2 SITE CONTEXT	10
2.2.1 Native Vegetation Cover	11
2.3 GEOLOGY AND SOILS	11
3. NATIVE VEGETATION	12
3.1 METHODOLOGY	12
3.1.1 Data Review	12
3.1.2 Vegetation Mapping Surveys	12
3.2 ASSESSMENT RESULTS	14
3.2.1 Vegetation Description	14
3.2.2 Vegetation Zones	16
3.2.3 Assessment of Patch Size	24
3.2.4 Vegetation Integrity Score	24
4. THREATENED SPECIES	25
4.1 ASSESSING HABITAT SUITABILITY	25
4.1.1 Habitat Assessment	25
4.1.2 Ecosystem Credit Species	31
4.1.3 Species Credit Species	32
4.2 THREATENED SPECIES SURVEYS	33
4.2.2 Candidate Threatened Flora Species	33
4.2.3 Candidate Threatened Fauna Surveys	38
4.3 IDENTIFIED THREATENED SPECIES	42

5.	AVOID AND MINIMISE IMPACTS ON BIODIVERSITY VALUES	44
5.1	AVOIDING AND MINIMISING IMPACTS DURING PROJECT PLANNING....	44
5.1.1	Avoid and Minimise Impacts on Native Vegetation and Habitat	44
5.1.2	Avoid and Minimise Impacts on Prescribed Biodiversity Impacts	45
5.2	ASSESSMENT OF IMPACTS.....	46
5.2.1	Impacts on Native Vegetation and Habitat	46
5.2.2	Prescribed Impacts	47
5.3	MITIGATING AND MANAGING IMPACTS ON BIODIVERSITY VALUES.....	47
6.	IMPACT SUMMARY	49
6.1	SERIOUS AND IRREVERSIBLE IMPACTS.....	49
6.2	IDENTIFICATION OF IMPACTS REQUIRING OFFSETS.....	49
6.2.1	Impacts on Native Vegetation (Ecosystem Credits)	49
6.2.2	Impacts on threatened species	50
7.	ASSESSMENT OF BIODIVERSITY LEGISLATION	51
7.1	<i>ENVIRONMENT AND BIODIVERSITY CONSERVATION ACT 1999</i>	51
7.2	SEPP 44 – KOALA HABITAT PROTECTION	51
7.2.1	Proposed Amendment to SEPP 44	51
7.3	<i>BIOSECURITY ACT 2015 (NSW)</i>	52
8.	REFERENCES	53

Tables

Table 1:	List of SEPP 44 Schedule 2 preferred Koala feed trees.....	8
Table 2:	Landscape features of the Development Footprint.....	10
Table 3:	Composition, Structure and Function components of vegetation integrity	13
Table 4:	Plant Community Types within the Development Site.....	14
Table 5:	Current vegetation integrity score for the vegetation zone	24
Table 6:	Habitat trees within the Study Area.....	26
Table 7:	Tree attributes and results of large hollow inspection	28
Table 8:	Survey of requirements and timing conducted for candidate flora species.....	33
Table 9:	Survey of threatened fauna species	38
Table 10:	Mitigation Measures for the Proposal.....	48
Table 11:	Summary of ecosystem credit requirements	49
Table 12:	Summary of species credit requirements.....	50

Figures

Figure 1:	Site Plan	3
Figure 2:	Locality Map.....	4
Figure 3:	Vegetation Map.....	15
Figure 4:	Habitat Trees	30
Figure 5:	Flora Survey Effort (August and September 2018).....	35
Figure 6:	Flora Survey Effort (October and December 2018)	36
Figure 7:	Flora Survey Effort (January and February 2019)	37
Figure 8:	Fauna Survey Effort	41
Figure 9:	Squirrel Glider Habitat Map.....	43

Plates

Plate 1:	PCT 1590: Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest – Moderate_Good within the Development Footprint	16
Plate 2:	PCT 1590: Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest – Cleared within the Development Footprint	19
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.....	20
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	22
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	23
Plate 6:	Common Ring-tailed Possum (<i>Pseudocheirus peregrinus</i>) found in hollow at Habitat Tree no. 18.	29
Plate 7:	Australian Wood Duck (<i>Chenonetta jubata</i>) nest and egg fragments found at waypoint no. 27.....	29

Appendices

Appendix 1.	Site Concept Design
Appendix 2.	Flora and Fauna Species List
Appendix 3.	Threatened Species Database Search
Appendix 4.	Predicted and Candidate Species
Appendix 5.	Like-for-like Biodiversity Credit Report
Appendix 6.	Staff Contributions
Appendix 7.	Licensing

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**).



<p>0 10 20 40 60 80 100 Metres</p> <p>KLEINFELDER Bright People. Right Solutions. www.kleinfelder.com</p>	<p>PROJECT REFERENCE: 20192176</p> <p>DATE DRAWN: 2/08/2019 13:36 Version 1</p> <p>DRAWN BY: GJoyce</p> <p>DATA SOURCE: NSW DFSI - 2017 ADW Johnson - 2019 Nearmap - 2019</p>	<p>Development Site Map</p> <p>NSW Department of Education (c/- Billard Leece Partnership) Biodiversity Development Assessment Report New Warnervale Public School Lot 71 DP 7091 Warnervale Rd, Warnervale NSW</p>	<p>FIGURE:</p> <p>1</p>
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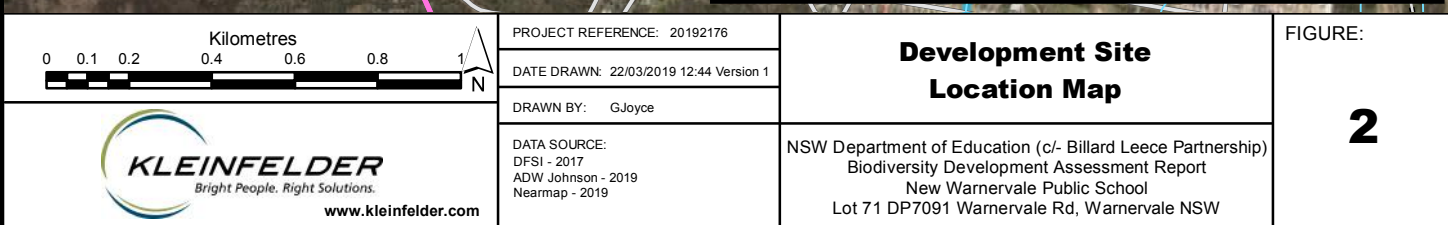
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Legend

- Development Site
- 1500m Landscape Assessment Boundary
- Landscape Assessment - Native Vegetation
- Mitchell Landscapes Boundary (V3)
- Watercourse
- Primary Road
- Arterial Road
- Local Road
- Track
- Access Way

Riparian Buffers

- Meters



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 Values 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
<i>Eucalyptus tereticornis</i>	Forest Red Gum
<i>Eucalyptus microcorys</i>	Tallowwood
<i>Eucalyptus punctata</i>	Grey Gum
<i>Eucalyptus viminalis</i>	Ribbon or Manna Gum
<i>Eucalyptus camaldulensis</i>	River Red Gum
<i>Eucalyptus haemastoma</i>	Broad-leaved Scribbly Gum
<i>Eucalyptus signata</i>	Scribbly Gum
<i>Eucalyptus albens</i>	White Box
<i>Eucalyptus populnea</i>	Bimble Box or Poplar Box
<i>Eucalyptus robusta</i>	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 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
<ul style="list-style-type: none"> • Tree (TG) • Shrub (SG) • Grass and grass-like (GG) • Forb (FG) • Fern (EG) • Other (OG) 	<ul style="list-style-type: none"> • 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>).

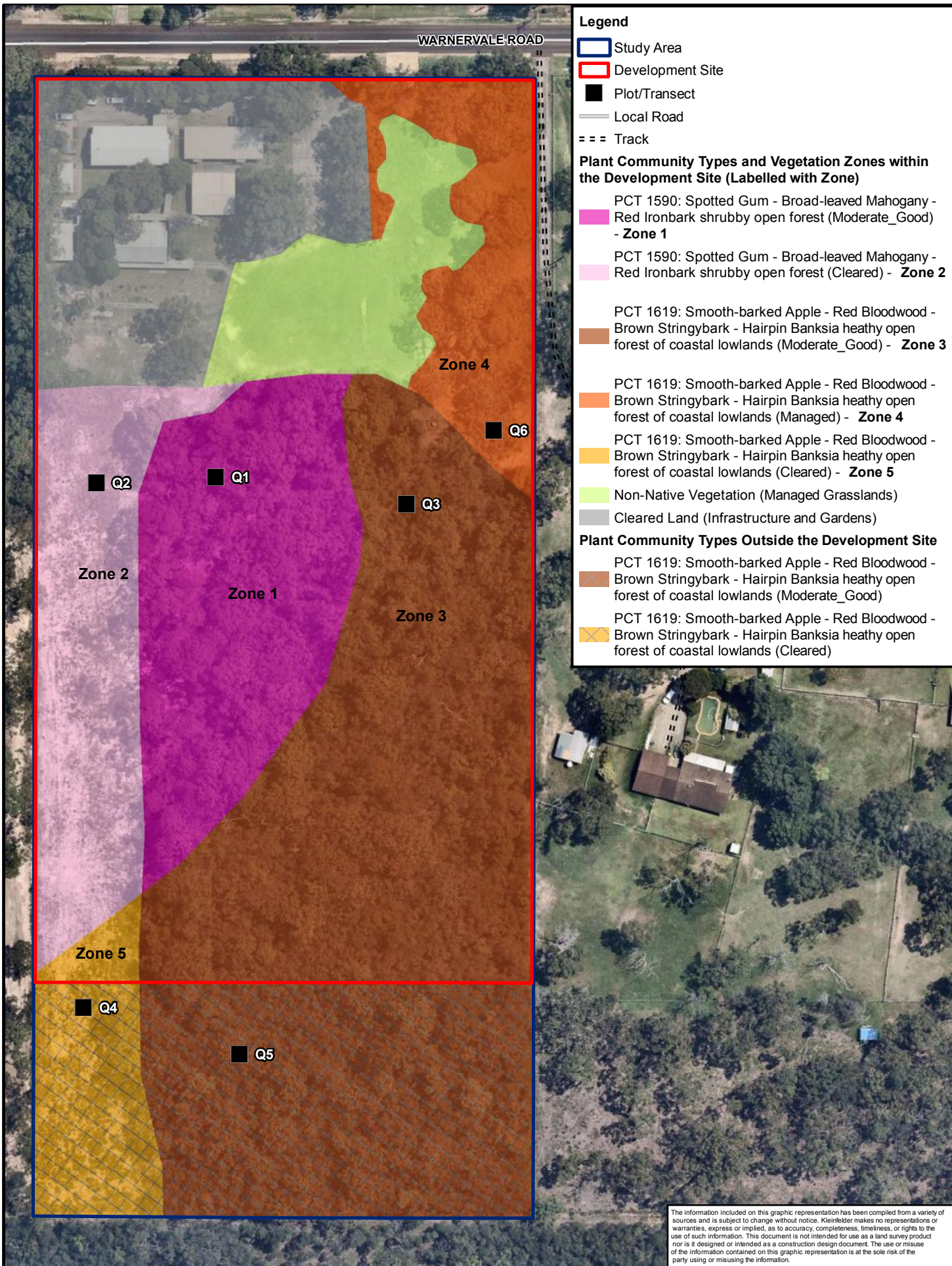
3.2 ASSESSMENT RESULTS

3.2.1 Vegetation Description

The majority of the site consist of remnant native vegetation, including areas of Narrabeen Buttonderry Foothills 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 Foothills 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



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 <i>Corymbia maculata</i> , <i>Eucalyptus eugenioides</i> and <i>Eucalyptus fibrosa</i> , with <i>Eucalyptus umbra</i> and <i>Angophora costata</i> also occurring. The midstorey is dominated by a dense layer of <i>Melaleuca nodosa</i> with scattered <i>Allocasuarina littoralis</i> occurring. There is a sparse shrub layer of <i>Pimelea linifolia</i> , <i>Phyllanthus hirtellus</i> , <i>Acacia longifolia</i> subsp. <i>longifolia</i> and <i>Podolobium scandens</i> .

Warnervale Spotted Gum – Red Ironbark Forest	
	<p>The ground layer is dominated by <i>Ptilothrix deusta</i>, <i>Entolasia stricta</i>, <i>Xanthorrhoea latifolia</i>, <i>Gahnia melanocarpa</i>, <i>Themeda triandra</i>, <i>Microlaena stipoides</i> var. <i>stipoides</i>, <i>Lobelia purpurascens</i>, <i>Cassytha pubescens</i>,</p> <p>Exotic species occur at the edge of the vegetation zone where and in areas of historical disturbance, including, <i>Axonopus fissifolius</i>, <i>Paspalum dilatatum</i>, <i>Ligustrum sinense</i>, <i>Conyza bonariensis</i> and <i>Asparagus aethiopicus</i>.</p>
Condition within Development Footprint	<p>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.</p>
Justification for PCT selection	<p>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.</p> <p>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.</p> <p>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 <i>E. crebra</i> within this PCT which is more representative of Central Hunter Spotted Gum – Ironbark Forest.</p> <p>PCT 1593 was excluded as this PCT is described as being dominated by <i>E. fibrosa</i>. PCT 1592 was excluded due to the presence of <i>E. punctata</i> 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.</p> <p>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 <i>Themeda triandra</i>, <i>Microlaena stipoides</i>, <i>Daviesia ulicifolia</i> and <i>Lobelia purpurascens</i>). PCT 1590 was determined to be more closely aligned to the vegetation on site to the presence of <i>E. fibrosa</i> in the canopy of this PCT where PCT 1589 has <i>E. punctata</i> 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.</p>
Status	<p>BC Act: Not Listed.</p> <p>The PCT is linked with the <i>Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions</i>. The final determination for the <i>Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions</i> (NSW TSSC 2019) describes the community as:</p> <ul style="list-style-type: none"> 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 <i>Corymbia maculata</i> (Spotted Gum) and <i>Eucalyptus fibrosa</i> (Broad-leaved Ironbark), with <i>E. punctata</i> (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 <i>Acacia parvipinnula</i>, <i>Bursaria spinosa</i>, <i>Daviesia ulicifolia</i>, <i>Lissanthe strigosa</i>, <i>Melaleuca nodosa</i>, <i>Persoonia linearis</i>, <i>Aristida vagans</i> <i>Cheilanthes sieberi</i>.

Warnervale Spotted Gum – Red Ironbark Forest	
	<p><i>Dianella revoluta</i>, <i>Entolasia stricta</i>, <i>Glycine clandestina</i>, <i>Hardenbergia violacea</i>, <i>Lepidosperma laterale</i>, <i>Lomandra filiformis</i>, <i>Lomandra multiflora</i>, <i>Macrozamia flexuosa</i>, <i>Microlaena stipoides</i>, <i>Panicum simile</i>, <i>Phyllanthus hirtellus</i>, <i>Pomax umbellata</i> and <i>Themeda triandra</i>.</p> <p>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:</p> <ul style="list-style-type: none"> • 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 <i>C. maculata</i> and <i>E. fibrosa</i> are typically dominant in LHSGIB, the site contains an abundance of other canopy species such as <i>E. eugenioides</i>, <i>E. umbra</i> and <i>A. costata</i>, which are not diagnostic of LHSGIB. Sub-dominant canopy species which typically occur in LHSGIB such as <i>E. punctata</i> and <i>E. crebra</i> were not recorded. • LHSGIB generally contains a prominent shrub layer dominated by <i>Acacia parvipinnula</i>, 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. <p>As such the vegetation within the study area has not been classified as the EEC.</p> <p>EPBC Act: Not Listed</p>
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	<p>This vegetation zone is dominated by <i>Entolasia stricta</i>, <i>Themeda triandra</i> and <i>Schoenus apogon</i>. Other species occurring include, <i>Juncus continuus</i>, <i>Dichelachne micrantha</i>, <i>Gonocarpus teucroides</i>, <i>Thysanotus tuberosus</i>, <i>Centella asiatica</i>, <i>Sphaeromorphaea australis</i>, <i>Fimbristylis dichotoma</i>, <i>Glycine tabacina</i>, <i>Lobelia purpurascens</i> and <i>Microlaena stipoides</i> var. <i>stipoides</i>. Regenerating canopy and midstorey species, such as <i>Corymbia maculata</i>, <i>Acacia longifolia</i> subsp. <i>longifolia</i>, and <i>Hakea sericea</i>.</p> <p>A number of exotic species also occur within the vegetation zone, including <i>Hydrocotyle bonariensis</i>, <i>Conyza bonariensis</i>, <i>Hypochaeris radicata</i>, <i>Plantago lanceolata</i> and <i>Senna pendula</i> var. <i>glabrata</i>.</p>
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	<p>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 <i>C. maculata</i>). 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.</p> <p>As such, the justification for PCT selection is as per Vegetation Zone 1.</p>
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	<p>The vegetation within the study area was dominated by <i>Angophora costata</i>, <i>Corymbia gummifera</i>, and <i>E. capitellata</i>, with <i>E. fibrosa</i> and <i>E. eugenioides</i> also occurring.</p> <p>The midstorey is dominated by dense layer of <i>Allocasuarina littoralis</i> and <i>Melaleuca nodosa</i>. Scattered <i>Melaleuca decora</i> also occur.</p> <p>The shrub and ground layers are dominated by <i>Ptilothrix deusta</i>, <i>Entolasia stricta</i>, <i>Microlaena stipoides</i> var. <i>stipoides</i>, <i>Gahnia radula</i>, <i>Xanthorrhoea latifolia</i>, <i>Brunoniella australis</i>, <i>Lepidosperma laterale</i>, <i>Lobelia purpurascens</i>, <i>Bossiaea rhombifolia</i> and <i>Persoonia levis</i>.</p> <p>The climber and twining species <i>Parsonsia straminea</i> and <i>Cassytha pubescens</i> also occur.</p> <p>The orchid species <i>Cryptostylis subulata</i> also occurs in large patches within the community.</p> <p>Scattered exotic species occur within the community, including, <i>Ligustrum sinense</i>, <i>Asparagus aethiopicus</i>, <i>Richardia stellaris</i> and <i>Lantana camara</i>.</p>
Condition within Development Footprint	<p>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 <i>Allocasuarina</i> and/or <i>Melaleuca</i> combined with a scattered canopy layer in areas, which suggests historic disturbance in these areas.</p>

Narrabeen Buttonderry Foothills Forest	
Justification for PCT selection	<p>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.</p> <p>All PCTs within this vegetation class, which are dominated by <i>Angophora costata</i> 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.</p> <p>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.</p> <p>PCT 1621 was excluded due to the occurrence of <i>E. pilularis</i> and <i>Allocasuarina torulosa</i> within this PCT, which are not present within this Study Area.</p> <p>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".</p> <p>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 <i>Angophora costata</i>, <i>Corymbai gummifera</i>, <i>Eucalyptus capitellata</i>, <i>Allocasuarina littoralis</i>, <i>Xanthorrhoea latifolia</i>, <i>Persoonia levis</i> and <i>Themeda triandra</i> and it is in line with the vegetation description of the PCT; "Open forests with a canopy dominated by <i>Angophora costata</i> and <i>Corymbia gummifera</i>. 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."</p>
Status	BC Act: Not Listed.
	EPBC Act: Not Listed.
SAIL	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	<p>This vegetation zone contains a scattered canopy dominated by <i>Angophora costata</i>, and <i>E. capitellata</i>.</p> <p>There is a scattered midstorey is dominated by <i>Melaleuca nodosa</i> with occasional <i>Allocasuarina littoralis</i>.</p> <p>The shrub is largely missing from this vegetation zone due to management (slashing) and ground layers are dominated by <i>Entolasia stricta</i>, <i>Themeda triandra</i>, <i>Imperata cylindrica</i>, <i>Microlaena stipoides</i> var. <i>stipoides</i>, <i>Gahnia radula</i>, <i>Lepidosperma laterale</i>, <i>Goodenia paniculata</i>, <i>Phyllanthus hirtellus</i>, and <i>Lepyrodia scariosa</i>.</p> <p>The orchid species <i>Calochilus robertsonii</i> occurs within this community.</p> <p>The ground layer is also co-dominated by a number of exotic species including, <i>Axonopus fissifolius</i>, <i>Andropogon virginicus</i>, <i>Hypochaeris radicata</i> and <i>Taraxacum officinale</i>.</p>
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 <i>A. costata</i>). 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 <i>Gahnia radula</i> , <i>Entolasia stricta</i> , <i>Persoonia levis</i> , <i>Pimelea linifolia</i> , <i>Schoenus apogon</i> , <i>Sphaeromorphaea australis</i> , <i>Pteridium esculentum</i> and <i>Cassytha pubescens</i> . Regenerating tree and shrub species occur within the zone, including <i>Eucalyptus capitellata</i> , <i>Allocasuarina littoralis</i> and <i>Melaleuca decora</i> .
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 <i>A. costata</i>). 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

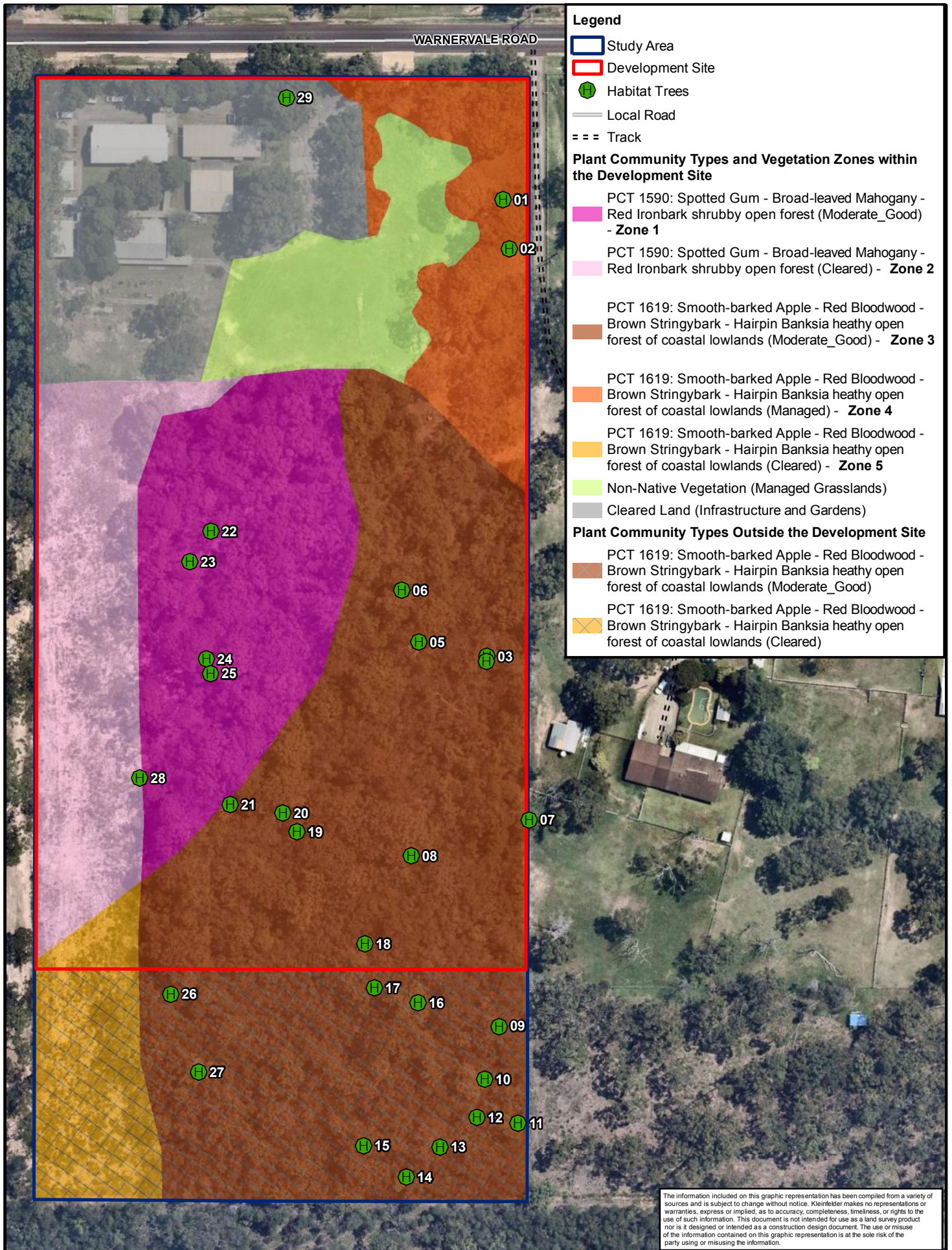
No.	Co-ordinates		Tree Species	Comments
18.	6319852.95	356134.76	Dead Stag	Common Ringtail Possum present
19.	6319887.68	356120.46	Dead Stag (Paperbark)	No signs of fauna use
26.	6319847.45	356077.53	Smooth-barked Apple	No signs of fauna use
27.	6319824.12	356081.89	Smooth-barked Apple	Australian Wood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



<p>Metres</p> <p>0 5 10 20 30 40 50</p>	<p>PROJECT REFERENCE: 20192176</p> <p>DATE DRAWN: 27/03/2019 16:40 Version 1</p> <p>DRAWN BY: gjoyce</p>	<p>Habitat Trees</p>	<p>FIGURE:</p> <p>4</p>
<p>Bright People. Right Solutions.</p> <p>www.kleinfelder.com</p>	<p>DATA SOURCE:</p> <p>NSW DFSI - 2017</p> <p>ADW Johnson - 2019</p> <p>Nearmap - 2019</p>		

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

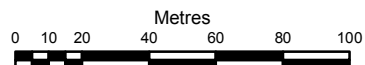
- PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (Moderate_Good) - **Zone 1**
- PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (Cleared) - **Zone 2**
- PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia 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)



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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

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)



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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

Legend

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

Plant Community Types and Vegetation Zones within the Development Site

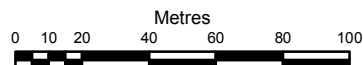
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- PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (Cleared) - **Zone 2**
- PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Moderate_Good) - **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)



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PROJECT REFERENCE: 20190632

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DRAWN BY: gjoyce

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

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			
<i>Crinia tinnula</i>	Wallum Froglet	All Year	February Spotlighting
<i>Litoria aurea</i>	Green and Golden Bell Frog	November to March	
<i>Litoria brevipalmata</i>	Green-thighed Frog	October to March	
<i>Uperoleia mahonyi</i>	Mahony's Toadlet	October to March	
Birds			
<i>Burhinus grallarius</i>	Bush Stone-curlew	All Year	February Spotlighting
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo (Breeding)	October to January	Bird Surveys November
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo (Breeding)	March to August	Bird Surveys March
<i>Hieraaetus morphnoides</i>	Little Eagle (Breeding)	August to October	Nest survey September
<i>Lophoictinia isura</i>	Square-tailed Kite (Breeding)	September to January	Nest survey September
<i>Pandion cristatus</i>	Eastern Osprey (Breeding)	April to November	Nest survey September
<i>Turnix maculosus</i>	Red-backed Button-quail	All Year	February Spotlighting
Mammals			
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	October to March	November to February Trapping (nest boxes)
<i>Petaurus norfolcensis</i>	Squirrel Glider	All Year	November to December & February Trapping & Spotlighting
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	All year	November to December & February Trapping & Spotlighting
<i>Planigale maculata</i>	Common Planigale	All Year	November to December Trapping
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	October to December	November to December Searches for camps
Reptiles			
<i>Hoplocephalus bitorquatus</i>	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 2019. 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 as there are no waterbodies present within the Study Area.

4.2.3.2 Fauna Survey Results

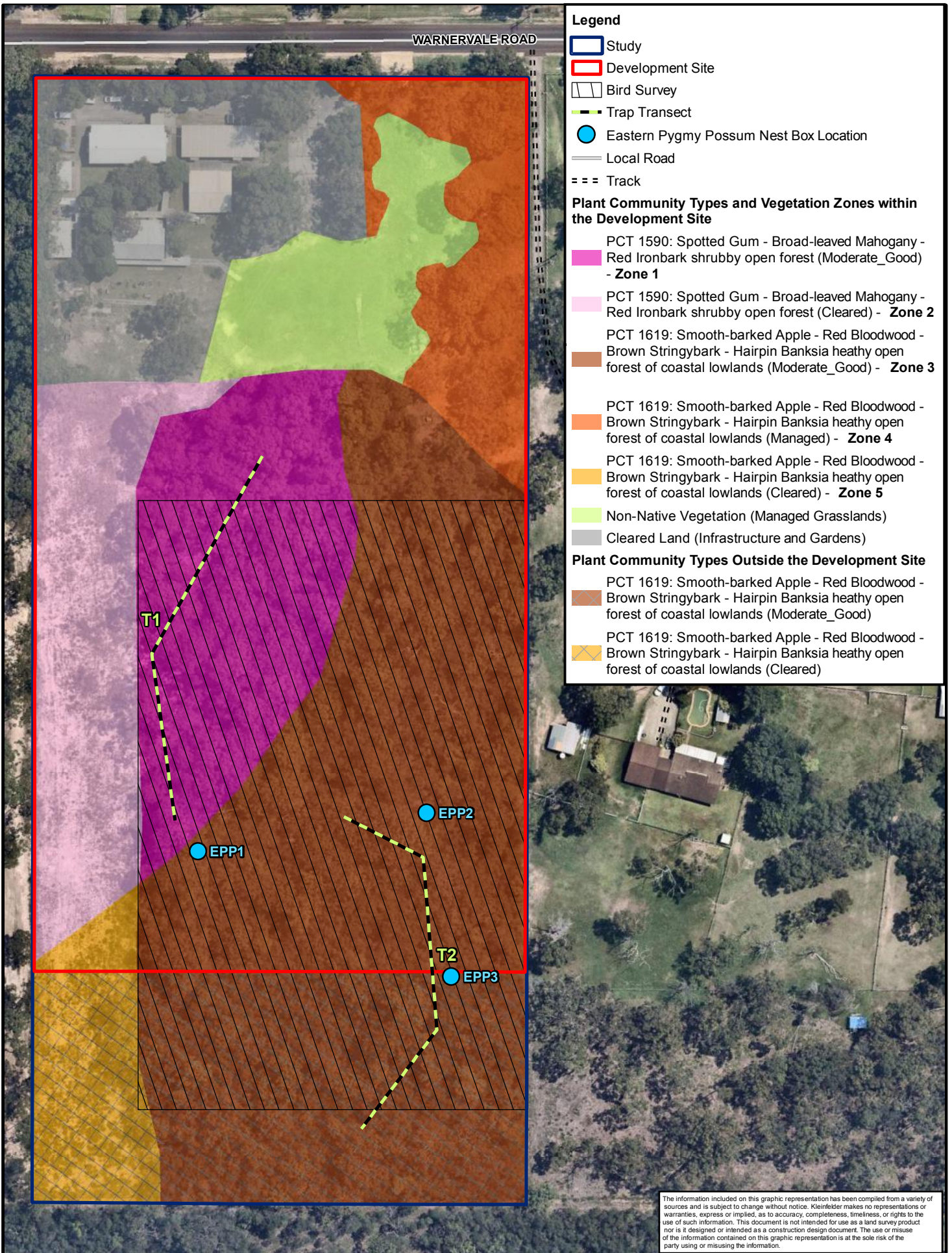
A total of 21 species of fauna were detected within the study area during field surveys (**Appendix 2**). This includes 15 bird, five mammal and one reptile species.

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.

While no Squirrel Gliders were trapped during the field surveys, due to recent records surrounding the site, Council have requested that the species be assumed present within the Study Area.



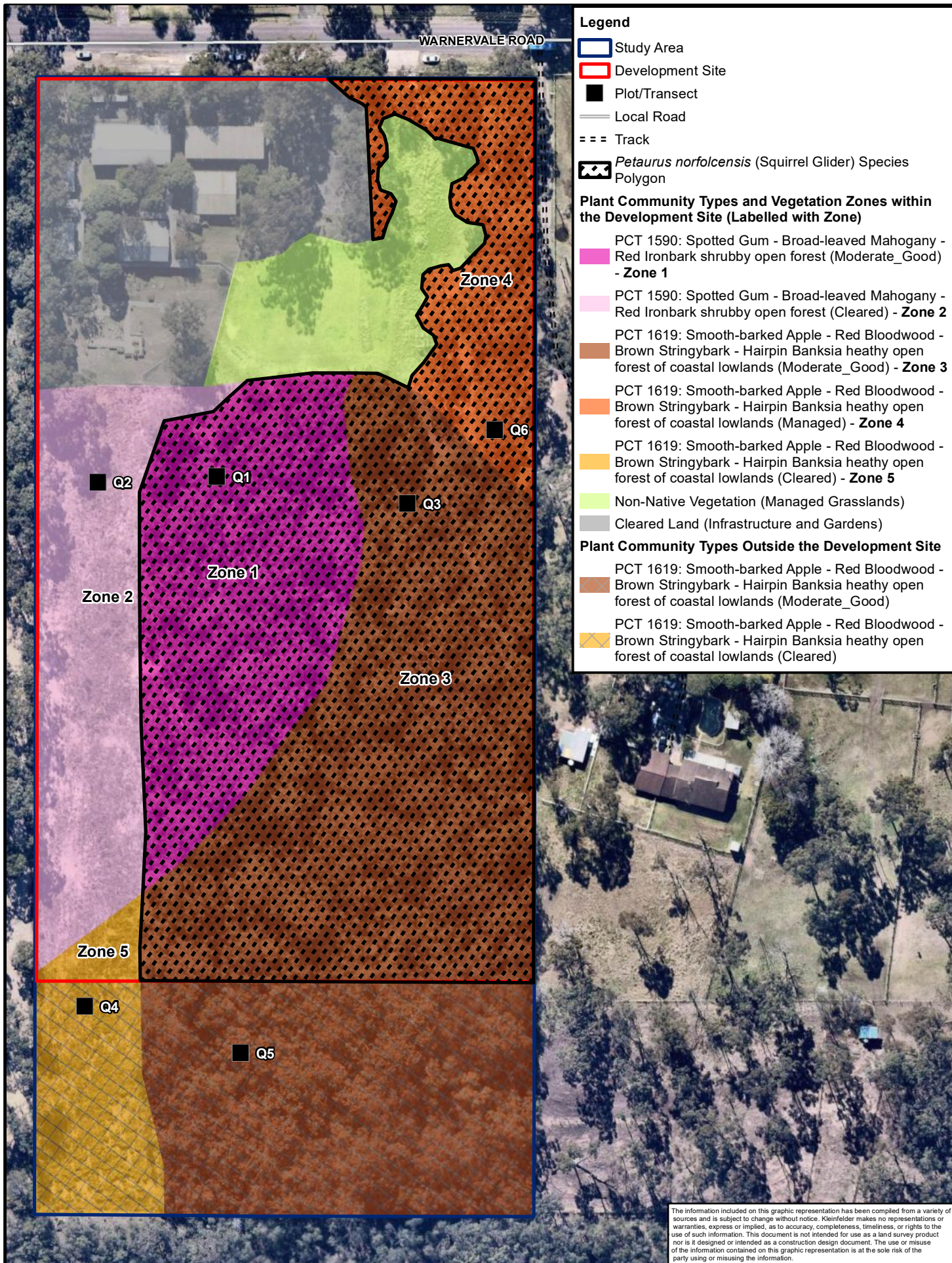
4.3 IDENTIFIED THREATENED SPECIES

Step 5: Determine the area or count, and location of suitable habitat for species credit species & Step 6: Determine the habitat condition within the species polygon for species assessed by area

Squirrel Glider

The Squirrel Glider (*Petaurus norfolcensis*) was assumed present within the Study Area. As such, all areas of suitable habitat within the Development Site has been assessed as forming part of the species polygon for the Squirrel Glider. Three of the five vegetation zones within the Development Site have been assessed as habitat for the species; Vegetation Zone 1 (PCT 1590 – Moderate_Good), Vegetation Zone 3, (PCT 1619 Moderate_Good) and Vegetation Zone 4 (PCT 1619 Managed). Due to the lack of canopy within Vegetation Zone 2 (PCT 1590 Cleared) and Vegetation Zone 5 (PCT 1619 Cleared), these areas were not assessed as habitat for the species.

The total area of the species polygon is 2.12 ha which consists of 0.65 ha in Zone 1, 1.15 ha in Zone 3 and 0.32 ha in Zone 4 (**Figure 9**).



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 facilitates 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 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	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> Use of appropriate wash down procedures and facilities for vehicles and equipment. 	Construction site manager	During vegetation clearing and construction.
Accidental incursions during clearing	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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 ≥ 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

A summary of the impact on native vegetation and the required species credits is provided in **Table 12**.

Table 12: Summary of species credit requirements

Species	Vegetation Zone	Area (ha)	Current Vegetation Integrity Score	Future Vegetation Integrity Score	Credits Required
Squirrel Glider	1: 1590 Mod_Good	0.65	72.5	0	24
	3: 1619 Mod_Good	1.15	56.8	0	33
	4: 1619 Managed	0.32	41	0	7
Total					64

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).

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

Family	Scientific Name	Common Name	Q1		Q2		Q3		Q4		Q6	
			FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab
Rubiaceae	<i>Richardia stellaris</i>						0.1	5			0.2	5
Verbenaceae	<i>Lantana camara</i>	Lantana					0.1	2				
Native Species												
Acanthaceae	<i>Brunoniella australis</i>	Blue Trumpet	0.1	20	0.1	10	0.1	20	0.1	20		
Anthericaceae	<i>Laxmannia gracilis</i>	Slender Wire Lily			0.1	100					0.2	10
Anthericaceae	<i>Thysanotus tuberosus</i>	Common Fringe Lily	0.1	10	0.1	100	0.1	10	0.1	20	0.1	5
Anthericaceae	<i>Tricoryne elatior</i>	Yellow Autumn-lily									0.1	5
Apiaceae	<i>Centella asiatica</i>	Indian Pennywort	0.1	5	0.1	100						
Apocynaceae	<i>Parsonsia straminea</i>	Common Silkpod	0.2	5			0.1	20				
Araliaceae	<i>Trachymene incisa</i>	-					0.1	1				
Asteraceae	<i>Coronidium scorpioides</i>	Button Everlasting			0.1	10						
Asteraceae	<i>Cyanthillium cinereum</i>	Iron Weed	0.1	5			0.1	1				
Asteraceae	<i>Lagenophora stipitata</i>	Blue Bottle-daisy	0.2	30								
Asteraceae	<i>Ozothamnus diosmifolius</i>	Rice flower			0.1	50						
Asteraceae	<i>Sphaeromorphaea australis</i>	Spreading Nut-heads			0.1	100			0.1	20	0.1	1
Casuarinaceae	<i>Allocasuarina littoralis</i>	Black She-oak	1	5			1	10	0.1	50	2	1
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed	0.2	20								
Convolvulaceae	<i>Polymeria calycina</i>		0.1	5								
Cyperaceae	<i>Chorizandra cymbaria</i>											
Cyperaceae	<i>Cyperus eragrostis</i>	Umbrella sedge			0.1	10						
Cyperaceae	<i>Fimbristylis dichotoma</i>	Common Fringe-sedge			0.1	100						
Cyperaceae	<i>Gahnia radula</i>		10	40	0.1	50	40	200	55	100	5	50
Cyperaceae	<i>Lepidosperma filiforme</i>											
Cyperaceae	<i>Lepidosperma laterale</i>		0.2	5	0.1	50	0.2	5			2	20
Cyperaceae	<i>Ptilothrix deusta</i>		40	1000	0.1	50	10	500			0.1	10

Family	Scientific Name	Common Name	Q1		Q2		Q3		Q4		Q6	
			FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab
Cyperaceae	<i>Schoenus apogon</i>	Common Bog-rush			20	500			0.1	50	0.2	20
Dennstaedtiaceae	<i>Pteridium esculentum</i>	Common Bracken							0.1	10		
Dilleniaceae	<i>Hibbertia diffusa</i>	Wedge Guinea Flower			0.1	10						
Dilleniaceae	<i>Hibbertia empetrifolia</i>				0.1	10	0.2	10	0.1	10		
Fabaceae (Faboideae)	<i>Bossiaea rhombifolia</i>						1	10				
Fabaceae (Faboideae)	<i>Daviesia ulicifolia</i>	Gorse Bitter Pea	0.1	5	0.1	10						
Fabaceae (Faboideae)	<i>Glycine clandestina</i>		0.2	20			0.1	10			0.1	5
Fabaceae (Faboideae)	<i>Glycine tabacina</i>				0.1	100						
Fabaceae (Faboideae)	<i>Hardenbergia violacea</i>	Purple Coral Pea			0.1	10			0.1	10		
Fabaceae (Faboideae)	<i>Mirbelia rubiifolia</i>	Heathy Mirbelia					0.1	10			0.2	10
Fabaceae (Faboideae)	<i>Podolobium scandens</i>	Netted Shaggy Pea	0.2	10	0.1	20						
Fabaceae (Faboideae)	<i>Pultenaea rosmarinifolia</i>				0.1	10						
Fabaceae (Mimosoideae)	<i>Acacia falcata</i>	Hickory Wattle			0.1	10			0.1	10		
Fabaceae (Mimosoideae)	<i>Acacia longifolia</i> subsp. <i>longifolia</i>	Sydney golden wattle	0.2	5	0.1	1						
Goodeniaceae	<i>Goodenia heterophylla</i> subsp. <i>eglandulosa</i>				0.1	50						
Goodeniaceae	<i>Goodenia paniculata</i>	Branched Goodenia							0.1	10	1	40
Haemodoraceae	<i>Haemodorum planifolium</i>		0.1	5	0.1	20						

Family	Scientific Name	Common Name	Q1		Q2		Q3		Q4		Q6	
			FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab
Haloragaceae	<i>Gonocarpus micranthus</i> subsp. <i>micranthus</i>								0.1	1		
Haloragaceae	<i>Gonocarpus teucrioides</i>	Raspwort	0.2	20	0.1	500	0.1	30	0.1	10	0.2	20
Hypericaceae	<i>Hypericum gramineum</i>	Small St. Johns Wort			0.1	100					0.2	30
Iridaceae	<i>Patersonia sericea</i>	Silky Purple-flag					0.1	5			0.1	5
Juncaceae	<i>Juncus continuus</i>				1	1						
Lauraceae	<i>Cassytha pubescens</i>		0.5	20	0.1	100	0.2	10	0.1	20	0.1	1
Lindsaeaceae	<i>Lindsaea linearis</i>	Screw fern							1	10		
Lindsaeaceae	<i>Lindsaea microphylla</i>	Lacy Wedge Fern					0.1	2				
Lobeliaceae	<i>Lobelia purpurascens</i>	Whiteroot	0.5	50	0.1	100	0.1	20			0.2	30
Lomandraceae	<i>Lomandra filiformis</i>	Wattle Mat-rush	0.1	1							0.1	5
Lomandraceae	<i>Lomandra glauca</i>	Pale Mat-rush					0.1	5				
Lomandraceae	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush			0.1	20						
Lomandraceae	<i>Lomandra multiflora</i> subsp. <i>multiflora</i>	Many-flowered Mat-rush	0.1	5	0.1	50	0.1	5	0.1	10		
Myrtaceae	<i>Angophora costata</i>	Sydney Red Gum	4	3			10	2			15	2
Myrtaceae	<i>Corymbia gummifera</i>	Red Bloodwood					10	2				
Myrtaceae	<i>Corymbia maculata</i>	Spotted Gum	25	8	0.1	20						
Myrtaceae	<i>Eucalyptus capitellata</i>	Brown Stringybark							0.1	1	20	3
Myrtaceae	<i>Eucalyptus eugenioides</i>		35	8	0.1	1	10	3			2	1
Myrtaceae	<i>Eucalyptus fibrosa</i>		2	1			10	6				
Myrtaceae	<i>Eucalyptus haemastoma</i>	Scribbly Gum										
Myrtaceae	<i>Eucalyptus umbra</i>	Broad-leaved White Mahogany										
Myrtaceae	<i>Melaleuca decora</i>				0.1	50	1	5	0.1	1		
Myrtaceae	<i>Melaleuca nodosa</i>		30	25			80	50			10	10

Family	Scientific Name	Common Name	Q1		Q2		Q3		Q4		Q6	
			FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab
Myrtaceae	<i>Melaleuca sieberi</i>											
Orchidaceae	<i>Caladenia carnea</i>	Pink Fairy										
Orchidaceae	<i>Calochilus robertsonii</i>	Purplish Beard Orchid										
Orchidaceae	<i>Cryptostylis subulata</i>	Large Tongue Orchid			0.1	1	0.1	5				
Orchidaceae	<i>Genoplesium fimbriatum</i>	Fringed Midge Orchid										
Orchidaceae	<i>Thelymitra pauciflora</i>	Slender Sun Orchid										
Phormiaceae	<i>Dianella caerulea</i> var. <i>caerulea</i>	Blue Flax-Lily	0.1	5	0.1	50	0.1	5	0.1	10	0.1	5
Phyllanthaceae	<i>Glochidion ferdinandi</i>	Cheese Tree					0.5	10			0.1	1
Phyllanthaceae	<i>Phyllanthus hirtellus</i>	Thyme Spurge	0.2	30			0.2	20			0.2	20
Pittosporaceae	<i>Billardiera scandens</i>	Hairy Apple Berry	0.1	5			0.1	10			0.1	5
Pittosporaceae	<i>Pittosporum undulatum</i>	Mock Orange					0.1	1				
Poaceae	<i>Aristida vagans</i>	Threeawn Speargrass	0.1	5							0.1	10
Poaceae	<i>Austrostipa pubescens</i>				0.1	50	0.1	5			0.1	5
Poaceae	<i>Cynodon dactylon</i>	Couch	0.1	5	0.1	10						
Poaceae	<i>Dichelachne micrantha</i>	Shorthair Plumegrass	0.1	10	1	20	0.1	5			0.2	20
Poaceae	<i>Echinopogon caespitosus</i>	Bushy Hedgehog-grass									0.1	20
Poaceae	<i>Entolasia stricta</i>	Wiry Panic	10	200	35	50	10	50	10	100	5	50
Poaceae	<i>Eragrostis brownii</i>	Brown's Lovegrass	0.1	5							0.2	20
Poaceae	<i>Imperata cylindrica</i>	Blady Grass									1	30
Poaceae	<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass	5	50	0.1	100	5	500			1	100
Poaceae	<i>Panicum effusum</i>	Hairy Panic			0.1	100						
Poaceae	<i>Panicum simile</i>	Two-colour Panic	0.1	5	0.1	100					0.5	40
Poaceae	<i>Poa labillardierei</i> var. <i>labillardierei</i>	Tussock	0.2	5							0.5	10
Poaceae	<i>Rytidosperma pilosum</i>		0.1	20	0.1	20					0.2	30

Family	Scientific Name	Common Name	Q1		Q2		Q3		Q4		Q6	
			FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab
Poaceae	<i>Rytidosperma setaceum</i>	Smallflower Wallaby Grass			0.1	20						
Poaceae	<i>Themeda triandra</i>	Kangaroo Grass	5	50	15	500					15	50
Polygalaceae	<i>Comesperma ericinum</i>	Pyramid Flower	0.1	5	0.1	50						
Polygonaceae	<i>Rumex brownii</i>	Swamp Dock			0.1	10						
Proteaceae	<i>Banksia spinulosa</i>	Hairpin Banksia					0.1	2	0.1	1		
Proteaceae	<i>Grevillea humilis</i> subsp. <i>humilis</i>	Linear-leaf Grevillea	0.2	10			0.1	10				
Proteaceae	<i>Hakea sericea</i>	Needlebush	0.1	1	0.1	10						
Proteaceae	<i>Persoonia levis</i>	Broad-leaved Geebung					0.2	5	5	5		
Pteridaceae	<i>Cheilanthes sieberi</i>	Poison Rock Fern	0.1	10			0.1	20				
Restionaceae	<i>Lepyrodia scariosa</i>								0.1	10	5	50
Rubiaceae	<i>Opercularia diphylla</i>				0.1	50	0.1	20	0.1	20		
Stylidiaceae	<i>Stylidium graminifolium</i>	Grass Trigger-plant	0.1	5							0.1	5
Thymelaeaceae	<i>Pimelea linifolia</i>	Slender Rice Flower	1	20	0.1	50	0.1	10	0.1	100	0.2	10
Xanthorrhoeaceae	<i>Xanthorrhoea latifolia</i>		10	30			1	10				

Fauna Species List

Scientific Name	Common Name	Status
Birds		
<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	-
<i>Calyptorhynchus funereus</i>	Yellow-tailed Black-cockatoo	-
<i>Chenonetta jubata</i>	Australian Wood Duck	-
<i>Corvus coronoides</i>	Australian Raven	-
<i>Cracticus torquatus</i>	Grey Butcher Bird	-
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	-
<i>Eolophus roseicapilla</i>	Galah	-
<i>Eopsaltria australis</i>	Little Yellow Robin	-
<i>Eurostopodus mystacalis</i>	White Throated Nightjar	-
<i>Grallina cyanoleuca</i>	Magpie Lark	-
<i>Gymnorhina tibicen</i>	Australian Magpie	-
<i>Manorina melanocephala</i>	Noisy Miner	-
<i>Ocyphaps lophotes</i>	Crested pigeon	-
<i>Platycercus eximius</i>	Eastern Rosella	-
<i>Trichoglossus moluccanus</i>	Rainbow Lorikeet	-
Mammals		
<i>Antechinus stuartii</i>	Brown Antechinus	-
<i>Mus musculus</i>	House Mouse	Introduced
<i>Petaurus breviceps</i>	Sugar Glider	-
<i>Pseudocheirus peregrinus</i>	Ringtail Possum	-
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	Vulnerable (BC Act & EBC Act)
Reptiles		
<i>Amphibolurus muricatus</i>	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.	<i>Angophora inopina</i> Charmhaven Apple	V	V	2657	OEH Atlas / BioNet / PMST	Occurs most frequently in four main vegetation communities: (i) <i>Eucalyptus haemastoma</i> – <i>Corymbia gummifera</i> – <i>Angophora inopina</i> woodland/forest; (ii) <i>Hakea teretifolia</i> – <i>Banksia oblongifolia</i> wet heath; (iii) <i>Eucalyptus resinifera</i> – <i>Melaleuca sieberi</i> – <i>Angophora inopina</i> sedge woodland; (iv) <i>Eucalyptus capitellata</i> – <i>Corymbia gummifera</i> – <i>Angophora inopina</i> woodland/forest.	Low
2.	<i>Astrotricha crassifolia</i> Thick-leaf Star-hair	V	V	-	BioNet	Occurs in dry sclerophyll woodland on sandstone.	Low
3.	<i>Caladenia tessellata</i> 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.	<i>Callistemon linearifolius</i> Netted Bottle Brush	V	-	4	OEH Atlas / BioNet	Grows in dry sclerophyll forest on the coast and adjacent ranges.	Low
5.	<i>Corunastylis sp.</i> 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 (<i>Allocasuarina littoralis</i>), Prickly Tea-tree (<i>Leptospermum juniperinum</i>), Prickly-leaved Paperbark (<i>Melaleuca nodosa</i>), Narrow-leaved Bottlebrush (<i>Callistemon linearis</i>) and Zig-zag Bog-rush (<i>Schoenus brevifolius</i>).	Moderate - Low

No.	Species	Legal Status*		No. of Records	Source [#]	Habitat Preferences	Likelihood of occurrence
		BC Act	EPBC Act				
6.	<i>Cryptostylis hunteriana</i> 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 (<i>Eucalyptus sclerophylla</i>), Silvertop Ash (<i>E. sieberi</i>), Red Bloodwood (<i>Corymbia gummifera</i>) and Black Sheoak (<i>Allocasuarina littoralis</i>); appears to prefer open areas in the understorey of this community.	Low - Moderate
7.	<i>Cynanchum elegans</i> 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 <i>Leptospermum laevigatum</i> – Coastal Banksia <i>Banksia integrifolia</i> subsp. <i>integrifolia</i> coastal scrub; Spotted Gum <i>Corymbia maculata</i> aligned open forest and woodland; and Bracelet Honeymyrtle <i>Melaleuca armillaris</i> scrub to open scrub.	Low
8.	<i>Darwinia glaucophylla</i> -	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.	<i>Diuris bracteata</i> -	E	Ex	-	BioNet	Dry sclerophyll woodland and forest with a predominantly grassy understorey.	Low
10.	<i>Diuris praecox</i> 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.	<i>Eucalyptus camfieldii</i> 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.	<i>Hibbertia procumbens</i> Spreading Guinea Flower	E	-	-	BioNet	Majority of known populations occur within <i>Banksia ericifolia</i> – <i>Angophora hispida</i> – <i>Allocasuarina distyla</i> 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.	<i>Melaleuca groveana</i> 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 sandstone on rocky outcrops and cliffs. It also occurs in dry scrubby open forest and woodlands.	Low
14.	<i>Prostanthera askania</i> Tranquility Mintbush	E	E	1	OEI 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.	<i>Prostanthera junonis</i> 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.	<i>Rutidosis heterogama</i> Heath Wrinklewort	V	V	172	OEI 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.	<i>Senna acclinis</i> Rainforest Cassia	E	-	-	BioNet	Grows on the margins of subtropical, littoral and dry rainforests.	Nil
18.	<i>Tetradlea glandulosa</i> -	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.	<i>Tetradlea juncea</i> Black-eyed Susan	V	V	117	OEI 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.	<i>Thelymitra adorata</i> 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.	<i>Helioporus australiacus</i> 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.	<i>Litoria brevipalmata</i> 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.	<i>Litoria aurea</i> Green and Golden Bell Frog	E	V	5	OEH Atlas / PMST / BioNet	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (<i>Typha</i> spp.) or spikerushes (<i>Eleocharis</i> spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (<i>Gambusia holbrooki</i>), have a grassy area nearby and diurnal sheltering sites available.	Low
4.	<i>Mixophyes iteratus</i> 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.	<i>Mixophyes balbus</i> 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.	<i>Anthochaera phrygia</i> 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.	<i>Burhinus grallarius</i> 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.	<i>Callocephalon fimbriatum</i> 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.	<i>Calyptorhynchus lathamii</i> 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 <i>Allocasuarina littoralis</i> in the south-east portion of the site.	Low - Moderate
5.	<i>Lathamus discolor</i> 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.	<i>Hieraaetus morphnoides</i> Little Eagle	V	-	3	OEH Atlas	Occupies open eucalypt forest, woodland or open woodland. Sheoak or <i>Acacia</i> 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.	<i>Lophoictinia isura</i> 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.	<i>Ninox connivens</i> 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.	<i>Ninox strenua</i> 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.	<i>Tyto novaehollandiae</i> 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

No.	Species	Legal Status*		No. of Records	Source [#]	Habitat Preferences	Likelihood of occurrence
		BC Act	EPBC Act				
1.	<i>Cercartetus nanus</i> 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.	<i>Chalinolobus dwyeri</i> 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 (<i>Petrochelidon ariel</i>), frequenting low to mid-elevation dry open forest and woodland close to these features.	Low
3.	<i>Macropus parma</i> 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.	<i>Miniopterus australis</i> 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.	<i>Miniopterus schreibersii oceanensis</i> 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.	<i>Myotis macropus</i> 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.	<i>Petaurus norfolcensis</i> Squirrel Glider	V	-	79	OEI 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 <i>Banksia</i> 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.	<i>Petrogale penicillata</i> 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.	<i>Phascogale tapoatafa</i> 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.	<i>Phascolarctos cinereus</i> Koala	V	V	2	OEI Atlas / PMST	Found in a variety of forest types with suitable feed tree species.	Low
11.	<i>Planigale maculata</i> 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.	<i>Pteropus poliocephalus</i> Grey-headed Flying-fox	V	V	24	OEI 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.	<i>Vespadelus troughtoni</i> 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.	<i>Hoplocephalus bitorquatus</i> 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.	<i>Hoplocephalus stephensii</i> 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.	<i>Apus pacificus</i> 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.	<i>Cuculus optatus</i> 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.	<i>Hirundapus caudacutus</i> 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.	<i>Monarcha melanopsis</i> 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.	<i>Monarcha trivirgatus</i> 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.	<i>Motacilla flava</i> Yellow Wagtail	-	M	-	PMST	Typically inhabits inundated fields, saltmarsh and wetlands and occasionally coastal areas. No suitable habitat within the study area.	Nil
7.	<i>Myiagra cyanoleuca</i> 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.	<i>Rhipidura rufifrons</i> 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
<i>Anthochaera phrygia</i>	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
<i>Callocephalon fimbriatum</i>	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
<i>Calyptorhynchus lathamii</i>	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
<i>Chthonicola sagittata</i>	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
<i>Climacteris picumnus victoriae</i>	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
<i>Daphoenositta chrysoptera</i>	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
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	All Zones	Yes	-

Scientific Name	Common Name	Associated PCT / Vegetation Zone	Confirmed Predicted Species	Justification
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	All Zones	Yes	-
<i>Glossopsitta pusilla</i>	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
<i>Grantiella picta</i>	Painted Honeyeater	All Zones	No	Habitat Constraint Absent – lack of Mistletoes species
<i>Haliaeetus leucogaster</i>	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
<i>Hieraaetus morphnoides</i>	Little Eagle	All Zones	Yes	-
<i>Kerivoula papuensis</i>	Golden-tipped Bat	All Zones	Yes	-
<i>Lathamus discolor</i>	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
<i>Lophoictinia isura</i>	Square-tailed Kite (Foraging)	All Zones	Yes	-
<i>Melithreptus gularis gularis</i>	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
<i>Miniopterus australis</i>	Little Bentwing-bat (Foraging)	All Zones	Yes	-
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat (Foraging)	All Zones	Yes	-
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	All Zones	Yes	-

Scientific Name	Common Name	Associated PCT / Vegetation Zone	Confirmed Predicted Species	Justification
<i>Neophema pulchella</i>	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
<i>Ninox connivens</i>	Barking Owl (Foraging)	All Zones	Yes	-
<i>Ninox strenua</i>	Powerful Owl (Foraging)	All Zones	Yes	-
<i>Pandion cristatus</i>	Eastern Osprey (Foraging)	Zone 3 – 1619 (Moderate_Good) / Zone 4 – 1619 (Managed) / Zone 5 – 1619 (Cleared)	Yes	-
<i>Petaurus australis</i>	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
<i>Petroica boodang</i>	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
<i>Phascolarctos cinereus</i>	Koala (Foraging)	All Zones	No	Habitat Constraint Absent – No Koala feed trees present within the Study Area
<i>Pomatostomus temporalis temporalis</i>	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
<i>Pseudomys gracilicaudatus</i>	Eastern Chestnut Mouse	Zone 3 – 1619 (Moderate_Good) / Zone 4 – 1619 (Managed) / Zone 5 – 1619 (Cleared)	Yes	-
<i>Pteropus poliocephalus</i>	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

Scientific Name	Common Name	Associated PCT / Vegetation Zone	Confirmed Predicted Species	Justification
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat	All Zones	Yes	-
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	All Zones	Yes	-
<i>Stagonopleura guttata</i>	Diamond Firetail	Zone 1 – 1590 (Moderate_Good)	Yes	-
		Zone 2 – 1590 (Cleared)	No	Habitat degraded – No woodland habitat present
<i>Tyto novaehollandiae</i>	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				
<i>Acacia bynoeana</i>	Bynoe's Wattle	1619	Yes	-
<i>Angophora inopina</i>	Charmhaven Apple	1619	Yes	-
<i>Astrotricha crassifolia</i>	Thick-leaf Star-hair	1619	Yes	-
<i>Callistemon linearifolius</i>	Netted Bottle Brush	1590 and 1619	Yes	-
<i>Corunastylis</i> sp. Charmhaven	-	Habitat assessed as within both 1590 (marginal) and 1619 (moderate – low)	Yes	Additional Candidate Species Added (as requested by Council in SEARs)
<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid	1590 and 1619	Yes	-
<i>Cynanchum elegans</i>	White-flowered Wax Plant	1590	Yes	-
<i>Diuris praecox</i>	Rough Doubletail	1619	Yes	-
<i>Eucalyptus oblonga</i>	<i>Eucalyptus oblonga</i> 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
<i>Genoplesium insigne</i>	Variable Midge Orchid	1619	Yes	-
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Small-flower Grevillea	1590 and 1619	Yes	-
<i>Melaleuca groveana</i>	Grove's Paperbark	1619	Yes	-
<i>Prostanthera askania</i>	Tranquility Mintbush	1619	Yes	-
<i>Rutidosia heterogama</i>	Heath Wrinklewort	1590 and 1619	Yes	-
<i>Tetradlea glandulosa</i>	-	1619	Yes	-
<i>Tetradlea juncea</i>	Black-eyed Susan	1590 and 1619	Yes	-
<i>Thelymitra adroata</i>	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				
<i>Crinia tinnula</i>	Wallum Froglet	1619	Yes	-
<i>Litoria aurea</i>	Green and Golden Bell Frog	1590 and 1619	Yes	-
<i>Litoria brevipalmata</i>	Green-thighed Frog	1590 and 1619	Yes	-
<i>Uperoleia mahonyi</i>	Mahony's Toadlet	1619	Yes	-
Birds				
<i>Anthochaera phrygia</i>	Regent Honeyeater (Breeding)	1590	No	Habitat Constraint Absent - Study Area not within mapped area (Site not within known breeding range)
<i>Burhinus grallarius</i>	Bush Stone-curlew	1590 and 1619	Yes	-
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo (Breeding)	1590 and 1619	Yes	-
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo (Breeding)	1590 and 1619	Yes	-
<i>Haliaeetus leucogaster</i>	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
<i>Hieraaetus morphnoides</i>	Little Eagle (Breeding)	1590 and 1619	Yes	-
<i>Lathamus discolor</i>	Swift Parrot (Breeding)	1590 and 1619	No	Habitat Constraint Absent - Study Area not within mapped area (Site not within known breeding range)
<i>Lophoictinia isura</i>	Square-tailed Kite (Breeding)	1590 and 1619	Yes	-
<i>Ninox connivens</i>	Barking Owl (Breeding)	1590 and 1619	No	Habitat Constraint Absent – No suitable hollows present within the Study Area
<i>Ninox strenua</i>	Powerful Owl (Breeding)	1590 and 1619	No	Habitat Constraint Absent – No suitable hollows present within the Study Area
<i>Pandion cristatus</i>	Eastern Osprey (Breeding)	1619	Yes	-

Scientific Name	Common Name	Associated PCT	Confirmed Candidate Species	Justification
<i>Turnix maculosus</i>	Red-backed Button-quail	1590	Yes	-
<i>Tyto novaehollandiae</i>	Masked Owl (Breeding)	1590 and 1619	No	Habitat Constraint Absent – No suitable hollows present within the Study Area
Mammals				
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	1590 and 1619	Yes	-
<i>Chalinolobus dwyeri</i>	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
<i>Miniopterus australis</i>	Little Bentwing-bat (Breeding)	1590 and 1619	No	Habitat Constraint 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
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat (Breeding)	1590 and 1619	No	Habitat Constraint 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
<i>Myotis macropus</i>	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
<i>Petaurus norfolcensis</i>	Squirrel Glider	1590 and 1619	Yes	-
<i>Petrogale penicillata</i>	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
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	1590 and 1619	Yes	-
<i>Phascolarctos cinereus</i>	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
<i>Planigale maculata</i>	Common Planigale	1590 and 1619	Yes	-

Scientific Name	Common Name	Associated PCT	Confirmed Candidate Species	Justification
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	1590 and 1619	Yes	-
<i>Vespadelus trougtoni</i>	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				
<i>Hoplocephalus bitorquatus</i>	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	26/11/2019
Assessor Name	Report Created	BAM Data version *
	06/04/2020	22
Assessor Number	Assessment Type	BAM Case Status
	Major Projects	Finalised
	Assessment Revision	Date Finalised
	0	06/04/2020

* 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

BAM Predicted Species Report

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
		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
		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

BAM Predicted Species Report

Grey-crowned Babbler (eastern subspecies)	Pomatostomus 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	Hieraetus 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

BAM Predicted Species Report

Scarlet Robin	<i>Petroica boodang</i>	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	<i>Chthonicola sagittata</i>	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	<i>Dasyurus maculatus</i>	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	<i>Lophoictinia isura</i>	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	<i>Lathamus discolor</i>	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	<i>Neophema pulchella</i>	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	<i>Daphoenositta chrysoptera</i>	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	<i>Petaurus australis</i>	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 Predicted Species Report

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	Proposal Name	BAM data last updated *
00013544/BAAS17039/19/00016916	The New Primary School Warnervale	26/11/2019
Assessor Name	Report Created	BAM Data version *
	06/04/2020	22
Assessor Number	Assessment Type	BAM Case Status
	Major Projects	Finalised
	Assessment Revision	Date Finalised
	0	06/04/2020

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

BAM Candidate Species Report

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

BAM Candidate Species Report

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

BAM Candidate Species Report

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

List of Species Not On Site

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

BAM Candidate Species Report

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 Tumby 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	Proposal Name	BAM data last updated *
00013544/BAAS17039/19/00016916	The New Primary School Warnervale	26/11/2019
Assessor Name	Assessor Number	BAM Data version *
		22
Proponent Names	Report Created	BAM Case Status
NSW Department of Education	06/04/2020	Finalised
Assessment Revision	Assessment Type	Date Finalised
0	Major Projects	06/04/2020

Potential Serious and Irreversible Impacts

Nil

Nil

* 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.

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%	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%	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

Species	Area	Credits
Petaurus norfolcensis / Squirrel Glider	2.1	64.00

Petaurus norfolcensis/ Squirrel Glider	1590_Mod_Good	Like-for-like credit retirement options	
		Spp	IBRA region

BAM Biodiversity Credit Report (Like for like)

		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	1619_Managed	Like-for-like credit retirement options	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	1619_Mod_Good	Like-for-like credit retirement options	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW

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	BSEngTech GFireE, 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.

Billard Leece Partnership
The New Primary School at Warnervale

Appendix B

Biodiversity – Payment Report *by Kleinfelder*

Biodiversity payment summary report

Assessment Id	Payment data version	Assessment Revision	Report created
00013544/BAAS17039/19/00016916	63	0	06/04/2020
Assessor Name	Assessor Number	Proposal Name	BAM Case Status
		The New Primary School Warnervale	Finalised
	Assessment Type	Date Finalised	
	Major Projects	06/04/2020	

PCT list

Price calculated	PCT common name	Credits
Yes	1590 - Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	18
Yes	1619 - Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	30

Species list

Price calculated	Species	Credits
Yes	<i>Petaurus norfolcensis</i> (Squirrel Glider)	64

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Biodiversity payment summary report

Biodiversity payment summary report

IBRA sub region	PCT common name	Threat status	Offset trading group	Risk premium	Administrative cost	Methodology adjustment factor	Price per credit	No. of ecosystem credits	Final credits price
Wyong	1590 - Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	No	Hunter-Macleay Dry Sclerophyll Forests <50%	19.73%	\$97.72	1.8195	\$3,022.61	18	\$54,407.05
Wyong	1619 - Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	No	Sydney Coastal Dry Sclerophyll Forests <50%	19.73%	\$346.38	1.7779	\$10,714.30	30	\$321,429.11
Subtotal (excl. GST)									\$375,836.16
GST									\$37,583.62
Total ecosystem credits (incl. GST)									\$413,419.78

Species credits for threatened species

Species profile ID	Species	Threat status	Price per credit	Risk premium	Administrative cost	No. of species credits	Final credits price
10604	<i>Petaurus norfolcensis</i> (Squirrel Glider)		\$636.69	34.3100%	\$80.00	64	\$59,848.85
Subtotal (excl. GST)							\$59,848.85

Biodiversity payment summary report



Biodiversity payment summary report

	GST	\$5,984.88
Total species credits (incl. GST)		\$65,833.74
Grand total		\$479,253.52

Billard Leece Partnership
The New Primary School at Warnervale

Appendix C

Biodiversity – Vegetation Management Plan (VMP) *by Kleinfelder*



Vegetation Management Plan



The NSW Department of Education

The New Primary School at Warnervale
NSW

6 April 2020

Vegetation Management Plan

The New Primary School at Warnervale NSW

Kleinfelder Document Number: NCA19R105059

Project No: 20190632

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Prepared for:

**THE NSW DEPARTMENT OF EDUCATION
C/- BILLARD LEECE PARTNERSHIP**

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Document Control:

Version	Description	Date	Author	Reviewer
1.0	Draft for client review	16 December 2019	G. Whyte	S. Schulz
2.0	Update as part of RFI	6 April 2020	S. Schulz	-

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Contents

1.	INTRODUCTION	1
1.1	BACKGROUND	1
1.2	SITE DESCRIPTION	2
1.3	PROPOSED DEVELOPMENT	2
1.4	DEFINITIONS	2
2.	BIODIVERSITY VALUES	5
2.1	GEOLOGY AND SOILS	5
2.2	NATIVE VEGETATION	5
2.2.1	Plant Community Types	5
2.2.2	Vegetation Condition (Zone)	6
2.3	FAUNA HABITAT	9
2.4	THREATENED FAUNA SPECIES	9
3.	MANAGEMENT ISSUES AND OBJECTIVES	12
3.1	EROSION AND SEDIMENT CONTROL	12
3.1.1	Key Issues	12
3.1.2	Management Objective	12
3.2	VEGETATION PROTECTION	12
3.2.1	Key Issues	12
3.2.2	Management Objective	13
3.3	FAUNA AND HABITAT MANAGEMENT	13
3.3.1	Key Issues	13
3.3.2	Management Objectives	13
3.4	FAUNA HABITAT REPLACEMENT	13
3.4.1	Key Issues	13
3.4.2	Management Objectives	14
3.5	WEED MANAGEMENT	14
3.5.1	Key Issues	14
3.5.2	Management Objective	15
3.6	VEGETATION RESTORATION	15
3.6.1	Key Issues	15
3.6.2	Management Objectives	15
4.	IMPLEMENTATION	17
4.1	MANAGEMENT ZONES	17
4.1.1	Management Zone 1	17

4.1.2	Management Zone 2	17
4.1.3	Management Zone 3	17
4.2	MANAGEMENT STRATEGIES	19
4.2.1	Erosion and Sediment Control	19
4.2.2	Vegetation Protection	19
4.2.3	Fauna Management	19
4.2.4	Fauna Habitat Replacement	21
4.2.5	Weed Management	23
4.2.6	Vegetation Restoration	24
5.	MONITORING AND REPORTING	26
5.1	MONITORING METHODS	26
5.1.1	Annual Walkover	26
5.1.2	Vegetation Integrity Monitoring	27
5.1.3	Nest Box Monitoring	28
5.1.4	Glider Pole and Canopy Link Monitoring	28
5.1.5	Reporting	28
5.2	RISK AND CONTINGENCY MEASURES	28
5.3	PROJECT SCHEDULE	29
6.	REFERENCES	31

Tables

Table 1:	Definition of terms	2
Table 2:	Plant Community Types within the Subject Site	6
Table 3:	Vegetation clearing summary.....	7
Table 4:	Threatened Species habitat within the Subject Site.....	9
Table 5:	Priority weed species and control methods	24
Table 6:	Composition, Structure and Function components of vegetation integrity	27
Table 7:	Current vegetation integrity score for Q4 (Management Zone 3) and Q5 (Management Zone 2)	27
Table 8:	Project schedule	29

Figures

Figure 1:	Development Site Map.....	4
Figure 2:	Vegetation Map.....	8

Figure 3: Vegetation and Habitat Trees	11
Figure 4: Management Zones.....	18

Appendices

Appendix 1.	Flora Species List
Appendix 2.	Habitat Tree Register
Appendix 3.	Glider Movement Strategy
Appendix 4.	Staff Contributions

1. INTRODUCTION

1.1 BACKGROUND

Kleinfelder was engaged by Billard Leece Partnership, on behalf of the NSW Department of Education (DoE), to prepare a Vegetation Management Plan (VMP) for Lot 71 DP 7091 Warnervale Road, Warnervale, NSW (hereafter referred to as the 'Subject Site'). DoE are proposing to develop the Subject Site for the New Warnervale Public School (hereafter referred to as the 'proposed development') and have lodged a Development Application (DA) with Central Coast Council (Council).

Kleinfelder prepared a Biodiversity Development Assessment Report (BDAR) to support a DA for proposed development. Following review of the DA, Council issued a submission including a request for further information on how biodiversity values would be managed within the Subject Site. Actions as requested by Council include the following:

- Replacement planting and bush regeneration within the 'biodiversity valued land to be retained' located at the rear of the site in order to revegetate the (existing unauthorised) cleared area would need to be carried out.
- More information is required about the future/long term management of the "avoid" lands. Council would want these to be retained and managed as a corridor in perpetuity.
- Concern is raised regarding the extent of tree removal associated with the proposal. Replacement native tree planting to compensate for the loss of trees along the street front, within the street setback and areas adjacent to the side boundary (within proximity and view of the street) should be investigated and carried out.
- The street trees also provide for a linking corridor of vegetation across Warnervale Road which is being impacted under the proposal. The squirrel glider glides between trees and the species is sensitive to habitat fragmentation when tree gaps exceed its gliding ability.

This VMP has prepared in consideration of the comments from Council. The VMP also describes the key issues, objectives and management guidelines that relate to the management of biodiversity values within the Subject Site.

1.2 SITE DESCRIPTION

The Subject Site is approximately 4.53 ha in area and occurs within the Central Coast Local Government Area (LGA) (**Figure 1**). The northern portion of the allotment is zoned R1 – General Residential, and the southern portion is zoned R2 – Low Density Residential.

The Subject Site 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 1**). The majority of the southern and central portions of the Subject Site are comprised of native bushland, with the northernmost portion supporting several buildings and managed grassland.

1.3 PROPOSED DEVELOPMENT

The area to be directly impacted by the proposed development occurs within Part of Lot 71 DP 7091. The proposal will directly impact on 3.58 ha of native vegetation. A total of 0.93 ha of native vegetation will be retained.

The proposed development has been designed to avoid vegetation and species habitat removal, where possible. The location of buildings and infrastructure within the site has been positioned within cleared areas where possible.

1.4 DEFINITIONS

A number of terms and abbreviations are used throughout this VMP. Definitions of these terms are provided in **Table 1**.

Table 1: Definition of terms

Term / Abbreviation	Definition
APZ	Asset protection zone
BC Act	<i>Biodiversity Conservation Act 2016</i>
BCD	Biodiversity Conservation Division of the NSW Department of Planning, Industry and Environment

Term / Abbreviation	Definition
Bush Regeneration	Defined by the Australian Association of Bush Regenerators (AABR) as the practice of restoring bushland by focussing on reinstating and reinforcing the systems' ongoing natural regeneration processes.
DA	Development Application prepared pursuant to the EP&A Act.
DPIE	The NSW Department of Planning, Industry and Environment
Development	In relation to land, means: The erection of a building on that land; The carrying out of a work in, on, over or under that and; The use of that land or of a building or work on that land; and The subdivision of that land, but does not include any development of a class or description prescribed by the regulations for the purposes of this definition.
Development area	An area of approximately 3.6 ha
Endangered Ecological Community	An ecological community specified in Schedule 2 of the BC Act
Endangered Population.	A population specified in Schedule 1 of the BC Act
EP&A Act	<i>Environmental Planning & Assessment Act 1979</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
Proposal	Development of Lot 71 DP 7091 Warnervale Road, Warnervale, NSW for the New Warnervale Public School
Regeneration	Where native vegetation can regenerate itself from an intact root zone and seed bank to a natural state, with associated management (weed control).
Rehabilitation	The vegetation rehabilitation is defined as the return of native vegetation within disturbed areas.
Resilience	The ability of an ecosystem to regenerate naturally and to withstand, or recover from, disturbances such as weed invasion, clearing, or fire.
Restoration	To restore pre-existing indigenous ecosystems and ecological processes, maintaining and developing the capacity of a natural system to self-perpetuate.
Subject site	Lot 71 DP 7091 Warnervale Road, Warnervale, NSW



<p>0 10 20 40 60 80 100 Metres</p> <p>KLEINFELDER Bright People. Right Solutions. www.kleinfelder.com</p>	<p>PROJECT REFERENCE: 20192176</p> <p>DATE DRAWN: 2019/12/13 12:55 Version 1</p> <p>DRAWN BY: GJoyce</p> <p>DATA SOURCE: NSW DFSI - 2017 ADW Johnson - 2019 Nearmap - 2019</p>	<p>Development Site Map</p> <p>NSW Department of Education (c/- Billard Leece Partnership) Vegetation Management Plan New Warnervale Public School Lot 71 DP 7091 Warnervale Rd, Warnervale NSW</p>	<p>FIGURE:</p> <p>1</p>
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2. BIODIVERSITY VALUES

2.1 GEOLOGY AND SOILS

The Subject Site 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).

2.2 NATIVE VEGETATION

2.2.1 Plant Community Types

The central and southern portions of the Subject Site contain forest vegetation, comprised of two Plant Community Types (PCTs):

- PCT 1590 - Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest and
- PCT 1619 - Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands.

Approximately 1.14 ha of PCT 1590 occurs within the central-western portion of the Subject Site. All of this vegetation will be removed by the proposed development.

Approximately 2.44 ha of PCT 1619 occurs in the Subject Site. Approximately 0.93 ha of this vegetation will be retained (0.21 ha of regenerating vegetation and 0.72 ha of mature vegetation).

Non-native vegetation is comprised of managed gardens and exotic grasslands (0.30 ha). Cleared areas and existing development (0.65 ha) also occur in the northern portion.

A floristic description of each PCT is presented in **Table 2**. Note that each description is based on the better-quality areas of the Subject Site. A list of all flora species recorded is presented in **Appendix 1**.

Table 2: Plant Community Types within the Subject Site

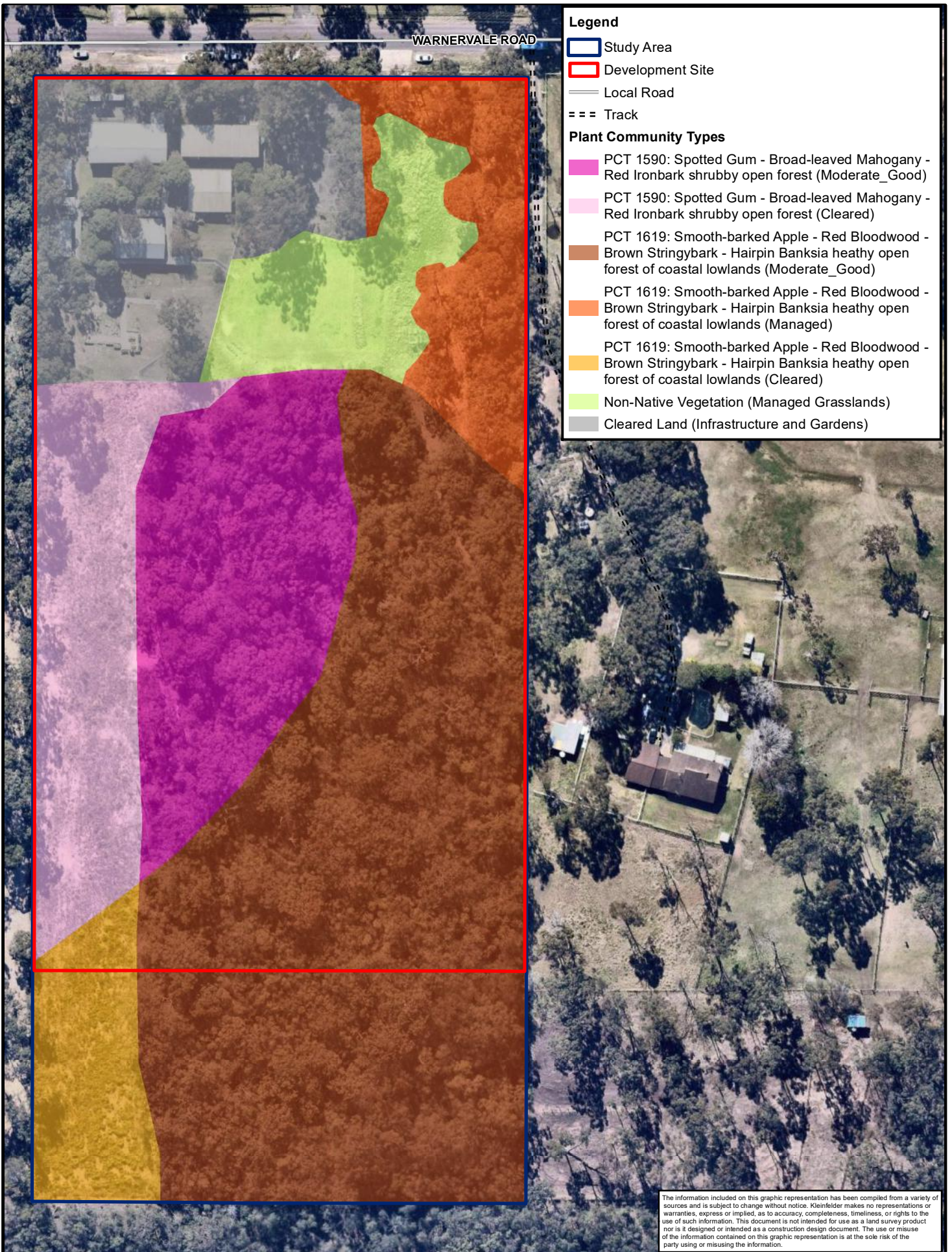
PCT	Floristic Description
PCT 1590: Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest	<p>The canopy of this vegetation is dominated by <i>Corymbia maculata</i>, <i>Eucalyptus eugenioides</i> and <i>Eucalyptus fibrosa</i>, with <i>Eucalyptus umbra</i> and <i>Angophora costata</i> also occurring.</p> <p>The midstorey is dominated by a dense layer of <i>Melaleuca nodosa</i> with scattered <i>Allocasuarina littoralis</i> occurring. There is a sparse shrub layer of <i>Pimelea linifolia</i>, <i>Phyllanthus hirtellus</i>, <i>Acacia longifolia</i> subsp. <i>longifolia</i> and <i>Podolobium scandens</i>.</p> <p>The ground layer is dominated by <i>Ptilothrix deusta</i>, <i>Entolasia stricta</i>, <i>Xanthorrhoea latifolia</i>, <i>Gahnia melanocarpa</i>, <i>Themeda triandra</i>, <i>Microlaena stipoides</i> var. <i>stipoides</i>, <i>Lobelia purpurascens</i> and <i>Cassytha pubescens</i>.</p>
PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	<p>The vegetation within the study area was dominated by <i>Angophora costata</i>, <i>Corymbia gummifera</i>, and <i>Eucalyptus capitellata</i>, with <i>Eucalyptus fibrosa</i> and <i>Eucalyptus eugenioides</i> also occurring.</p> <p>The midstorey is dominated by dense layer of <i>Allocasuarina littoralis</i> and <i>Melaleuca nodosa</i>. Scattered <i>Melaleuca decora</i> also occur.</p> <p>The shrub and ground layers are dominated by <i>Ptilothrix deusta</i>, <i>Entolasia stricta</i>, <i>Microlaena stipoides</i> var. <i>stipoides</i>, <i>Gahnia radula</i>, <i>Xanthorrhoea latifolia</i>, <i>Brunoniella australis</i>, <i>Lepidosperma laterale</i>, <i>Lobelia purpurascens</i>, <i>Bossiaea rhombifolia</i> and <i>Persoonia levis</i>.</p> <p>The climber and twining species <i>Parsonsia straminea</i> and <i>Cassytha pubescens</i> also occur. The orchid species <i>Cryptostylis subulata</i> also occurs in large patches within the community.</p> <p>Scattered exotic species occur within the community, including, <i>Ligustrum sinense</i>, <i>Asparagus aethiopicus</i>, <i>Richardia stellaris</i> and <i>Lantana camara</i>.</p>

2.2.2 Vegetation Condition (Zone)

The vegetation within the Subject Site exists in various states of condition due to historical vegetation clearing, weed encroachment and general habitat degradation. A summary of information pertaining to impacts (vegetation clearing) of each PCT/ vegetation zone is presented in **Table 3**. The extent of each PCT and vegetation zone is presented in **Figure 2**.

Table 3: Vegetation clearing summary

PCT	Veg Zone	Impact Type			
		APZ	Development Area	No Impact	Grand Total
Cleared Land (Infrastructure and Gardens)	-	-	0.65		0.65
Non-Native Vegetation (Managed Grasslands)	-	-	0.30		0.30
PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	Mod/Good	0.04	0.60	-	0.65
PCT 1590: Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	Cleared	0.12	0.37	-	0.49
PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Cleared	-	-	0.21	0.21
	Mod/Good	-	-	0.72	0.72
PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Mod/Good	0.55	0.61	-	1.15
PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Managed		0.32	-	0.32
PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Cleared	0.04	-	-	0.04
Total		0.75	2.85	0.93	4.53



2.3 FAUNA HABITAT

The native vegetation within the Subject Site is continuous with a larger patch of bushland which extends to south-east, south and west. The fauna habitat (predominantly canopy trees and shrubs) is likely to provide foraging habitat for a range of fauna species including birds, arboreal and terrestrial mammals, reptiles, amphibians and invertebrates.

Key habitat features within the Subject Site include hollow-bearing trees which may provide habitat for nesting birds, arboreal mammals, reptiles, amphibians and microbats (Gibbons and Lindenmayer 2003). A total of 29 hollow-bearing trees and dead stags were identified, of which 18 occur within the development area. These habitat trees contain a range of potential hollows sizes.

Information pertaining to each habitat tree including the number and size of each hollow is presented in **Appendix 2**.

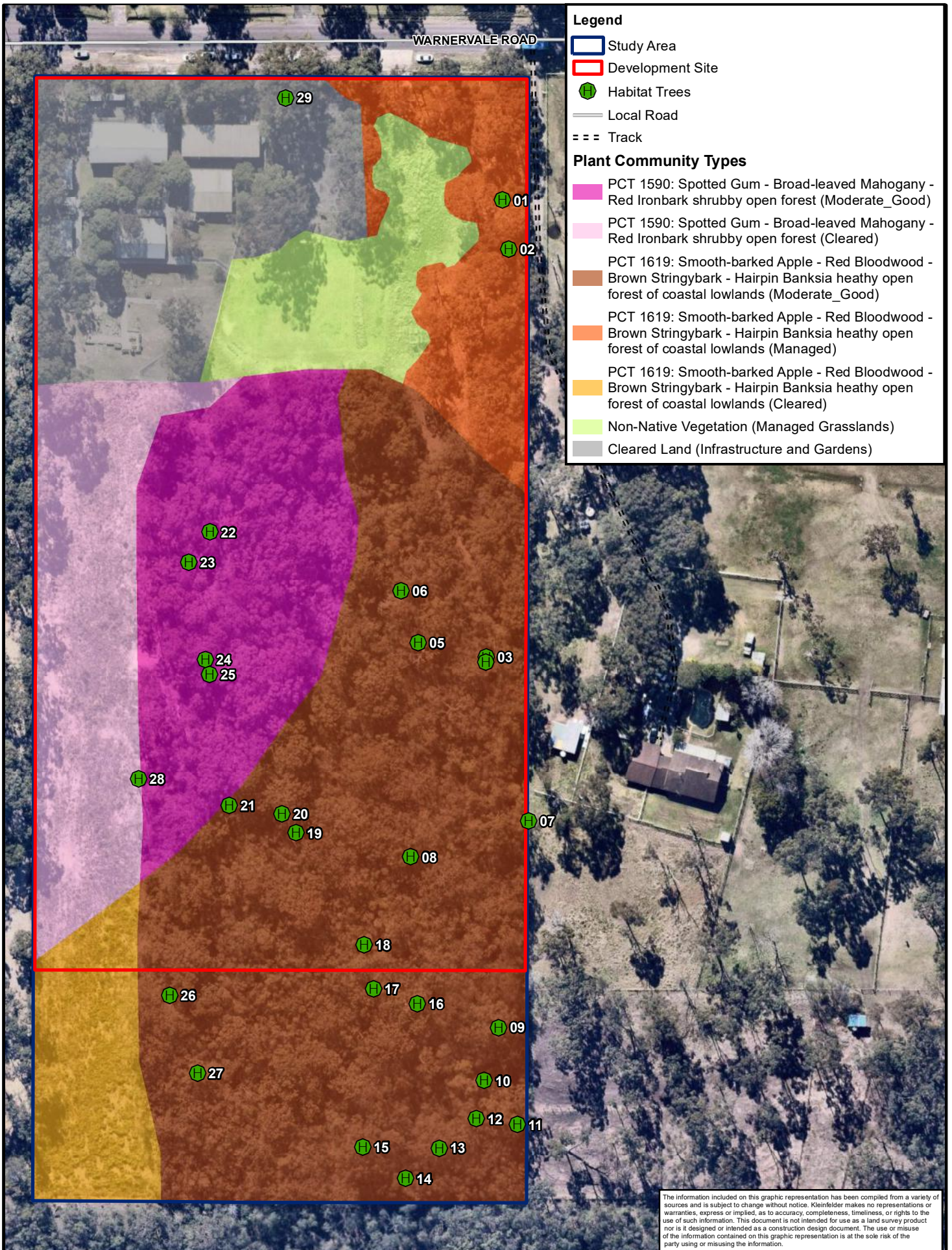
2.4 THREATENED FAUNA SPECIES

No threatened species were identified within the Subject Site; however, habitat was identified for several species. The habitat requirements of each of these species is presented in **Table 4**.

Table 4: Threatened Species habitat within the Subject Site

Threatened Species	Habitat Characteristics
Eastern Bentwing-bat <i>Miniopterus orianae</i> subsp. <i>oceanensis</i>	Forages in forested habitats. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. The Subject Site contains foraging and roosting habitat (hollow-bearing trees) for this species which is nocturnal and preys on insects. No caves or other forms of breeding habitat are present.
Glossy Black-Cockatoo <i>Calyptrorhynchus lathami</i>	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. The Subject Site contains foraging habitat for this species including feed tree species such as Black She-oak (<i>Allocasuarina littoralis</i>). A detailed inspection of large hollows within the Subject Site identified no individuals breeding.

Threatened Species	Habitat Characteristics
<p>Grey-headed Flying-fox <i>Pteropus poliocephalus</i></p>	<p>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.</p> <p>The vegetation within the Subject Site is dominated by <i>Eucalyptus</i> sp., <i>Angophora</i> sp. and <i>Corymbia</i> sp. These trees provide foraging resources for the Grey-headed Flying Fox (GHFF) including nectar and pollen.</p> <p>No GHFF camps occur within the Subject Site. The habitat therefore represents foraging habitat rather than breeding habitat.</p>
<p>Little Bentwing-bat <i>Miniopterus australis</i></p>	<p>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.</p> <p>The Subject Site contains foraging and roosting habitat (hollow-bearing trees) for this species which is nocturnal and preys on insects. No caves or other forms of breeding habitat are present.</p>
<p>Squirrel Glider <i>Petaurus norfolcensis</i></p>	<p>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. Dens and breeds in hollow-bearing trees.</p> <p>The vegetation within the Subject Site is dominated by <i>Eucalyptus</i> sp., <i>Angophora</i> sp. and <i>Corymbia</i> sp. These trees provide foraging resources for the Squirrel Glider including nectar, sap, pollen, insects and other small prey.</p> <p>The canopy vegetation within the Subject Site has been identified as an important habitat corridor for the Squirrel Glider. Due to the large number of historical records of Squirrel Gliders within the locality and high connectivity of the vegetation, the Squirrel Glider has been identified as a target species for which habitat values within the Subject Site are to be improved via implementation of this VMP.</p>
<p>Swift Parrot <i>Lathamus discolor</i></p>	<p>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.</p> <p>The vegetation within the Subject Site is dominated by <i>Eucalyptus</i> sp., <i>Angophora</i> sp. and <i>Corymbia</i> sp. These trees provide foraging resources for the Swift Parrot including nectar, pollen and insects such as Psyllids.</p>



<p>Metres</p> <p>0 5 10 20 30 40 50</p>	<p>PROJECT REFERENCE: 20192176</p> <p>DATE DRAWN: 2019/12/13 13:03 Version 1</p> <p>DRAWN BY: GJoyce</p>	<p>Habitat Trees</p>	<p>FIGURE:</p> <p>3</p>
<p>Bright People. Right Solutions.</p> <p>www.kleinfelder.com</p>	<p>DATA SOURCE:</p> <p>NSW DFSI - 2017</p> <p>ADW Johnson - 2019</p> <p>Nearmap - 2019</p>		

3. MANAGEMENT ISSUES AND OBJECTIVES

3.1 EROSION AND SEDIMENT CONTROL

3.1.1 Key Issues

Construction activities such as vegetation clearing and excavation may disturb the soil profile and create bare areas. These areas are more prone to erosion the movement of sediment. Runoff can carry this sediment to other environments where it can cause pollution. Disturbed soils are also more favourable for weed establishment.

3.1.2 Management Objective

The objective of erosion and sediment control is to contain soil and sediment within the development area and prevent these materials from leaving the Subject Site.

3.2 VEGETATION PROTECTION

3.2.1 Key Issues

The proposed development has been designed to avoid vegetation and species habitat removal, where possible. A total of 0.93 ha of native vegetation will be retained in the southern portion of the Subject Site.

Potential direct impacts include the following:

- Habitat fragmentation and a general loss of biodiversity.
- Damage to adjacent vegetation during clearing.

Potential indirect impacts include the following:

- The spread of weeds via clothes, boots, vehicles and machinery.
- Weed encroachment due to increased edge effects.

3.2.2 Management Objective

The key management objective is to ensure that native vegetation to be retained within the Subject Site is adequately protected during the construction phase.

3.3 FAUNA AND HABITAT MANAGEMENT

3.3.1 Key Issues

The development area contains key habitat features suitable for a range of fauna species. These features include hollow-bearing trees and habitat logs that may contain resident fauna populations at risk of displacement.

3.3.2 Management Objectives

Key objectives that relate to the management of fauna habitat and displaced fauna include the following:

- Provide a clear description of the protocols and methods for pre-clearing surveys, vegetation clearing and habitat tree removal; and
- Prevent injury or death of fauna that are displaced during vegetation clearing or any other construction activities.

3.4 FAUNA HABITAT REPLACEMENT

3.4.1 Key Issues

Hollow-bearing trees

A total of 29 hollow-bearing trees and dead stags were identified within the Study Area, of which 18 potential will be removed for the proposed development (some hollows may be retained within school design within the Biodiversity Area). Due to the range of hollow-dependent species (including potential threatened species) that may utilise the Subject Site, a nest-box program is required to supplement the removal of hollow-bearing trees at a ratio of 1:1.

Habitat Connectivity

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 such as the Squirrel Glider.

3.4.2 Management Objectives

The following objectives are relevant to habitat replacement:

- To encourage the recovery and reuse of existing natural resources such as habitat logs and hollows to be placed in suitable habitat.
- To ensure that there is no net loss of hollow specialist species, by installation of nest boxes.
- To ensure that nest boxes are occupied by a broad range of native fauna including target threatened species such as the Squirrel Glider.
- To describe monitoring and reporting strategies to monitor utilisation of nest-boxes and the overall effectiveness of the habitat replacement strategy.

The following objective are relevant to improving habitat connectivity.

- To reinstate glider poles in key areas to reduce canopy gaps and allow the uninterrupted movement of gliders through the Subject Site and maintain a north-south corridor.
- To plant tree species that will eventually create canopy links in key areas.
- To describe the monitoring and reporting strategies promote habitat connectivity.

3.5 WEED MANAGEMENT

3.5.1 Key Issues

A total of 19 exotic plant species were recorded within the Subject Site. Of these, four species are declared priority weed species within the Central Coast LGA (DPI 2019):

- Asparagus Fern (*Asparagus virgatus*)
- Ground Asparagus (*Asparagus aethiopicus*)

- Lantana (*Lantana camara*)
- Small-leaved Privet (*Ligustrum sinense*)

In accordance with the objectives of the NSW *Biosecurity Act 2015*, landowners have a duty to control and prevent the spread of priority weeds within their lands.

In addition to priority weeds, the subject site also contains infestations of environmental weeds such as Whiskey Grass (*Andropogon virginicus*). This species and others have the potential to cause habitat degradation if left unmanaged.

A complete list of exotic plant species recorded within the Subject Site is presented in **Appendix 1**.

3.5.2 Management Objective

The objective of weed management is to achieve a weed free resilient self-sustaining vegetation community within the Subject Site. The specific target for the VMP is to reduce weeds to less than 10% cover by Year 1 and to less than 5% by Year 3 following construction.

3.6 VEGETATION RESTORATION

3.6.1 Key Issues

Historical vegetation clearing along the western boundary of the Subject site has reduced the extent of canopy and midstorey vegetation. The vegetation in this area is regenerating naturally and is comprised of a sparse native groundcover, with juvenile shrubs, and occasional larger trees. Replacement plantings may be required in addition to assisted regeneration to ensure that vegetation integrity in this area is restored.

3.6.2 Management Objectives

The objectives of vegetation restoration include the following:

- To restore and enhance vegetation integrity in cleared areas.
- To achieve a 90% survival rate of tube-stock plantings.

- To achieve a species diversity target that is 50% compatible with mature native vegetation by Year 3.
- To describe monitoring and reporting strategies to measure the success of restoration management activities.

4. IMPLEMENTATION

4.1 MANAGEMENT ZONES

The subject site has been split into three management zones (**Figure 4**). A description of each management zone is described below.

4.1.1 Management Zone 1

Management Zone 1 is the largest management zone within the Subject Site and is defined by the development area. Given that construction will be limited to this area, several management guidelines are applicable, including the following:

- Erosion and Sediment Control – to prevent sediment from leaving the development area.
- Vegetation Protection - pre-clearance surveys and vegetation clearing protocols.
- Fauna Management - displaced fauna and fauna habitat recovery.
- Fauna Habitat Restoration – the installation of glider poles.
- Weed Management.

4.1.2 Management Zone 2

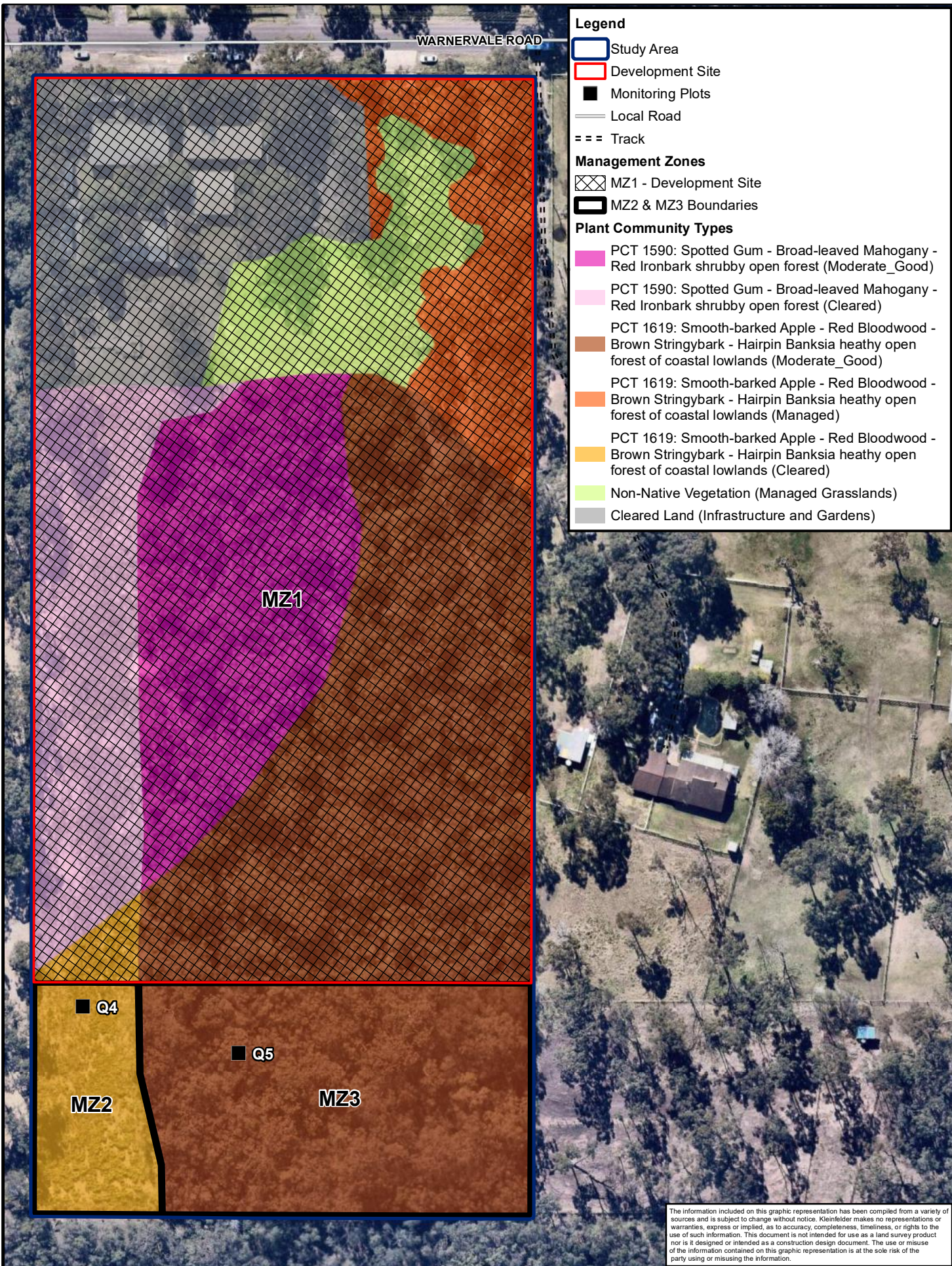
Management Zone 2 consists of the better-quality forest vegetation to be retained in the south-eastern corner of the Subject Site. Management guidelines which apply to this zone include:

- Erosion and Sediment Control – to prevent sediment from entering this zone.
- Fauna Management - displaced fauna may be released into this zone and fauna habitat features may be reinstated.
- Fauna Habitat Restoration -nest boxes may be installed in this area.
- Weed Management.

4.1.3 Management Zone 3

Management Zone 3 consists of the naturally regenerating vegetation to be retained in the south-western corner of the Subject Site. Management guidelines which apply to this zone include:

- Erosion and Sediment Control – to prevent sediment from entering this zone.



- Weed Management
- Vegetation Restoration – assisted natural regeneration and supplemented planting if required.

4.2 MANAGEMENT STRATEGIES

4.2.1 Erosion and Sediment Control

The following recommendations are to be implemented during the construction and operational phases to reduce erosion potential within the development area:

- Install a suitable sediment control fence on down slopes of the development area prior to any ground excavations.
- Conduct weekly checks of the fence to identify and repair any areas of failure.
- Remediate any rills or areas of erosion within 1 month of observed erosion to prevent sediment transfer.
- Avoid stockpiling of materials adjacent to native vegetation, but instead use areas that are already cleared/ disturbed.

4.2.2 Vegetation Protection

Vegetation to be retained within the Subject Site should be clearly identified either through the construction of a temporary fence or barricade along the southern portion of the development area. This should be conducted prior to construction. Vegetation clearing should be conducted in a way that ensures that large trees and branches do not fall and damage retained vegetation.

4.2.3 Fauna Management

4.2.3.1 Pre-clearance Surveys

Pre-clearing surveys are to be undertaken by an experienced ecologist prior to commencement of any vegetation clearing activities within the development area. The ecologist will conduct pre-clearing surveys to identify:

- Fauna species likely to be encountered during construction and potential impacts to fauna during vegetation clearing.

- Preferred locations to relocate fauna species and habitat features that can be retained following construction.
- Pre-clearing surveys will take place 1-2 days prior to the commencement of vegetation clearing. The ecologist will mark all potential fauna habitat in the development area with high visibility tape (e.g. hollow-bearing trees, habitat logs, trees containing active bird nests).

4.2.3.2 Vegetation Clearing Protocol

The following recommendations are to be implemented during vegetation clearing within the Development Site:

- An ecologist is to be present on site during all vegetation clearing operations.
- Vegetation should be cleared in a way that will allow fauna species living in or near the clearing site enough time to move out of the area without additional human intervention.
- No clearing should occur during the early evening or at night, as this is when fauna species are most likely to be active.
- Habitat links must be maintained during clearing to allow fauna species to move safely from the site to adjacent areas.
- Clearing should begin in the area that is furthest from vegetation to be retained.
- The direction of clearing should also ensure that fauna species are directed away from threats such as roads, developed areas or disturbed areas (e.g. residential areas or cleared spaces > 100m).
- Habitat trees are to be cleared following the removal of all other vegetation within the development area.
- Habitat trees are to be left standing for 1-2 nights after all other vegetation has been removed, to allow for occupying species to self-relocate.
- Habitat trees are to be 'soft-felled' under the supervision of the ecologist. The soft-felling technique involves tapping trees with an excavator bucket and waiting for signs of fauna activity. If no fauna is observed after 1-minute of observation, the tree should be felled and then inspected on the ground for fauna.
- Vegetation clearing is to be conducted in a manner such that vegetation is not felled onto retained vegetation or habitat trees.

4.2.3.3 Displaced Fauna

The following recommendations apply to the management of any displaced fauna species during vegetation clearing activities:

- All handling of fauna species should be conducted by an experienced ecologist.
- Animals are to be removed and relocated to the adjacent bushland/nest boxes.
- Nocturnal fauna species, such as microbats, are to be 'soft released' using bat boxes placed in adjacent habitat.
- Nocturnal fauna species, such as gliders and possums, are to be secured in suitable enclosures and kept in a quiet, dark and cool environment until they can be released into suitable habitat after dark.
- If any injured fauna species are found during the construction period, construction must stop immediately so that the injured animal can be taken to a vet or wildlife carer.

4.2.3.4 Fauna Habitat Recovery

The following recommendations apply specifically to fauna habitat features that are to be recovered from the development area following vegetation clearing:

- Habitat features suitable for recovery, including tree hollows, logs and bush rock, should be selected by an experienced ecologist prior to vegetation clearing.
- The ecologist should inspect any habitat features for the presence of fauna prior to relocation. If fauna species are identified, the habitat feature is to be left for a 24 hour period and then moved if the animal has not self-relocated. Relocation of the animal into suitable adjacent habitat is to be conducted by the ecologist as a final option in the event that the animal will not self-relocate.
- Habitat features are to be relocated in Management Zone 2 or suitable adjacent bushland areas under the supervision of the ecologist.

4.2.4 Fauna Habitat Replacement

4.2.4.1 Nest-boxes

Commercial suppliers that produce a range of nest boxes that have been designed to suit specific species/groups of wildlife. Important characteristics when constructing or commissioning nest boxes include the following:

- The front and base should be made from hardwood (> 25 mm thick).

- The box should include a hinged lid to allow easy inspection during monitoring/maintenance checks (the hinge should be stainless steel or aluminium).
- Only non-toxic paint should be used on the outside and the inside and the entrance hole should be left un-painted.
- Grooves should be cut on the inside face to allow ease of access/exit.
- Drainage holes should be included in the base.
- Wood shavings or sawdust should be placed in the bottom of the box prior to installation.
- Rear entrances should be included in the design where appropriate.

Habitat occurs within the Subject Site for a range of fauna species. A total of 18 habitat trees potentially containing 62 hollows will be removed from the development area. Hollows removed from the disturbance area will be replaced with nest-boxes on a ratio of one to one. The following nest box types are to be installed:

- Microbat Boxes
- Small Parrot Boxes
- Large Parrot Boxes
- Small Arboreal Mammal Boxes
- Medium Arboreal Mammal Boxes
- Large Forest Owl Boxes.

Note that a larger number of nest boxes for arboreal mammals should be installed due to the large number of Sugar Gliders that were detected within the Subject Site and in consideration of the large number of local records of the Squirrel Glider.

Nest boxes are to be installed in the southern portion of the Subject Site (Management Zone 3). The exact location of nest box placement within these areas should be determined by an experienced ecologist during installation and should take into account the following factors:

- Target species home range and likely territory to be defended.
- Fauna access (e.g. flight path for birds).
- Aspect (i.e. overheating can increase mortality of young).
- Distance to feeding resources.
- Camouflage from potential predators.
- Access for monitoring.

Nest boxes should be mounted in healthy living trees without existing hollows. Aspect of the nest box should aim to provide shelter from the sun and rain (Freegard and Richter 2009), with

the exception that bat boxes may be positioned to receive late afternoon sun providing warmth prior to nocturnal exit (Goldingay and Stevens 2009). Bat boxes should be installed on a tree clear of branches above or below the box (de Souza-Daw, 2003) and where possible nest boxes should be installed on opposite sides of a single tree to provide two approaches and exit options.

4.2.4.2 Habitat Connectivity

A habitat connectivity strategy has been developed for the project (**Appendix 3**). This will involve the installation of glider poles in key locations to reduce canopy gaps between retained trees and allow Gliders to move freely through the Subject Site (north-south movement corridor). Gliders can glide for a distance of up to 1.8 times the height of the launch site less 2 m (i.e. gliding distance = (launch height – 2) x 1.8). All Glider poles will be installed in consideration of the height of the nearest tree with the aim of providing options for animals using the Subject Site for movement and dispersal.

Tree planting at the base of each glider pole (2 trees) will occur with suitable tree species (*Corymbia gummifera* (Red Bloodwood) is recommended). These plantings are designed to eventually replace the glider poles with naturally linking canopy. Additionally, understorey species (4 per pole) will be planted around the base of the glider poles to provide shelter for fauna utilising the gliding poles (*Banksia spinulosa* (Hairpin Banksia) and *Lambertia formosa* (Mountain Devil), are recommended).

Installation of glider poles and tree planting is to occur during School Construction works.

4.2.5 Weed Management

Weed control is to be conducted by a qualified bush regenerator either with demonstrated experience or holding TAFE Certificate IV in Conservation and Land Management. Weed control is to be achieved using a combination of slashing, mowing and herbicide application. Recommended control methods for priority weeds are presented **Table 5**. The following recommendations are also considered necessary to prevent the spread of weeds during construction:

- Any vehicles, machinery or equipment should be inspected and be free of weed propagules before entering the Subject Site.

- Pre-construction control of weeds within the development area is to occur four weeks prior to construction commencing. This will involve appropriate application of herbicide and the slashing/ removal of woody weeds such as *Lantana camara* (Lantana) and other priority weeds.

Table 5: Priority weed species and control methods

Scientific Name	Method of control
Asparagus Fern <i>Asparagus virgatus</i>	<ul style="list-style-type: none"> • Spray all of the foliage to the point of runoff on actively growing plants with 500 mL of Glyphosate 360 g/L per 100 L of water during spring to autumn. • Or hand pull if the soil is moist – make sure all of the roots are removed.
Ground Asparagus <i>Asparagus aethiopicus</i>	<ul style="list-style-type: none"> • Spray all of the foliage to the point of runoff on actively growing plants with 500 mL of Glyphosate 360 g/L per 100 L of water during spring to autumn. • Or hand pull if the soil is moist – make sure all of the roots are removed.
Lantana <i>Lantana camara</i>	<ul style="list-style-type: none"> • A combination of manual removal and using herbicides. • Follow up control is generally required to prevent re-infestation by regrowth or new seedlings.
Small-leaved Privet <i>Ligustrum sinense</i>	<ul style="list-style-type: none"> • Remove large plants manually and then apply herbicide using the cut and paint method. Ensure that plants are cut close to the ground and that sawdust is removed prior to herbicide application. • Follow up control may be required to prevent re-infestation by regrowth or new seedlings from seeds already present in the seedbank.

Within Management Zone 1, weed control works are to occur prior to the commencement of clearing on site to reduce the potential for spread of weed species during disturbance works. Within Management Zones 2 and 3, initial weed control works are to occur upon the commencement of works within the development site. A follow-up control event is to occur within year 1. Weed control is then to occur annually, thereafter for the 5-year period of this VMP.

4.2.6 Vegetation Restoration

Cleared areas within the southern portion of the Subject Site (Management Zone 3) are already in a state of natural regeneration. These areas are therefore likely to continue to improve with minimal management. In the event that supplemented planting is required to achieve restoration objectives, canopy and shrub species are preferred for planting. It is likely that groundcover species such as grasses and herbs will colonise the area naturally.

Suitable tree and shrub species for supplemented planting include the following, these species should be planted at a density of one plant per 10 m²:

- *Angophora costata* (Smooth-barked Apple).

- *Corymbia gummifera* (Red Bloodwood).
- *Eucalyptus capitellata* (Brown Stringybark).
- *Allocasuarina littoralis* (Black She-oak).
- *Melaleuca nodosa* (Prickly Paperbark).

5. MONITORING AND REPORTING

Implementation of the VMP is required to commence immediately upon any construction work beginning. Annual monitoring to ensure compliance and maintenance is required for five (5) years.

5.1 MONITORING METHODS

5.1.1 Annual Walkover

To monitor the area subject to this VMP the following methods are required:

- A general random meander across all three management zones to assess the condition of the vegetation and to look for any changes in structure or new weed species/populations;
- Photo monitoring points in Management Zone 2 and Management Zone 3 should be established prior to clearing and rehabilitation works, and again immediately following initial weed control and planting works, to monitor the condition and natural regeneration of the vegetation;
- Assessment of the status of rehabilitation of Zone 3:
 - Monitor success of initial plant installations (90% or greater survival rate of plantings);
 - If initial plantings and native rehabilitation of groundcover, understorey and canopy has not reached target cover by year two (2) further installation of native plantings characteristic of the PCT 1619: Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands will be required. Target cover for Zone 3 comprises:
 - Native groundcover – minimum of 4/m²;
 - Understorey – minimum of 1/5m²; and
 - Canopy – minimum of 1/10m².
- Inspection and documentation to ensure annual weed control within Management Zones 1 to 3 has been implemented in according to methods discussed in **Section 3.5**.

Monitoring reports and mapping detailing the results of the annual survey should be provided to Council. Monitoring should be undertaken for a five-year period.

5.1.2 Vegetation Integrity Monitoring

Vegetation plots/transects were undertaken by Kleinfelder (2019) as part of the BDAR works. These plots/transects included collection of site condition data for the composition, structure and function attributes listed in **Table 6** in accordance with Section 5.3 of the BAM (OEH 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 6: Composition, Structure and Function components of vegetation integrity

Growth form groups used to assess composition and structure	Function attributes
<ul style="list-style-type: none"> • Tree (TG) • Shrub (SG) • Grass and grass-like (GG) • Forb (FG) • Fern (EG) • Other (OG) 	<ul style="list-style-type: none"> • 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)

As indicated on **Figure 4**, Q5 was undertaken in the area which forms VMP Management Zone 2, and Q4 was undertaken in the area which forms VMP Management Zone 3. The data collected from Q4 and Q5 as part of the BDAR works will be utilised as baseline data to inform vegetation integrity monitoring for the VMP.

The current vegetation integrity score of Q4 and Q5 is outlined in **Table 7**.

Table 7: Current vegetation integrity score for Q4 (Management Zone 3) and Q5 (Management Zone 2)

Zone	PCT	Condition class	Area (ha)	Condition scores (Current Score)			Vegetation integrity score
				Composition	Structure	Function	
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

Vegetation integrity monitoring should be conducted annually in the locations of BDAR plot/transects Q4 and Q5. Data collected should be consistent with that collected for the BDAR to enable annual review of the composition, structure and function components which inform the vegetation integrity score of the Management Zone. Results of the monitoring will be provided in the annual VMP reports. Should a drop in vegetation integrity score be observed in either Management Zone 2 or 3, remedial works should be undertaken (e.g. replanting, weed management) to re-establish the vegetation integrity score.

5.1.3 Nest Box Monitoring

Nest box monitoring and maintenance should occur annually, commencing at the end of Year 1. Monitoring will be conducted annually to determine nest box usage, and any repair and replacement requirements (as required). Monitoring will be conducted for a minimum of five years. Results of the monitoring will be provided in the annual VMP reports, including locations of any threatened species identified.

5.1.4 Glider Pole and Canopy Link Monitoring

Glider pole and canopy link monitoring and maintenance should occur annually, commencing at the end of Year 1. Monitoring will be conducted annually to determine glider pole usage and any repair and replacement requirements (as required). During each monitoring event, all glider poles should be inspected for evidence of use such as scratches and worn areas. Monitoring will be conducted for a minimum of five years. Results of the monitoring will be provided in the annual VMP reports, including locations of any threatened species identified.

5.1.5 Reporting

Annual monitoring reports should be prepared by a suitably qualified Ecologist and/or bush regenerator and submitted to Council annually detailing the progress of the bush regenerator works, observations of the annual walkover, and results of the vegetation integrity monitoring, nest box monitoring and glider pole and canopy link monitoring. A final report should be submitted to Council certifying the completion of the VMP at the end of the five-year period. Photo monitoring points, vegetation integrity monitoring points, and method of performance must be identified for future monitoring and reporting purposes. Any recommended additional actions must be completed to the satisfaction of Council prior to the lodgement of the final report.

5.2 RISK AND CONTINGENCY MEASURES

The subject site is located close to a busy road and is adjacent other wooded areas, making it susceptible to risks. The primary risks include:

- Vandalism;
- Rubbish dumping;

- Weed encroachment; and
- Bushfire.

Contingency measures include the application of this VMP which will help to minimise the above risks, as well as ongoing repair/replacement of any damaged fences. A 70 m asset protection zone (APZ) will be implemented around the subject site reducing potential bushfire impacts (Kleinfelder, 2019b).

5.3 PROJECT SCHEDULE

The project schedule detailed below in **Table 8** provides an indication regarding the timing and duration for the management requirements of the subject site.

Table 8: Project schedule

Management task	Timing	Personnel	Deliverable
Erosion and Sediment Control: Installation of a sediment fence	Installation prior to vegetation clearing.	Site supervisor	Sediment and runoff protection documented.
	Inspections, and clean out as required, for entire duration of construction works.		
Vegetation Protection: Installation of temporary exclusion fencing along southern disturbance area-retained vegetation interface.	Prior to the commencement of clearing.	Site Supervisor	Appropriate installation of fencing, and documented within VMP Annual Report.
Fauna Management: Pre-clearing surveys	Conducted prior to the commencement of clearing.	Qualified Ecologist	All habitat features appropriate marked prior to clearing. Documented in clearing supervision letter/report and submitted to Council.
Fauna Management: Vegetation Clearing supervision	During clearing	Qualified Ecologist	All habitat trees soft-felled under the supervision of an ecologist. Documented in clearing supervision letter/report and submitted to Council.

Management task	Timing	Personnel	Deliverable
Fauna Management: Displaced Fauna	During clearing	Qualified Ecologist	All fauna captured during habitat tree felling is appropriately relocated. Documented in clearing supervision letter/report and submitted to Council.
Fauna Habitat Replacement: Installation of nest boxes	Portion of the boxes installed prior to vegetation clearing (install at least two weeks prior). Remaining boxes installed within 1 month of clearing.	Qualified Ecologist	Installation of appropriate nest boxes to replace lost habitat. Documented within VMP.
Fauna Habitat Replacement: Installation of glider poles	During construction works within site.	Construction contractors under supervision of Qualified Ecologist	Appropriate installation of glider poles. Documented within VMP Annual Report.
Monitoring: Nest box monitoring and repair	Annually from Year 1 during winter.	Qualified Ecologist	Documented in VMP Annual Report, with associated mapping
Monitoring: Glider Pole and Canopy Link Monitoring	Annually from Year 1.	Qualified Ecologist	Documented in VMP Annual Report, with associated mapping
Weed Management: Weed control works	Within management zone 1: conducted prior to works on site.	Qualified bush regenerator	Documented in VMP Annual Report, with associated mapping
	Within Management Zones 2 and 3: Conducted twice in first year and then annually thereafter.	Qualified bush regenerator	Documented in VMP Annual Report, with associated mapping
Vegetation Restoration: Tree planting (if required)	Post year 2 monitoring event, if required.	Qualified bush regenerator	Documented in VMP Annual Report, with associated mapping
Monitoring: Annual monitoring	Annually at the completion of works	Ecologist	Annual VMP report. Completion report at the end of Year 5.

6. REFERENCES

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Freegard, C. and Richter, V. (2009). *DEC Nature Conservation Service Biodiversity Standard Operating Procedure Nest Boxes for Monitoring Arboreal Mammals*.

Gibbons, P and Lindenmayer, DB. (2003). *Tree Hollows and Wildlife Conservation in Australia*, CSIRO Publishing, Canberra.

Goldingay, R.L. and Stevens, J.R. (2009). 'Use of artificial tree hollows by Australian birds and bats'. *Wildlife Research*, 36: 81-97.

Kleinfelder (2019). Biodiversity Development Assessment Report for the New Warvervale Public School. A report prepared on behalf of the NSW Department of Education.

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.

OEH (Office of Environment and Heritage) (2017). The Biodiversity assessment Method.

APPENDIX 1. FLORA SPECIES LIST

Native plant species recorded within the Subject Site

Family	Scientific Name	Common Name
Acanthaceae	<i>Brunoniella australis</i>	Blue Trumpet
Anthericaceae	<i>Laxmannia gracilis</i>	Slender Wire Lily
Anthericaceae	<i>Thysanotus tuberosus</i>	Common Fringe Lily
Anthericaceae	<i>Tricoryne elatior</i>	Yellow Autumn-lily
Apiaceae	<i>Centella asiatica</i>	Indian Pennywort
Apocynaceae	<i>Parsonsia straminea</i>	Common Silkpod
Araliaceae	<i>Trachymene incisa</i>	-
Asteraceae	<i>Coronidium scorpioides</i>	Button Everlasting
Asteraceae	<i>Cyanthillium cinereum</i>	Iron Weed
Asteraceae	<i>Lagenophora stipitata</i>	Blue Bottle-daisy
Asteraceae	<i>Ozothamnus diosmifolius</i>	Rice flower
Asteraceae	<i>Sphaeromorphaea australis</i>	Spreading Nut-heads
Casuarinaceae	<i>Allocasuarina littoralis</i>	Black She-oak
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed
Convolvulaceae	<i>Polymeria calycina</i>	
Cyperaceae	<i>Chorizandra cymbaria</i>	
Cyperaceae	<i>Cyperus eragrostis</i>	Umbrella sedge
Cyperaceae	<i>Fimbristylis dichotoma</i>	Common Fringe-sedge
Cyperaceae	<i>Gahnia radula</i>	
Cyperaceae	<i>Lepidosperma filiforme</i>	
Cyperaceae	<i>Lepidosperma laterale</i>	
Cyperaceae	<i>Ptilothrix deusta</i>	
Cyperaceae	<i>Schoenus apogon</i>	Common Bog-rush
Dennstaedtiaceae	<i>Pteridium esculentum</i>	Common Bracken
Dilleniaceae	<i>Hibbertia diffusa</i>	Wedge Guinea Flower
Dilleniaceae	<i>Hibbertia empetrifolia</i>	
Fabaceae (Faboideae)	<i>Bossiaea rhombifolia</i>	
Fabaceae (Faboideae)	<i>Daviesia ulicifolia</i>	Gorse Bitter Pea
Fabaceae (Faboideae)	<i>Glycine clandestina</i>	
Fabaceae (Faboideae)	<i>Glycine tabacina</i>	
Fabaceae (Faboideae)	<i>Hardenbergia violacea</i>	Purple Coral Pea
Fabaceae (Faboideae)	<i>Mirbelia rubiifolia</i>	Heathy Mirbelia
Fabaceae (Faboideae)	<i>Podolobium scandens</i>	Netted Shaggy Pea

Family	Scientific Name	Common Name
Fabaceae (Faboideae)	<i>Pultenaea rosmarinifolia</i>	
Fabaceae (Mimosoideae)	<i>Acacia falcata</i>	Hickory Wattle
Fabaceae (Mimosoideae)	<i>Acacia longifolia</i> subsp. <i>longifolia</i>	Sydney golden wattle
Goodeniaceae	<i>Goodenia heterophylla</i> subsp. <i>eglandulosa</i>	
Goodeniaceae	<i>Goodenia paniculata</i>	Branched Goodenia
Haemodoraceae	<i>Haemodorum planifolium</i>	
Haloragaceae	<i>Gonocarpus micranthus</i> subsp. <i>micranthus</i>	
Haloragaceae	<i>Gonocarpus teucrioides</i>	Raspwort
Hypericaceae	<i>Hypericum gramineum</i>	Small St. Johns Wort
Iridaceae	<i>Patersonia sericea</i>	Silky Purple-flag
Juncaceae	<i>Juncus continuus</i>	
Lauraceae	<i>Cassytha pubescens</i>	
Lindsaeaceae	<i>Lindsaea linearis</i>	Screw fern
Lindsaeaceae	<i>Lindsaea microphylla</i>	Lacy Wedge Fern
Lobeliaceae	<i>Lobelia purpurascens</i>	Whiteroot
Lomandraceae	<i>Lomandra filiformis</i>	Wattle Mat-rush
Lomandraceae	<i>Lomandra glauca</i>	Pale Mat-rush
Lomandraceae	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush
Lomandraceae	<i>Lomandra multiflora</i> subsp. <i>multiflora</i>	Many-flowered Mat-rush
Myrtaceae	<i>Angophora costata</i>	Sydney Red Gum
Myrtaceae	<i>Corymbia gummifera</i>	Red Bloodwood
Myrtaceae	<i>Corymbia maculata</i>	Spotted Gum
Myrtaceae	<i>Eucalyptus capitellata</i>	Brown Stringybark
Myrtaceae	<i>Eucalyptus eugenioides</i>	
Myrtaceae	<i>Eucalyptus fibrosa</i>	
Myrtaceae	<i>Eucalyptus haemastoma</i>	Scribbly Gum
Myrtaceae	<i>Eucalyptus umbra</i>	Broad-leaved White Mahogany
Myrtaceae	<i>Melaleuca decora</i>	
Myrtaceae	<i>Melaleuca nodosa</i>	
Myrtaceae	<i>Melaleuca sieberi</i>	
Orchidaceae	<i>Caladenia carnea</i>	Pink Fairy
Orchidaceae	<i>Calochilus robertsonii</i>	Purplish Beard Orchid
Orchidaceae	<i>Cryptostylis subulata</i>	Large Tongue Orchid
Orchidaceae	<i>Genoplesium fimbriatum</i>	Fringed Midge Orchid
Orchidaceae	<i>Thelymitra pauciflora</i>	Slender Sun Orchid
Phormiaceae	<i>Dianella caerulea</i> var. <i>caerulea</i>	Blue Flax-Lily
Phyllanthaceae	<i>Glochidion ferdinandi</i>	Cheese Tree
Phyllanthaceae	<i>Phyllanthus hirtellus</i>	Thyme Spurge

Family	Scientific Name	Common Name
Pittosporaceae	<i>Billardiera scandens</i>	Hairy Apple Berry
Pittosporaceae	<i>Pittosporum undulatum</i>	Mock Orange
Poaceae	<i>Aristida vagans</i>	Threeawn Speargrass
Poaceae	<i>Austrostipa pubescens</i>	
Poaceae	<i>Cynodon dactylon</i>	Couch
Poaceae	<i>Dichelachne micrantha</i>	Shorthair Plumegrass
Poaceae	<i>Echinopogon caespitosus</i>	Bushy Hedgehog-grass
Poaceae	<i>Entolasia stricta</i>	Wiry Panic
Poaceae	<i>Eragrostis brownii</i>	Brown's Lovegrass
Poaceae	<i>Imperata cylindrica</i>	Blady Grass
Poaceae	<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass
Poaceae	<i>Panicum effusum</i>	Hairy Panic
Poaceae	<i>Panicum simile</i>	Two-colour Panic
Poaceae	<i>Poa labillardierei</i> var. <i>labillardierei</i>	Tussock
Poaceae	<i>Rytidosperma pilosum</i>	
Poaceae	<i>Rytidosperma setaceum</i>	Smallflower Wallaby Grass
Poaceae	<i>Themeda triandra</i>	Kangaroo Grass
Polygalaceae	<i>Comesperma ericinum</i>	Pyramid Flower
Polygonaceae	<i>Rumex brownii</i>	Swamp Dock
Proteaceae	<i>Banksia spinulosa</i>	Hairpin Banksia
Proteaceae	<i>Grevillea humilis</i> subsp. <i>humilis</i>	Linear-leaf Grevillea
Proteaceae	<i>Hakea sericea</i>	Needlebush
Proteaceae	<i>Persoonia levis</i>	Broad-leaved Geebung
Pteridaceae	<i>Cheilanthes sieberi</i>	Poison Rock Fern
Restionaceae	<i>Lepyrodia scariosa</i>	
Rubiaceae	<i>Opercularia diphylla</i>	
Stylidiaceae	<i>Stylidium graminifolium</i>	Grass Trigger-plant
Thymelaeaceae	<i>Pimelea linifolia</i>	Slender Rice Flower
Xanthorrhoeaceae	<i>Xanthorrhoea latifolia</i>	

Exotic plant species recorded within the Subject Site

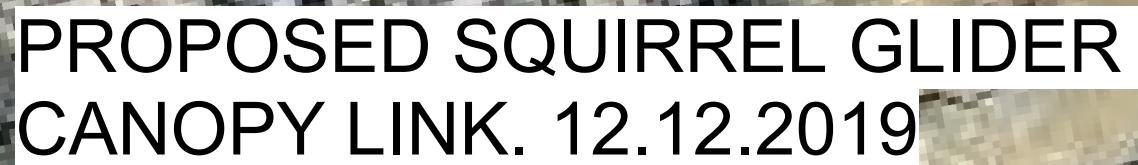
Family	Scientific Name	Common Name
Araliaceae	<i>Hydrocotyle bonariensis</i>	Largeleaf Pennywort
Asparagaceae	<i>Asparagus aethiopicus</i>	Ground Asparagus
Asparagaceae	<i>Asparagus virgatus</i>	Asparagus Fern
Asteraceae	<i>Conyza bonariensis</i>	Flaxleaf Fleabane
Asteraceae	<i>Gamochaeta purpurea</i>	Purple Cudweed
Asteraceae	<i>Hypochaeris radicata</i>	Catsear
Asteraceae	<i>Sonchus oleraceus</i>	Common Sowthistle
Asteraceae	<i>Taraxacum officinale</i>	Dandelion
Caesalpinioidae	<i>Senna pendula</i> var. <i>glabrata</i>	
Iridaceae	<i>Watsonia meriana</i>	
Malvaceae	<i>Sida rhombifolia</i>	Paddy's Lucerne
Oleaceae	<i>Ligustrum sinense</i>	Small-leaved Privet
Plantaginaceae	<i>Plantago lanceolata</i>	Lamb's Tongues
Poaceae	<i>Andropogon virginicus</i>	Whiskey Grass
Poaceae	<i>Axonopus fissifolius</i>	Narrow-leaved Carpet Grass
Poaceae	<i>Cenchrus clandestinus</i>	Kikuyu Grass
Poaceae	<i>Paspalum dilatatum</i>	Paspalum
Rubiaceae	<i>Richardia stellaris</i>	
Verbenaceae	<i>Lantana camara</i>	Lantana

APPENDIX 2. HABITAT TREE REGISTER

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
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

No.	Tree / Type	Hollows			Comments	Impact / Retained
		Small (<5 cm)	Medium (5 – 20 cm)	Large (>20 cm)		
28.	Dead Stag (Ironbark)	4	-	-	Flaky bark – possibly microbat habitat.	Impact
29.	Blue Gum / Flooded Gum	-	1	-	-	Impact

APPENDIX 3. GLIDER MOVEMENT STRATEGY



APPENDIX 4. STAFF CONTRIBUTIONS

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

Name	Qualification	Title/Experience	Contribution
Gilbert Whyte	PhD. Bsc (Hons)	Senior Ecologist	Reporting
Samara Schulz	B.Env.Sc&Mgmt (Hons)	Senior Ecologist	Report review
Gayle Joyce	B. Forestry (Hons)	GIS Team Leader	Data management and preparation of maps

Appendix D

Traffic Engineering – Response *by Stantec*

Ref: 300300107

6 April 2020

Kelsey Godwin-Smith
Project Coordinator
Billard Leece Partnership
SYDNEY, NSW

Attention: kelsey@blp.com.au

Dear Kelsey,

**NSW Department of Planning and Environment
New Primary School at Warnervale – Traffic Engineering Statement**

Stantec has reviewed Council's response dated 16 March 2020 (SSD 9439: NEW WARNERVALE PUBLIC SCHOOL, LOT: 71 DP: 7091, 75 WARNERVALE ROAD, WARNERVALE) and has provided responses in the following response table. It is noted that this response letter should be read in conjunction with the Transport and Accessibility Report prepared by Stantec (dated 5 August 2019).

Comments		Stantec Response
Central Coast		
6	<p>Public (parent/carer) car parking around schools is a major issue on the Central Coast as a higher percentage of students arrive and depart by private transport than in metropolitan areas.</p> <p>It is not anticipated that providing additional car parking spaces will encourage more parents to drive students to school, rather this will simply accommodate the potential demand and relocate parking demand from Warnervale Road.</p>	<p>It is understood that majority of the students typically travel to/from school via private transport.</p> <p>As shown within Section 6.3 of the Transport and Accessibility report, the pick-up and drop off assessment was undertaken using the travel patterns of the existing Warnervale Public School, with 74% of students being driven to and from school. Additional details noted below for Point 15 and 16.</p> <p>The proposed parking provisions and its methodology were presented to Council during past consultations and are in line with the Central Coast Development Control Plans, in particular: <i>"Bus standing areas, parent drop-off and set-down are to be provided subject to a Transport Management Plan based on anticipated mode split."</i></p>

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<p>7</p>	<p>The provision of kerbside drop-off and pick-up directly adjacent to the school and relocating the staff carpark to the west is still considered to provide a better road safety outcome and will only require minimal re-design of the carpark layout.</p> <p>Council still considers that the turning head at the southern end of the carpark is necessary and could be deleted to create additional car parking. It has not been demonstrated how the turning head will eliminate conflict points within the carpark.</p>	<p>As noted previously, Council's recommended option has been considered in the earlier stages of this project.</p> <p>However, a trade-off has been made in retaining the current design due to design constraints. Nonetheless, it is expected that the current design is able to provide a similar road safety outcome for the following reasons:</p> <ul style="list-style-type: none"> Staff parking is highly secured and fenced off from the rest of the carpark, with two security control points for staff access only in the entry and exit locations. This ensures that students will go around this staff carpark area via a designated safe route. Staff is expected to enter and exit the carpark outside the typical school peak period, minimising disruptions to the pick-up and drop-off. <p>An Operational Transport and Access Management Plan (OTAMP) is typically prepared prior to the commencement of the school, in consultation with Council and Transport for NSW. This should also involve a detailed pedestrian analysis including the identification of safe route options to ensure that students and staff are able to access and leave the school in a safe and efficient manner during school start and finish.</p> <p>Austroads Guide to Traffic Management – Part 6 states the following: “ <i>From the Safe System perspective roundabouts act predominantly by reducing severity of impacts because:</i></p> <ul style="list-style-type: none"> Entry and circulating speeds of traffic are moderated by horizontal deflections; <u>Of the reduction in the number of conflict points;</u> Of the relative simplicity of decision-making at the point of entry.”
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		As such, the internal roundabout within the car park is required to facilitate the relatively high number of movements generated from pick-up and drop off.
14	Figure 1 indicates sight distance of 20m, however in accordance with AS 2890.1 "Off-street car parking" 35m of SSD is required for driveway exits.	Updated figure is attached within Appendix.
15/16	Arrivals during the PM peak is an existing issue at schools on the Central Coast. The proposed set-down and pick up area will not cope with this number of vehicles. Staff management of this area will not prevent queuing out onto Warnervale Road creating significant delays to non-school traffic.	<p>The times used for parking restrictions within the Transport and Accessibility report dated 05 August 2019 are obtained from both Austroads¹ and Transport for NSW² and should be adhered to, with or without staff management.</p> <p>Table 6-3 of the report shows that the provision of 16 short-term parking and eight temporary pick up/drop off spaces will satisfy the expected parking demands (for 460 students) of the new Warnervale school.</p> <p>The following advantages of having a supervisor/staff management to assist children in and out of the vehicle, as part of the 'Drop-off and Pick-up initiative³', are referenced from NSW Centre for Road Safety:</p> <ul style="list-style-type: none"> • Provides a designated zone at a school access point for drivers to stop and drop off or pick up their children. • Relieves traffic congestion around the school by ensuring cars do not park illegally. • Provides adult supervision for students being dropped off and picked up from school by car. • Reinforces road safety messages and safe passenger behaviour to parents and children.

¹ Austroads Guide to Traffic Management Part 11: Parking

² TfNSW: NSW Centre for Road Safety

³ https://roadsafety.transport.nsw.gov.au/stayingsafe/schools/dropoff_pickup.html

We trust this assists in addressing Council comments. If you require further information or clarification please contact the below.

Yours sincerely

A handwritten signature in blue ink, appearing to read 'Desmond Ang', with a long horizontal flourish extending to the right.

Ang, Desmond
Traffic Engineer

A handwritten signature in blue ink, appearing to read 'Kirk Martinez', with a stylized, cursive script.

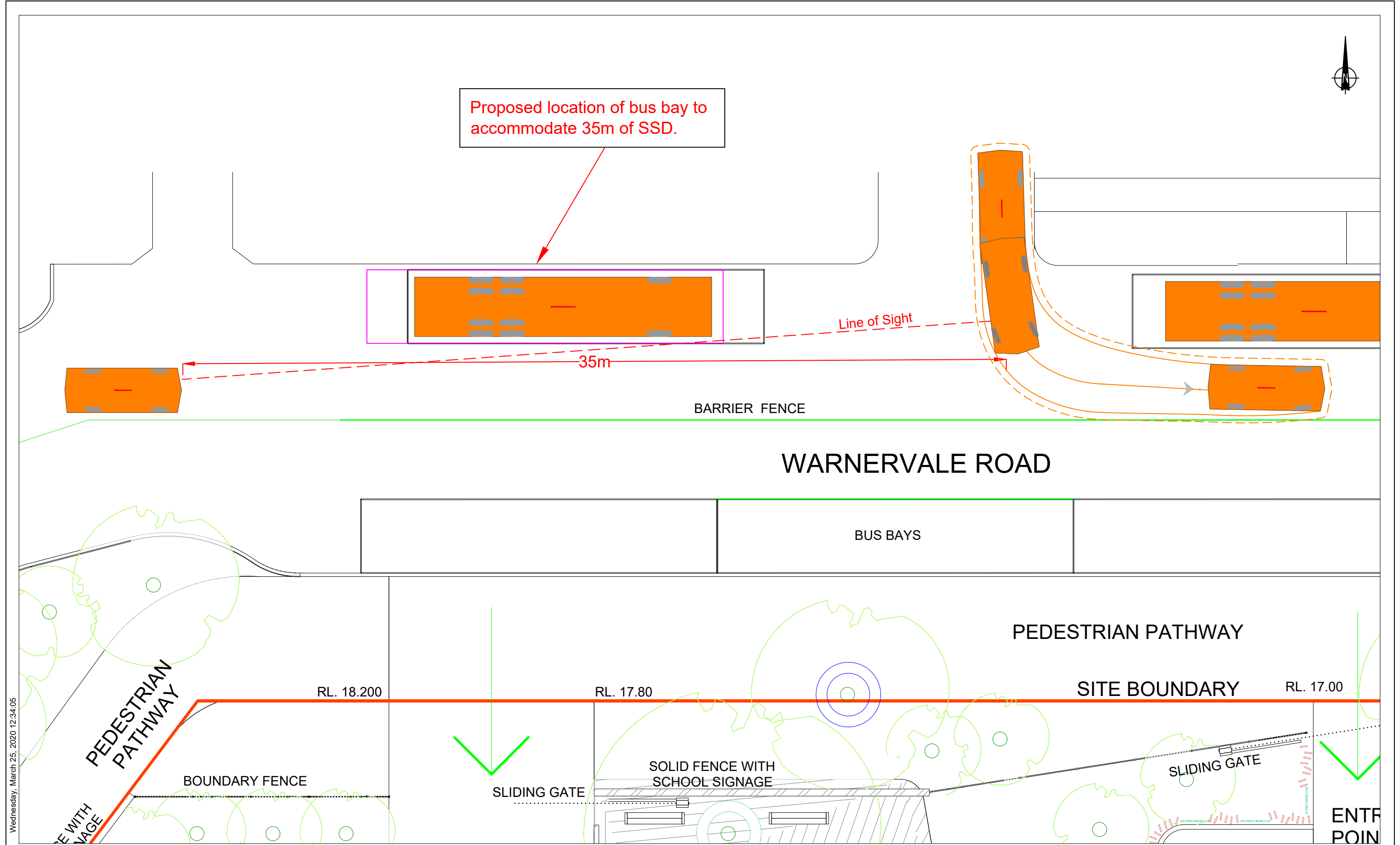
Kirk Martinez
Senior Traffic Engineer

Stantec Australia Pty Ltd

Encl:

Appendix A – Sight distance assessment

Appendix A – Sight Distance Assessment



REV	DATE	DRN	CHK	DESCRIPTION
00	25/03/20	DA		

75 Warnervale Road, Warnervale
Sight Distance Assessment

DRAWN: DA
DATE: 25-03-20
SCALE: N.T.S @ A3
DWG NO:300300107 200325

1

Appendix E

Architectural – GFA Plans *by BLP*

Gross Floor Area means the sum of the floor area of each floor of a building measured from the internal face of external walls, or from the internal face of walls separating the building from any other building, measured at a height of 1.4 metres above the floor, and includes—

- (a) the area of a mezzanine, and
- (b) habitable rooms in a basement or an attic, and
- (c) any shop, auditorium, cinema, and the like, in a basement or attic, but excludes—
 - (d) any area for common vertical circulation, such as lifts and stairs, and
 - (e) any basement—
 - (i) storage, and
 - (ii) vehicular access, loading areas, garbage and services, and
 - (f) plant rooms, lift towers and other areas used exclusively for mechanical services or ducting, and
- (g) car parking to meet any requirements of the consent authority (including access to that car parking), and
- (h) any space used for the loading or unloading of goods (including access to it), and
- (i) terraces and balconies with outer walls less than 1.4 metres high, and
- (j) voids above a floor at the level of a storey or storey above.

Floor plan of the ground floor (GFA) showing a large rectangular area with a central staircase and a smaller rectangular area to the left. The total area is 126.52 m².

NOMINATED ARCHITECT IN NSW TARA VELDMAN
REG NO. 8790

[illegible]

100% SCHEMATIC DESIGN

Billard Leece Partnership Pty Ltd



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Gross Floor Area means the sum of the floor area of each floor of a building measured from the internal face of external walls, or from the internal face of walls separating the building from any other building, measured at a height of 1.4 metres above the floor, and includes—

- (a) the area of a mezzanine, and
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- (e) any basement—
 - (i) storage, and
 - (ii) vehicular access, loading areas, garbage and services, and
- (f) plant rooms, lift towers and other areas used exclusively for mechanical services or ducting, and
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- (i) terraces and balconies with outer walls less than 1.4 metres high, and
- (j) voids above a floor at the level of a storey or storey above.



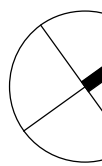

Architectural floor plan of a building complex, showing four main wings and their respective Gross Floor Areas (GFA):

- Top-left wing: GFA 361.58 m²
- Bottom-left wing: GFA 463.54 m²
- Bottom-middle wing: GFA 362.67 m²
- Bottom-right wing: GFA 344.89 m²

The plan includes detailed room layouts, corridors, and stairwells. Some areas are shaded in pink, while others are in light blue.

The image shows three overlapping sheets of white paper with light blue horizontal ruling. The sheets are oriented vertically and overlap in a staggered manner. The top sheet is at the back, the middle sheet is in front of it, and the bottom sheet is in front of the middle one. The bottom sheet features four small black squares arranged in a 2x2 grid near its center. On the right edge of the bottom sheet, there is a vertical scale bar with markings from 0 to 6 inches. A diagonal line runs across the left side of the bottom sheet, separating a section with vertical blue ruling from the rest of the sheet which has horizontal blue ruling.

0 5 10 15 25m
1:500 @A1

Structural Engineer	
CARDNO	
Mechanical / Hydraulic Engineer	
NORTHROP	
Electrical Engineer	
NORTHROP	
Landscape Architect	
ARCADIA	
Access Consultant	
DESIGN CONFIDENCE	
Civil & Structural Engineer	
CARDNO	
Client	
SCHOOLS INFRASTRUCTURE	
	
Project Name	
THE NEW PRIMARY SCHOOL AT WARNERVALE	
Drawing Name	
Gross Floor Area Plan - Ground Level	
	
Scale	
1 : 200 @A1	
Project No	Revision Date
17070	07.04.20
100% SCHEMATIC DESIGN	
Drawing No.	
AA18-0002 [A]	
Billard Leece Partnership Pty Ltd	
	
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Billard Leece Partnership
The New Primary School at Warnervale














Appendix F

Architectural – Elevations *by BLP*



ALLOW FOR GRAPHIC BAND AROUND STRUCTURAL COLUMNS TO FOR DDA COMPLIANCE.

LEGEND

-  **BWK-01**
BORAL BLUE BRICK
-  **BWK-02**
WHITE/CREAM BRICK
-  **CFC-01**
CFC CLADDING TYPE 01
-  **CFC-02**
CFC CLADDING TYPE 02
-  **CFC-03**
CFC CLADDING TYPE 03
-  **CFC-04**
CFC CLADDING TYPE 02
-  **CFC-05**
CFC CLADDING TYPE 03
-  **CFC-06**
CFC CLADDING TYPE 04
-  **CFC-07**
CFC CLADDING TYPE 05
-  **CFC-08**
CFC CLADDING TYPE 06
-  **CFC-09**
CFC CLADDING TYPE 06
-  **GS-02**
GLAZING
-  **CL-05**
TIMBER LOOK SOFFIT

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NOMINATED ARCHITECT IN NSW TARA VELDMAN
2004-2005

**REFER TO EFSG FOR
FURTHER DETAILED
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REFER TO:
<https://efsg.det.nsw.edu.au/welcome>**

Rev	Date	Revision	By	Chk.
A	31.05.19	For Information	KGS	QS
B	05.06.19	For SSDA Issue	KGS	TSA/SINSW
C	07.08.19	For SSDA Final Issue	KGS	Consultants
D	24.10.19	100% SD PRELIMINARY	KGS	SINSW
E	27.11.19	100% SD ISSUE	KGS	SINSW
F	09.12.19	TENDER ADDENDUM	MDM	SINSW
G	07.04.20	For SSDA RFI Issue	KGS	SINSW

Structural Engineer
CARDNO
Mechanical / Hydraulic Engineer
NORTHROP
Electrical Engineer
NORTHROP
Landscape Architect
ARCADIA
Access Consultant
DESIGN CONFIDENCE
Civil & Structural Engineer
CARDNO

Drawing Name
ELEVATIONS
OVERALL_ADMIN &
HALL

Scale	
As indicated	
Object No	Revision Date
17070	07.04.20

100% SCHEMATIC DESIGN

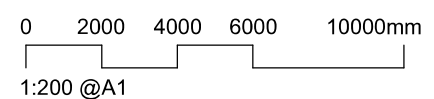
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NOMINATED ARCHITECT IN NSW TARA VELDMAN
2015-2016



Mechanical / Hydraulic Engineer

Electrical Engineer

Landscape Architect

Access Consultant

Civil & Structural Engineer

MINISTRY OF EDUCATION, CULTURE AND SPORTS

Drawing Name
FLUENT

@A1	
Project No	Revision Date

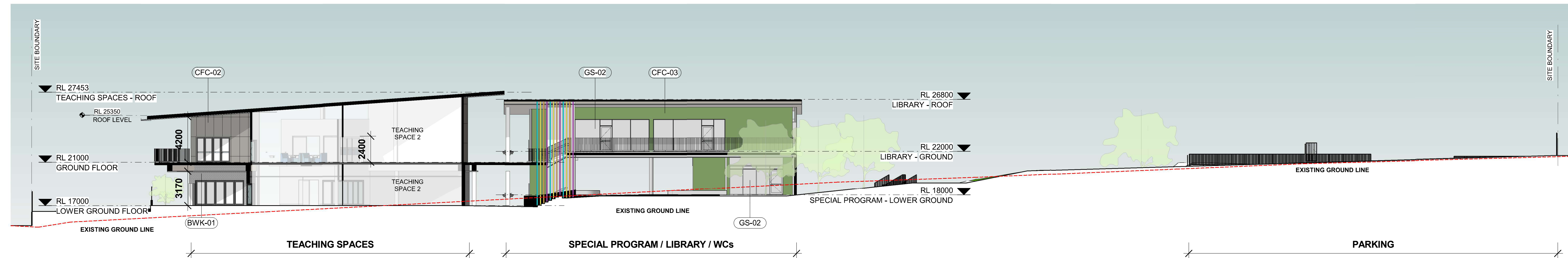
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Drawing No. **1-100-0000-101**

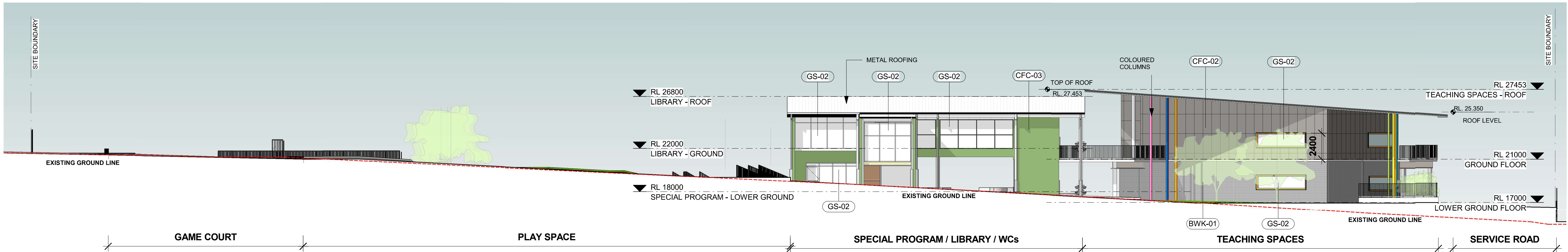
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2. ALL DIMENSIONS TO BE VERIFIED ON SITE (V.O.S.)
3. FOR WINDOW LOCATIONS REFER TO DRG. AA12-0010-040 & AA20-0110 TO AA20-1120
4. FOR WINDOW TYPE LEGEND REFER TO DRG. AA81-0003
5. FOR WINDOW SCHEDULE REFER TO DRG. AA81-0003
6. FOR FURNITURE DETAILS FOR ALL WINDOW HARDWARE
7. ALL OPERABLE/LOWEY WINDOWS TO HAVE INTERNAL FLY SCREEN MESH
8. ALL AWNING AND SLIDING WINDOWS TO HAVE RESTRICTORS
9. TO BE READ IN CONJUNCTION WITH ACOUSTIC REPORT
10. TO BE READ IN CONJUNCTION WITH SECTION J REPORT
11. ALL WINDOW FRAME FINISHES TO BE NATURAL UNPAINTED "PF08" REFER TO EXTERIOR FINISHES SCHEDULE AA98-0009
12. ALL WINDOW LOUVRES TO HAVE MANUAL HAND OPERATED CONTROL ADJACENT TO WINDOW FRAME UNLESS NOTED OTHERWISE
13. ALL HIGH LEVEL HAND WINDOW LOUVRES TO HAVE REMOTE ELECTRICAL CONTROL AND REMOTE REMOTE FROM CONTROL SWITCH TO BE LOCATED 1000mm ABOVE FINISHES FLOOR LEVEL
14. DUAL ROLLER BLIND WITH CHARCOAL TRANSPARENT SHADE AND HIGHLY TRANSPARENT BLIND
15. ALL ROLLER BLINDS TO BE MANUALLY OPERATED WITH METAL CHAIN AND MOTORIZED IN AREAS WHERE SHADING IS REQUIRED
16. ALL FULL HEIGHT GLAZED PARTITIONS & DOORS TO HAVE FILM STRIP (GL-01) REFER TO AA98-0003
17. HIGH LEVEL WINDOWS/GLAZED LOUVRES TO BE RESERVED TO HIGH LEVEL WINDOWS WITH CHARCOAL BLIND OR BLINDS ONLY

ALLOW FOR GRAPHIC BAND AROUND STRUCTURAL
COLUMNS TO FOR DDA COMPLIANCE.



1 NORTH ELEVATION (TEACHING SPACES AND LIBRARY)
1 : 200



2 LIBRARY & TEACHING SPACES_SOUTH
1 : 200

GENERAL NOTES:

- ALL DIMENSIONS TO BE VERIFIED ON SITE (V.O.S.)
- FOR WINDOW LOCATIONS REFER TO DRG. AA12-0010-40 & AA20-010 TO AA20-12
- FOR WINDOW TYPE LEGEND REFER TO DRG. AA81-0003
- FOR WINDOW SCHEDULE REFER TO DRG. AA81-0003
- REFER TO BUILDERS DETAILS FOR ALL WINDOW HARDWARE
- ALL OPERABLE/LOUVRE WINDOWS TO HAVE INTERNAL FLY SCREEN MESH
- ALL AWNING AND SLIDING WINDOWS TO HAVE RESTRICTORS
- TO BE READ IN CONJUNCTION WITH ACOSUTIC REPORT
- TO BE READ IN CONJUNCTION WITH SECTION J REPORT
- ALL WINDOW FRAME FINISHES TO BE NATURAL ANODISED "PF08" REFER TO EXTERIOR FINISHES SCHEDULE AA96-0009
- ALL WINDOW LOUVRES TO HAVE MANUAL HAND OPERATED CONTROL ADJACENT TO WINDOW FRAME UNLESS NOTED OTHERWISE
- ALL HIGH LEVEL HALL WINDOW LOUVRES TO HAVE REMOTE ELECTRIC ACTUATORS OPERATED REMOTELY FROM CONTROL SWITCH TO BE LOCATED 1000mm ABOVE FINISHES FLOOR LEVEL
- DUAL ROLLER BLIND WITH CHARCOAL TRANSPARENT SHADE AND CHARCOAL BLOCK OUT BLIND
- ALL FULL HEIGHT GLAZED PARTITIONS & DOORS TO HAVE FILM STRIP (GL-01) REFER TO AA96-0003
- HIGH LEVEL WINDOWS/GLAZED LOUVRES BY THEMSELVES TO HAVE SINGLE ROLLERS WITH CHARCOAL BLOCK OUT BLINDS ONLY

ALLOW FOR GRAPHIC BAND AROUND STRUCTURAL COLUMNS TO FOR DDA COMPLIANCE.

LEGEND

- BWK-01 BORAL BLUE BRICK
- BWK-02 WHITE/CREAM BRICK
- CFC-01 CFC CLADDING TYPE 01
- CFC-02 CFC CLADDING TYPE 02
- CFC-03 CFC CLADDING TYPE 03
- CFC-04 CFC CLADDING TYPE 02
- CFC-05 CFC CLADDING TYPE 03
- CFC-06 CFC CLADDING TYPE 04
- CFC-07 CFC CLADDING TYPE 05
- CFC-08 CFC CLADDING TYPE 06
- CFC-09 CFC CLADDING TYPE 06
- GS-02 GLAZING
- CL-05 TIMBER LOOK SOFFIT

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0 2000 4000 6000 10000mm
1:200 @A1

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NOMINATED ARCHITECT IN NSW TARA VELDMAN
REG NO. 8790

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Rev	Date	Revision	By	Chk
A	24.10.19	100% SD PRELIMINARY	KGS	SINSW
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CARDNO

Mechanical / Hydraulic Engineer

NORTHROP

Electrical Engineer

NORTHROP

Landscape Architect

ARCADIA

Access Consultant

DESIGN CONFIDENCE

Civil & Structural Engineer

CARDNO

Client

SCHOOLS INFRASTRUCTURE



Education



Project Name

THE NEW PRIMARY SCHOOL AT WARNERVALE

Drawing Name

ELEVATIONS
OVERALL_LIBRARY

Scale

As indicated

Sheet No

17070

Revision Date

07.04.20

100% SCHEMATIC DESIGN

Drawing No.

AA20-0003 [D]

Billard Leece Partnership Pty Ltd



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