Normanhurst Loreto – Concept Plan and Stage 1 development
Biodiversity Development Assessment Report

Loreto Normanhurst c/o Allen Jack + Cottier

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Template 2.8.1

Executive Summary

Eco Logical Australia Pty Ltd (ELA) was engaged by Loreto Normanhurst on behalf of Allen Jack + Cottier to prepare a Biodiversity Development Assessment Report (BDAR) for a 30 year Concept Masterplan and Stage 1 development at 91 - 93 Pennant Hills Road, Normanhurst, NSW. Stage 1 will involve the construction of a new boarding house facility and demolition of an existing building for landscaping purposes. The proposed development is classified as State Significant Development and requires approval under State Significant Development Application SSD 17_8996 and is required to be assessed by the *Department of Planning and Environment* (DP&E). The preparation of a BDAR is a requirement of the Secretary's Environmental Assessment Requirements (SEARs).

The Loreto Normanhurst site (referred to as the 'subject site') covers an area of 12.99 ha. The Stage 1 and Concept Plan works (i.e. the 'development site') covers an area of 5.33 ha and the proposed development will result in the removal of 0.40 ha of non-native planted vegetation, 0.46 ha of native planted vegetation, and 0.09 ha of remnant non-planted vegetation. The remaining 4.38 ha represents buildings and cleared areas. The development site is zoned R2 Low Density Residential under the *Hornsby Shire Council Local Environmental Plan 2013* (HLEP) which allows for residential development and educational establishments with council development consent.

The proposed development will impact upon biodiversity values within the development site and as such a BDAR is required to assess the vegetation clearing under the NSW *Biodiversity Conservation Act 2016* (BC Act) in accordance with the SEARs. This report has been prepared to meet the requirements of the Biodiversity Assessment Method 2016 (BAM) established under Section 6.7 of the NSW BC Act 2016. Requirements of the HLEP and *Hornsby Development Control Plan 2013* have also been addressed in this report.

The vegetation within the development site is highly disturbed with a mixed canopy of mature exotic and native planted species and some remnant regrowth canopy species which have been incorporated into horticultural landscape gardens. Although the vegetation in the development site is highly modified and has been planted, under the BAM all vegetation native to NSW must be assigned a Plant Community Type (PCT) in accordance with the NSW Government's BioNet Vegetation Classification System. Where native vegetation has been planted and does not clearly confirm to any PCT, a 'best-fit' PCT must be assigned. Based on Office of Environment and Heritage (OEH) 2016 vegetation mapping, soil mapping and field validation of regrowth remnant vegetation retained within the subject site, it has been determined that the planted native vegetation conforms to PCT 1237 *Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion*. PCT 1237 was also represented as an isolated remnant tree of which 0.002 ha will require minor trimming of trees as part of the development works. Although components of PCT 1237 corresponds to Blue Gum High Forest which is listed as a threatened ecological community (TEC), only the small amount of remnant vegetation (i.e. not planted) present within the development site was considered part of the TEC under the NSW BC Act and none of the patches satisfied the criteria for listing under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

A second PCT 1281 *Turpentine - Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion* was mapped in the southern section of the subject site and contains remnant regrowth

vegetation in good condition and disturbed/weedy condition. This patch of bushland has also been mapped on the NSW Government Biodiversity Values Map and Hornsby Council Terrestrial Biodiversity layer in the HLEP. PCT 1281 correspond to Sydney Turpentine-Ironbark Forest which is listed as critically endangered under the EPBC Act and endangered under the BC Act. Blue Gum High Forest (BGHF) and Sydney Turpentine-Ironbark Forest (STIF) are both listed Serious and Irreversible Impacts (SAII) candidate entities and are impacted by this proposal. Consideration of SAII candidates have been assessed as part of this BDAR.

Despite the presence of native vegetation, no threatened flora or fauna species were recorded within the development site or subject site. Targeted surveys were conducted to determine if threatened microchiropteran (microbat) species utilise the roof cavity of a historic building to be demolished for Stage 1 works. Some microbat species are considered dual ecosystem credit and species credit species; however, no species credit species habitat was identified as potential habitat within the development site. However, the BAM also requires targeted surveys as part of assessing Prescribed Impacts, this includes man-made structures. There was no evidence of microbat species recorded during targeted surveys.

This BDAR outlines the measures taken to avoid, minimise and mitigate impacts to the vegetation and species habitat present within the development site and methodologies to minimise impacts during construction and operation of the development. Following consideration of all the above aspects, the residual unavoidable impacts of the project were calculated in accordance with the BAM by utilising the Biodiversity Assessment Method Credit calculator (BAMC). Under the BAM, ten (10) ecosystem credits are required to offset the removal of 0.46 ha of PCT 1237 (integrity score of 35.1) and two (2) ecosystem credits for PCT 1281 for the removal of 0.09 ha (integrity score of 39.7).

One Matter of National Environmental Significance (MNES) was identified as having potential to be adversely affected by the proposed works. *Pteropus poliocephalus* (Grey-headed Flying-fox) is listed as Vulnerable under the EPBC Act and it is considered that this species is likely to use some of the development site for foraging. An assessment of the Commonwealth Significant Impact Criteria was undertaken for the Grey-headed Flying-fox and concluded that the project would not have a significant impact on this species. As such, a referral to the Commonwealth is not required.

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Contents

List of Figures

List of Tables

Abbreviations

Abbreviation	Description
BAM	Biodiversity Assessment Method
BAMC	Biodiversity Assessment Method Credit Calculator
BC Act	NSW Biodiversity Conservation Act 2016
BDAR	Biodiversity Development Assessment Report
BGHF	Blue Gum High Forest
CEEC	Critically Endangered Ecological Community
CEEC	Critically Endangered Ecological Community
DA	Development Application
DotEE	Commonwealth Department of the Environment and Energy
DPE	NSW Department of Planning and Environment
EEC	Endangered Ecological Community
ELA	Eco Logical Australia Pty Ltd
EP&A Act	NSW Environmental Planning and Assessment Act 1979
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
FM Act	NSW Fisheries Management Act 1994
GIS	Geographic Information System
GPS	Global Positioning System
HBT	Hollow-bearing Tree
HDCP	Hornsby Development Control Plan 2013
HLEP	Hornsby Local Environmental Plan 2013
IBRA	Interim Biogeographic Regionalisation for Australia
LEP	Local Environment Plan
LGA	Local Government Area
LLS	Local Land Service
NSW	New South Wales
NOW	NSW Office of Water
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
SEARs	Secretary's Environmental Assessment Requirement
SEPP	State Environmental Planning Policy
SSD	State Significant Development
STIF	Sydney Turpentine Ironbark Forest
TEC	Threatened Ecological Community

Abbreviation	Description
VIS	Vegetation Information System
WM Act	NSW Water Management Act 2000

1. State Significant Development Application (Concept Masterplan and Detailed Stage 1 Works)

The following text has been supplied by Ethos Urban to support the BDAR.

1.1 Introduction

This report supports a State Significant Development Application (SSDA) submitted to the Department of Planning and Environment (DPE) pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

This application is SSD by way of clause 8 and schedule 1 under *State Environmental Planning Policy (State and Regional Development) 2011* on the basis that the development is for the purpose of an existing school and has a Capital Investment Value of more than $20 million.

Specifically, this application relates to a staged SSDA within the meaning of Section 4.12 of the EP&A Act, with this application being the Concept Proposal for a new site wide masterplan for the existing Loreto Normanhurst School at 91 – 93 Pennant Hills Road, Normanhurst. In addition, consent is also sought for the Stage 1 detailed design works for a new on campus student boarding facility, landscaping works, and some demolition works to the buildings between Mary Ward and existing dining room building and associated works to make good existing.

This report has been prepared having regard to the Secretary's Environmental Assessment Requirements issued for the project by DPE, ref no SEAR 8996 issued on 12 January 2018.

1.2 Background

1.2.1 Need for a Campus Masterplan

Loreto Normanhurst is an independent, Catholic day and boarding school for girls from Years 5 to 12. The existing school campus was established in 1897 and has evolved in an organic and ad-hoc manner across the span of a 120 years.

A new campus wide planning approach offers the opportunity to strategically review and plan for the campus' future in a sustainable and efficient manner such that the campus' unique aesthetic and ecological values are best preserved. The preparation of a campus wide masterplan is also consistent with the School's 'Loreto Normanhurst 2016 - 2020 Strategic Plan' which identified the need for a broader strategic plan to coordinate renewal and orderly development in a feasible and staged manner.

1.2.2 Early Learning Centre

A separate DA (D/1227/2018) has been submitted to Hornsby Shire Council on 23 November 2018 for an 80 place Early Learning Centre (ELC) building and the DA is currently under assessment. The ELC building is consistent with the overall concept masterplan, and was prepared concurrently with the final preferred campus masterplan. However, to meet the School's operational timeframe requirements for the ELC, a separate application was seen to be the best pathway to allow the building to be built, fitout and operational by 2021.

1.3 The Site

Loreto Normanhurst is located within the suburb of Normanhurst on Sydney's Upper North Shore approximately 3km south of Hornsby and 25km north of Sydney CBD. The school is located in the local government area of Hornsby Shire Council, approximately 750m south of the Normanhurst Railway Station.

The site comprises the existing campus grounds of the Loreto Normanhurst school at 91 – 93 Pennant Hills Road, Normanhurst. The northern part of the site accommodates much of the school's existing built form, while the rear extent consists of the school's sporting fields, and a portion of largely undeveloped land covered in remnant vegetation.

The campus itself is bound by Pennant Hills Road (to the north), Osborn Road (to the west) and Mount Pleasant Avenue (to the east). Detached dwellings on individual residential lots abut the southern boundary of the site.

1.3.1 Legal description and ownership

The campus comprises several allotments, the legal descriptions of which are provided in **Table 1** below. The existing campus has a site area of approximately 13.02ha. The site in its entirety is owned by the Trustees of the Loreto Property Association.

Table 1: Legal Description

Address	Lot	Plan
16 Mount Pleasant Avenue	Lot 5	DP 1218765
	Lot 16	DP 6612
30 – 62 Mount Pleasant Avenue	Lots 20 – 23 and 25 – 36	DP 6612
	Lot 1	DP 34834
91 – 93 Pennant Hills Road	Lot 1	DP 114580
	Lot 3	DP 1217496
	Lot 1 – Lot 3	DP 1218765
	Lot B	DP327538
24 – 28 Mount Pleasant Avenue	Lot 1	DP 809066
6 Mount Pleasant Avenue	Lot C	DP 366271
14 Mount Pleasant Avenue	Lot 4	DP1218765
89 Pennant Hills Road	Lot 1	DP136156

1.4 Overview of proposed development

This application sets out a new campus masterplan for the existing school campus that will guide and shape the development of the school campus for the next 30 years. This SSDA also includes detailed plans for the first stage of the concept proposal (Stage 1 works). Accordingly, consent is sought for the following:

- The concept masterplan, including:
  - Establishment of 10 new building envelopes across the site for education and ancillary uses including student accommodation;
  - Increase of the student number cap by 850 students from 1150 to 2000 students;
  - The open space and landscape design;
  - Pedestrian and circulation arrangements, and
  - Associated car parking provision.
- Detailed consent for Stage 1 works, being:
  - Construction of a new 3 to 6-storey boarding house to accommodate up to 216 boarders.
  - Excavation works to accommodate partially underground carpark and dock facilities within the proposed footprint of the new boarding house facility;
  - Demolition works to buildings between Mary Ward and existing dining room building and associated works to make good existing;
  - Landscaping works and removal and replacement of approximately 50 trees of varying significance; and
  - Augmentation of connection of services and utilities infrastructure.

2. Stage 1: Biodiversity assessment

2.1 Introduction

This Biodiversity Development Assessment Report (BDAR) has been prepared by Belinda Failes, an accredited person (BAAS18159) under the NSW *Biodiversity Conservation Act 2016* (BC Act). And peer reviewed by Nicole McVicar (BAAS18077) who is also an accredited person under the BC Act.

The BDAR has been prepared for the Concept Plan (30 year Masterplan) and Stage 1 construction works. It is acknowledged that there may be minor amendments to the 30 year Masterplan Concept Plan and will be subject to future Development Applications (DAs). However, the Secretary's Environmental Assessment Requirements (SEARs) have requested that the biodiversity impacts of the Concept Plan including Stage 1 works are considered in a BDAR. As such this BDAR will address the biodiversity impacts of the Concept Plan as the proposed footprint.

2.1.1 General description of the development site

The development site is located within Loreto Normanhurst subject site which is approximately 12.99 ha in size, bounded by Pennant Hills Road to the north, Mount Pleasant Avenue to the east, Osborn Road to the west and residential development to the south (Figure 1). The development site is 5.33 ha and is zoned R2 Low Density Residential which provides opportunities for residential or educational use with consent approval as defined in the *Hornsby Local Environmental Plan 2013* (HLEP).

The existing development is concentrated within the northern portion of the subject site. A large patch of native vegetation is located in the southern portion, this is separated from the existing educational buildings by a large sporting oval. Planted native trees and one remnant *Eucalyptus pilularis* (Blackbutt) are located in horticultural gardens which are intersperse around the existing buildings and along the eastern and western perimeters which link the scattered vegetation in the north to the vegetation in the south.

There is an intermittent drainage line which flows through the vegetated bushland in the south of subject site and drains into the headwaters to an unnamed Strahler first order stream. This unnamed stream flows south-west and merges with Coups Creek. Coups Creek is surrounded by a large riparian buffer outside of the study area which is managed by the Sydney Adventist Aged Care Facility. In the broader landscape the development site is located within an urbanised matrix with scattered canopy trees and to the south there is a large corridor of vegetation along Coups Creek and links to Lane Cove National Park.

This report includes two base maps, the Site Map (Figure 1) and the Location Map (Figure 2).

2.1.2 Development site footprint

The development footprint includes the Concept Plan and Stage 1 construction works and are provided in Figure 1. The proposed development will primarily utilise the existing building footprints and open space where available. The proposed development will involve modification of existing development and construction of several new buildings within the subject site. The Concept Plan includes staged development of the following facilities; educational buildings, boarding houses, kitchen, administration offices, carparking, landscaping, bush chapel and sporting facilities. Scattered canopy trees and some

landscaping gardens may be impacted or removed to accommodate the new development. The new Early Learning Centre has been included in this BDAR, however, it has been assessed as a separate Development Application. A detailed description of the project has been provided in the previous section.

2.1.3 Sources of information used

The following data sources were reviewed as part of this report:

- Biodiversity Assessment Methodology Calculator
- BioNet Vegetation Classification System
- BioNet / Atlas of NSW Wildlife 5 km database search (OEH 2018)
- *Environment Protection and Biodiversity Conservation Act 1999* EPBC Act Protected Matters Search Tool 5 km database search (DotEE 2018)
- The Native Vegetation of the Sydney Metropolitan Area (OEH 2016)
- Hornsby Shire Council vegetation mapping (HSC 2017)
- Aerial mapping (SIXMaps)
- Additional GIS datasets including soil, topography, geology and drainage.

Figure 1: Site Map

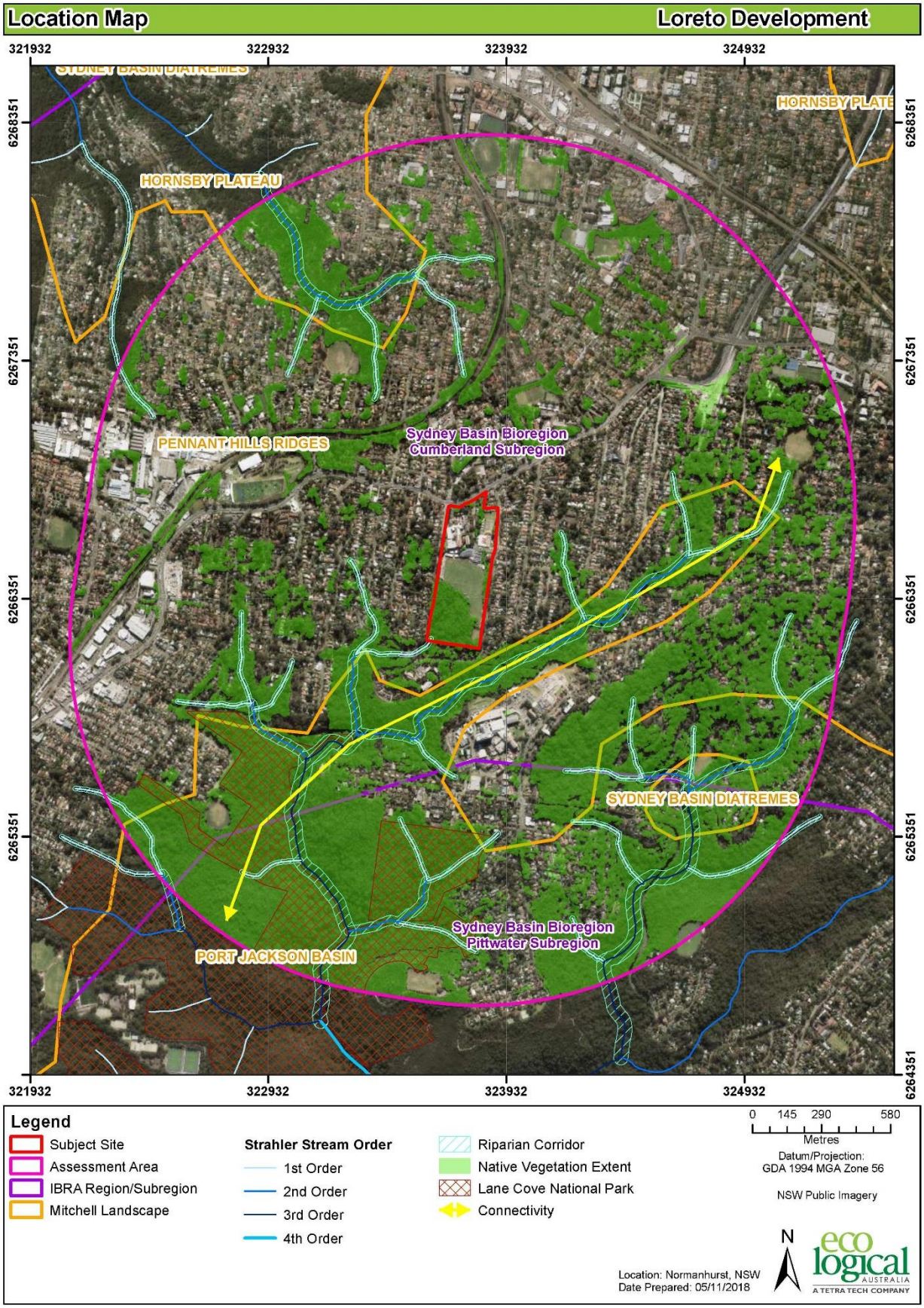

Figure 2: Location Map

2.2 Legislative context

Table 2: Legislative context

Name	Relevance to the project	Report Section
Commonwealth		
Environmental Protection and Biodiversity Conservation Act 1999	Matters of National Environmental Significance have been identified on or near the development site. This report does not require further assessment to MNES under the EPBC Act.	3.6.1
State		
Biodiversity Conservation Act 2016	The proposed development requires submission of a Biodiversity Development Assessment Report (BDAR) (i.e. this report) under the BC Act.	All
Environmental Planning and Assessment Act 1979 **(EP&A Act)**	The proposed development requires consent under the EP&A Act.	N/A
Fisheries Management Act 1994	The development does not involve impacts to Key Fish Habitat, does not involve harm to marine vegetation, dredging, reclamation or obstruction of fish passage. A permit or consultation under the FM Act is not required.	N/A
Local land Services Amendment Act 2016 (LLS)	Assessment under the LLS Act is not required this development.	N/A
Water Management Act 2000	The project does not involve works on waterfront land or riparian land. As the project is under a SSD a Controlled Activity Approval under s91 of the WM Act is not required.	N/A
Planning Instruments		
SEPP Coastal Management 2018	SEPP Coastal Management 2018 consolidated SEPP 14 Coastal Wetlands, SEPP 26 Littoral Rainforests and SEPP 71 Coastal Protection. The proposed development is not located on land subject to SEPP Coastal Management 2018.	N/A
SEPP 44 – Koala Habitat Protection	The proposed development does not impact on potential or core koala habitat as defined by SEPP 44.	N/A
SEPP (Vegetation in Non-Rural Areas)	This SEPP applies to development that does not require development consent. As this project requires development consent under the EP&A Act, application of the Vegetation SEPP is not required.	N/A
Hornsby Local Environmental Plan 2013 (HLEP)	The subject site is zoned R2 Low Density Residential under the HLEP. R2 zones require development consent for the construction of educational facilities. Section 6.4 Terrestrial Biodiversity of the HLEP applies to the bushland vegetation in the southern portion of the subject site. The proposed development includes a small bush chapel within areas mapped on the Terrestrial Biodiversity layer. This layer corresponds to the layer on the Biodiversity Values Map (see Figure 1).	3.6.2
Hornsby Development Control Plan 2013 (HDCP)	The HDCP has been reviewed for additional biodiversity provisions that may relate to the subject and development site. No additional provisions were identified.	N/A

2.3 Landscape features

2.3.1 IBRA regions and subregions

The development site falls within the Sydney Basin Interim Biogeographic Regionalisation for Australia (IBRA) region and Cumberland subregion.

2.3.2 Mitchell Landscapes

The development site falls within the Pennant Hills Ridges Mitchell Landscapes (DECC 2002) as outlined in Table 2.

Table 3: Mitchell Landscapes

Mitchell landscape	Description	Area within Development Site (ha)
Pennant Hills Ridges	Rolling to moderately steep hills on Triassic shales and siltstones. Elevation from 10 to 90m with local relief 60m. Deep red texture-contrast soils on narrow hillcrests, red and brown to yellow texture-contrast soils on slopes becoming slightly harsher in drainage lines. Vegetation typically tall open forest of *Eucalyptus saligna* and *Syncarpia glomulifera*. Rainforest elements in protected moist gully heads are also present.	5.33

2.3.3 Rivers and streams

The development site contains the headwaters to an unnamed 1st order Strahler stream located in the south-western corner of the subject site (Figure 1) as outlined in Table 4. There is evidence of an intermittent drainage line within the bushland to the south of the development site, which links with the headwaters to the unnamed stream. This is likely to support surface water runoff following heavy rainfall events. At other time of field surveys, this area was dry. There is potential that mapping of the hydrolines could be updated to extend the start of the headwaters further north, inside the subject site.

Table 4: Rivers and streams

River/stream	Order	Riparian buffer
Unnamed	1st Order Strahler	10 m

2.3.4 Wetlands

The development site does not contain any wetlands.

2.3.5 Connectivity features

The development site contains the connectivity features outlined in Table 5 and shown in Figure 2. Contiguous connections are present within the development site, adjoining to vegetation within the subject site and into adjoining land. There are two main links, both located in the south of the development site. The first occurs in the south-eastern corner where the vegetation within the subject site links with the intact riparian corridor along Coups Creek via a short gap in the vegetation at Mount Pleasant Avenue. Coups Creek riparian corridor is managed by a trust for the Sydney Adventist Aged Care Facility.

The second contiguous connection is present in the south-western corner where a tributary of Coups Creek links with vegetation on council land from Pine Street where it crosses The Comenarra Parkway and into Lane Cove National Park, approximately 950 m to the south-west of the development site. There is also a link in the north of the subject site along a tributary of Berowra Creek which flows into Berowra Creek Regional Park.

Connectivity to large tracts of habitat is considered suitable for highly mobile species such as birds and bats. This includes flyways for migratory birds and bat species moving through the landscape. Connectivity is present (with road crossings) for less mobile species such as reptiles and mammals.

Table 5: Connectivity features

Connectivity feature name	Feature type
Coups Creek riparian corridor	Private land and riparian corridor
Lane Cove National Park	National Park

2.3.6 Areas of geological significance and soil hazard features

The development site does not contain areas of geological significance and soil hazard features.

2.3.7 Site context

2.3.7.1 Method applied

The site based method has been applied to this development.

2.3.7.2 Percent native vegetation cover in the landscape

The current percent native vegetation cover in the landscape was assessed in a Geographic Information System (GIS) using aerial imagery sourced from SIX Maps using increments of 5%. The percent native vegetation cover within the 1,500 m buffer area is 41 % (392.8 ha).

2.3.7.3 Patch size

Patch size was calculated using available vegetation mapping for all patches of intact native vegetation on and adjoining the development site. The patch size area is 101 ha.

2.4 Native vegetation

2.4.1 Survey effort

An initial constraints assessment was conducted on 24 and 31 March 2017 to identify the vegetation type and condition of the vegetation community in the southern portion of the subject site for the proposed realignment of the sporting field. Three vegetation plots were undertaken in the bushland in the south using floristic plots (20 x 20m) plots to confirm the vegetation type and condition. These plots were not used in any credit calculations.

The site visit also involved vegetation mapping of the remaining subject site and mapping of habitat features, namely hollow-bearing trees (HBTs).

Additional vegetation survey was undertaken within the development site by Belinda Failes on 12 October and 5th November (Figure 4) in accordance with the new BC Act and BAM. A total of four full-

floristic and vegetation integrity plots (BAM plots) were undertaken in accordance with the BAM (Table 6).

All field data collected in the BAM plots is included in Appendix B:.

Table 6: Full floristic and vegetation integrity plots

Veg Zone	PCT ID	PCT Name	Ancillary code	Condition	Area (ha)	Plots required	Plots surveyed
1	1237	Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion.	Remnant	Moderate	0.002	1	0*
2			Planted native	Low	0.50	1	3**
3	1281	Turpentine - Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion	Remnant	Moderate	0.003	0	0*
4			Weedy	Low	0.09	1	1

* Due to the insignificant size of the vegetation zones 1 and 3 within the development site, a plot could not be undertaken.
**Three plots were undertaken for Vegetation zone 2, however, only two plots were used in the credit calculator as one plot was located outside of the development site area.

2.4.2 Plant Community Types present

Two PCTs were identified in the development site (Table 7, Figure 3). Both of these PCTs may be listed as a TECs under the BC and/or EPBC Act (Table 8, Figure 5) (refer to Section 2.4.2.2 for further details). The development site also contains planted native canopy, shrubs and occasionally ground cover species which are native to NSW, however these were not considered locally indigenous to the PCTs. However, under the BAM, planted vegetation native to NSW requires consideration as to the 'best fit' PCT. Based on the soil landscape, elevation, presence of remnant vegetation and remnant regrowth vegetation within the development site and along the eastern perimeter (i.e. Osbourn Road), it was determined that planted native vegetation 'best-fit' PCT was PCT 1237. Justifications are provided below in Section 2.4.2.1.

Table 7: Plant Community Types

PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Area within development site (ha)	Percent cleared
1237	Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion.	North Coast Wet Sclerophyll Forests	Wet Sclerophyll Forests (Shrubby sub-formation)	0.46	90%
1281	Turpentine - Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion	Northern Hinterland Wet Sclerophyll Forests	Wet Sclerophyll Forests (Grassy sub-formation)	0.09	90%

Table 8: Threatened Ecological Communities

PCT ID	BC Act			EPBC Act		
	Listing status*	Name	Area (ha)	Listing status	Name	Area (ha)
1237	CEEC	Blue Gum High Forest in the Sydney Basin Bioregion	0.002	**	Blue Gum High Forest	N/A
1281	EEC	Sydney Turpentine-Ironbark Forest in the Sydney Basin Bioregion	0.09	CEEC	Turpentine-Ironbark Forest	0.09

CEEC – Critically endangered ecological community; EEC – Endangered ecological community
** Note that planted PCT 1237 (0.46 ha) did not satisfy the requirements for listing under the BC Act or EPBC Act criteria.

Table 9: PCT selection justification

PCT ID	PCT Name	Selection criteria	Justification
1237	Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion	IBRA region, subregion, soil landscape, elevation and presence of canopy species *Eucalyptus saligna* and *E. pilularis*	Remnant patches of vegetation consistent with this PCT have been mapped within the subject site and along the road verge of Osbourn Road. This PCT has been accepted as the best fit PCT for planted native vegetation scattered around the development site due to the location in the landscape, presence of remnant species within the area and soil profile.
1281	Turpentine - Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion	IBRA region, subregion, soil landscape, elevation and results of floristic plot analysis including the presence of canopy species *Syncarpia glomulifera*	This PCT has been accepted as the best fit PCT for remnant vegetation located in the south of the site based on floristic analysis.

2.4.2.1 PCT selection justification

The boundaries of between PCT 1237 and PCT 1281 were delineated by the transition of two different soil landscapes, change in elevation and the presence of key characteristic canopy species namely presence or absence of *Eucalyptus saligna* (Sydney Blue Gum), *E. pilularis* (Blackbutt) and *Syncarpia glomulifera* (Turpentine). At higher elevations on Glenorie soil landscapes the vegetation was mapped as PCT 1237. Glenorie soil landscape is associated with clay soils of the Wianamatta Group Ashfield Shale (Chapman and Murphy 1989). This vegetation also includes patches of remnant vegetation along Osbourn Road and near Pennant Hills Road. Scattered patches of planted native vegetation within the higher elevations on the same soil landscape were also mapped as part of this PCT 1237, however, they were not considered part of the TEC (see justification in Section 2.4.2.2 below).

PCT 1281 was generally located in the intact native vegetation in the southern portion of the subject site and only a small portion was represented in the development site. PCT 1281 was located in lower elevations on Hawkesbury soil landscape which is associated with sandier soils. Floristic analysis was conducted to confirm the presence of PCT 1281 and delineate with PCT 1237. PCT 1237 occurs at the transition between Wiannamatta Shale and Hawkesbury Sandstone and corresponds to TEC Sydney Turpentine Ironbark Forest. Justification for the selection of PCTs occurring on the development site is based on a quantitative analysis of full-floristic plot data and is provided in Table 9.

2.4.2.2 Threatened Ecological Communities Justification

The BioNet Vegetation Classification lists PCT 1237 as Blue Gum High Forest which is listed as critically endangered ecological community (CEEC) under the BC Act. Patches of certain quality Blue Gum High Forest may be listed under the EPBC Act listed provided they satisfy the following criteria (DotEE 2018a):

- Patch size is greater than 1 ha; AND
  - Canopy cover greater than 10% OR
  - Canopy cover less than 10% and occurs in areas of vegetation in excess of 5 ha.

There was one remnant patch of PCT 1237 located within the subject site. This was represented by a large remnant *Eucalyptus pilularis* located in a landscaped garden in the north of the subject site and is isolated from other remnant vegetation. This patch does not satisfy the criteria for listing under the EPBC Act as the patch size is less than 1 ha.

The remaining patches of PCT 1237 mapped within the development site represent planted native species including species which are indigenous to PCT 1237 such as *Eucalyptus saligna* and native planted species which are not indigenous to PCT 1237 such as *Ficus macrophylla* (Moreton Bay Fig). A review of the final determination for this Blue Gum High Forest TEC and profile description determined that the native planted vegetation within the development site does not conform to the TEC. This is due to a lack of regeneration of native vegetation and a low probability of an existing soil seed bank due to the fact that the landscape and soil profile has been substantially altered.

Another small patch of PCT 1237 represented by remnant *Eucalyptus saligna* was mapped along the road verge of Osbourn Road and is located outside of the subject site. Some of the branches were overhanging into the subject site and have therefore been included in the PCT mapping (see Figure 4). There is potential that the road verge patch of PCT 1237 would be considered for listing under the EPBC Act due to its connectivity with the large patch of PCT 1281 in the south of the subject site. However, this patch of road verge PCT 1237 is located outside of the subject site and will not be directly impacted under the proposed development.

The BioNet Vegetation Classification lists PCT 1281 as a component of Sydney Turpentine Ironbark Forest which is listed as endangered under the BC Act and CEEC under the EPBC Act. This PCT was categorised as high and moderate condition vegetation zones based on the presence/absence of weeds. Both conditions of this PCT 1281 are listed as part of the Sydney Turpentine Ironbark Forest listing under the BC Act and the more stringent criteria for listing under the EPBC Act. The criteria for listing under the EPBC Act for Sydney Turpentine Ironbark Forest are provided below (DotEE 2018b):

- The vegetation contains some characteristic components from all structural layers (tree canopy, small tree/shrub midstorey, and understorey).
- Tree canopy cover is greater than 10% and remnant size is greater than one hectare. These areas have the greatest conservation value and their high quality and size makes them most resilient to disturbance.
- However, remnants with tree canopy cover less than 10% are also included in the ecological community, if the fragments are greater than one hectare in size and occur in areas of native vegetation in excess of 5 hectares in area. These areas enhance the potential for

connectivity and viability of the ecological community. They support native flora and fauna species by facilitating gene flow among remnants and buffering against disturbance.

Vegetation integrity assessment

A vegetation integrity assessment using the Credit Calculator (referred to as the BAMC) was undertaken and the results are outlined in Table 10.

The impact areas were entered into the BAMC for each of the vegetation zones. The small impact areas for vegetation zones 1 and 3, 0.002 ha and 0.003 ha respectively, were entered into the BAMC, however, due to the small impact size for these zones, the BAMC reverted the scores to zero value and would not allow further assessment for these two vegetation zones. Therefore, the assessor added the impact area values (prior to rounding) for zone 1 (0.002 ha) and zone 2 (0.460 ha) together as they are of the same PCT. However, due to the insignificant value it did not result in a change of score for vegetation zone 2 (0.46 ha). Similarly, the same was conducted for the impact area for zone 3 (0.003 ha) and zone 4 (0.09 ha). Therefore, the vegetation integrity assessment has included the impacts for zone 1 and 3, however, the impact values do not change the overall integrity score of the development.

Table 10: Vegetation integrity

Veg Zone	PCT ID	Ancillary code	Condition	Area (ha)	Composition Condition Score	Structure Condition Score	Function Condition Score	Current vegetation integrity score
1	1237	Remnant regeneration	Moderate	0.002*	N/A	N/A	N/A	N/A
2	1237	Planted native canopy	Low	0.460	24.3	48.9	36.5	35.1
3	1281	Remnant	Moderate	0.003*	N/A	N/A	N/A	N/A
4	1281	Weedy	Low	0.09	40.8	51.2	30	39.7

* Note – Vegetation Zones 1 and 3 were entered into the credit calculator, however, the impact areas are too low that the credit calculator rounded the values to zero. Therefore, the impact hectares for Zone 1 was added to Zone 2 and Zone 3 was added to Zone 4, however, the due to the small amounts, this did not change the value of Zones 2 and 4.

Figure 3: Plant Community Types and native vegetation extent

Figure 4: Plot locations

Figure 5: Threatened Ecological Communities

2.5 Threatened species

2.5.1 Ecosystem credit species

Ecosystem credit species predicted to occur at the development site, their associated habitat constraints, geographic limitations and sensitivity to gain class is included in Table 11.

Table 11: Predicted ecosystem credit species

Species	Common Name	Habitat constraints/ Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
Anthochaera phrygia	Regent Honeyeater (Foraging)	N/A	High	CE	CE	Habitat features for this species are not present at this site. The development site does not comprise key plant species required for foraging.
Artamus cyanopterus cyanopterus	Dusky Woodswallow		Moderate	V	Not Listed	Habitat features for this species are not present at this site. The development site does not comprise key plant species required for foraging.
Callocephalon fimbriatum	Gang-gang Cockatoo (Foraging)	N/A	Moderate	V	Not Listed	Habitat present is substantially degraded such that this species is unlikely to utilise the development site. Additionally, the Gang-gang Cockatoo favours old growth forest/woodland attributes, of which the development site does not contain.
Calyptorhynchus lathami	Glossy Black-Cockatoo (Foraging)	N/A	High	V	Not Listed	Habitat present is substantially degraded such that this species is unlikely to utilise the development site. The development site was not considered suitable habitat due to disturbance and insufficient presence of foraging habitat.
Chthonicola sagittata	Speckled Warbler	N/A	High	V	Not Listed	Habitat present does not contain suitable habitat features for this species such as abundance of fallen logs. The vegetation within the development site is substantially degraded.

Species	Common Name	Habitat constraints/ Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
Daphoenositta chrysoptera	Varied Sittella	N/A	Moderate	V	Not Listed	Habitat present does not contain suitable habitat features for this species such as abundance of fallen logs. The vegetation within the development site is substantially degraded
Dasyurus maculatus	Spotted-tailed Quoll	N/A	High	V	E	Habitat features for this species are not present at this site. This species requires habitat features such as maternal den sites, an abundance of food (birds and small mammals) and large areas of relatively intact vegetation to forage in (DECC 2007).
Falsistrellus tasmaniensis	Eastern False Pipistrelle	N/A	High	V	Not Listed	Habitat present is PCT 1237_Native is substantially degraded however, it still provides foraging habitat and the occasional tree hollow for this species. This species was included in this assessment.
Glossopsitta pusilla	Little Lorikeet	N/A	High	V	Not Listed	There are eight BioNet records for this species within a 5 km radius of the development site. This species may utilise the flowering species within the development site This species was included in this assessment
Grantiella picta	Painted Honeyeater	N/A	Moderate	V	V	Habitat features associated with this species are not present in the development site. This species is a specialist feeder requiring mistletoe which is absent from the development site.
Hieraaetus morphnoides	Little Eagle (Foraging)	N/A	Moderate	V	Not Listed	Included in this assessment. In PCT1281
Hoplocephalus bungaroides	Broad-headed Snake (Foraging)	N/A	High	E	V	Habitat present is substantially degraded such that this species is unlikely to utilise the development site. The development site does not contain sufficient rocky habitat for this species to utilise. No individuals have been recorded within 5km of the development site.

Species	Common Name	Habitat constraints/ Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
Lathamus discolor	Swift Parrot (Foraging)	N/A	Moderate	E	CE	Habitat features associated with this species were identified within the development site such as *Corymbia maculata* and *Eucalyptus sideroxylon* within PCT1237_native Planted and *Corymbia. gummifera* and *Eucalyptus pilularis* used for lerps in PCT1237 and PCT 1281. Therefore, this species has been included in this assessment.
Lophoictinia isura	Square-tailed Kite (Foraging)	N/A	Moderate	V	Not Listed	Habitat features associated with this species are not present on the development site. This species requires dry woodlands and open forests with a particular preference for timbered watercourses.
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	N/A	Moderate	V	Not Listed	Habitat features associated with this species are not present on the development site. This species requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses which the development site does not contain. No individuals have been recorded within 5km of the development site.
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	N/A	Moderate	V	Not Listed	Habitat features associated with this species are not present in the development site. This species occupies forests or woodlands dominated by box and ironbark eucalypts (especially Mugga Ironbark), which the development site is not dominated by. No individuals have been recorded within 5km of the development site.
Miniopterus australis	Little Bentwing-bat (Foraging)	N/A	High	V	Not Listed	Included in this assessment
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat (Foraging)	N/A	High	V	Not Listed	Included in this assessment

Species	Common Name	Habitat constraints/ Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
Mormopterus norfolkensis	Eastern Freetail-bat	N/A	High	V	Not Listed	included in this assessment
Neophema pulchella	Turquoise Parrot	N/A	High	V	Not Listed	Habitat features associated with this species are not present in the development site. The development site does not contain suitable hollow-bearing trees required for breeding (within woodland) or foraging habitat in open woodland required for this species. No individuals have been recorded within 5km of the development site.
Ninox connivens	Barking Owl (Foraging)	N/A	High	V	Not Listed	Included in this assessment. Of PCT 1281_weedy.
Ninox strenua	Powerful Owl (Foraging)	N/A	High	V	Not Listed	Included in this assessment.
Petaurus australis	Yellow-bellied Glider	Hollow-bearing Trees (hollow > 25cm)	High	V	Not Listed	Habitat features associated with this species (i.e. old growth forests and large hollows) are not present in the development site. The development site does not contain suitable hollow-bearing trees required for breeding (within woodland) or foraging habitat in open woodland required for this species. No individuals have been recorded within 5km of the development site.
Petroica boodang	Scarlet Robin	N/A	Moderate	V	Not Listed	There is a 2000 BioNet record for this species recorded within the subject site. However, the development site does not contain breeding habitat (i.e. breeds on ridges, hills and foothills). After breeding, this species disburses to lower elevations. Habitat features associated with this species includes an abundance of logs and fallen timber, these features were not present in the Development Site.

Species	Common Name	Habitat constraints/ Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
Petroica phoenicea	Flame Robin	N/A	Moderate	V	Not Listed	Habitat features associated with this species are not present in the development site. This species requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses which the development site does not contain. No individuals have been recorded within 5km of the development site.
Phascolarctos cinereus	Koala (Foraging)	N/A	High	V	V	Habitat present is substantially degraded such that this species is unlikely to utilise the development site. Habitat was not considered suitable due to the high disturbance and limited feed trees.
Pteropus poliocephalus	Grey-headed Flying-fox (Foraging)	N/A	High	V	V	Included in this assessment.
Ptilinopus superbus	Superb Fruit-Dove	N/A	Moderate	V	Not Listed	Habitat features associated with this species are not present in the development site. The development site does not contain suitable foraging habitat (i.e. fruit bearing trees) required for this species.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	N/A	High	V	Not Listed	Included in this assessment.
Scoteanax rueppellii	Greater Broad-nosed Bat	N/A	High	V	Not Listed	Included in this assessment.
Tyto novaehollandiae	Masked Owl (Foraging)	N/A	High	V	Not Listed	Included in this assessment.
Varanus rosenbergi	Rosenberg's Goanna	To northern and south western margins of the sub region	High	V	Not Listed	Habitat features for this species are not present in the development site. Critical habitat components such as termite mounds are not present in the development site. No individuals have been recorded within 5km of the development site.

CE = Critically Endangered; E = Endangered; E2 = Endangered Population; V = Vulnerable

2.6 Species credit species

Species credit species predicted to occur in the development site (i.e. candidate species), their associated habitat constraints, geographic limitations and sensitivity to gain class are shown in Table 12. Habitat assessments were undertaken during the field surveys on 24 and 31 March 2017 and 12 October and 5th November 2018 to determine the likelihood of threatened species occurring within the development site on an intermittent or permanent basis.

Habitat assessments involved a search of all possible hollow-bearing trees within the development site, on ground inspection of roof cavities using binoculars for possible entrance for microbats, indirect evidence of fauna foraging such as chew cones or sap trees or roosting habitat in the form of white wash and pellets for owl species.

It should be noted that there were three flora species which have been planted as horticultural varieties which in some locations are listed as threatened flora species under the BC and/or EPBC Act. These species are located outside of their normal distribution and are cultivated varieties and should not be considered as threatened species. These include:

- *Grevillea juniperina* is a horticultural variety and should not be confused with the threatened *Grevillea juniperina* subsp. *juniperina* which is associated with clay soils of western Sydney region and listed as a vulnerable species under the BC Act. The subject site does not comprise appropriate habitat for this threatened species and would therefore not occur naturally.
- *Eucalyptus scoparia* (Wallangarra White Gum) listed as endangered under the BC Act and vulnerable under the EPBC Act. This species has been planted. The threatened species is known from only three locations in NSW near Tenterfield, which is more than 640 km from the subject site.
- *Syzygium paniculatum* (Magenta Cherry), this species is readily available from local nurseries as a horticultural species. This species is also listed as endangered under the BC Act and vulnerable under the EPBC Act. The threatened species is only located in littoral coastal rainforest areas along NSW from Upper Lansdowne to Conjola State Forest. The development site does not include littoral coastal rainforest environments.

Given that these species are located outside of their natural range of distribution and/or outside of their natural habitat and the fact these species have been clearly planted due to the landscaped setting, no additional considerations are required for these three species under the BC Act or EPBC Act.

Table 12: Candidate species credit species

Species	Common Name	Habitat constraints/ Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
Acacia bynoeana	Bynoe's Wattle	N/A	High	E	V	The presence of this species was not identified (conspicuous species) and it was determined that the habitat is substantially degraded such that this species is unlikely to utilise the development site.
Acacia prominens –	Endangered population	N/A	High	E2	Not Listed	The subject site is not located within the Gosford, Hurstville or Kogarah LGAs.

Species	Common Name	Habitat constraints/ Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
endangered population	Gosford Wattle, Hurstville and Kogarah LGAs					This species is not considered a candidate species for this assessment.
Acacia pubescens	Downy Wattle	N/A	High	V	V	The presence of this species was not identified (conspicuous species) and it was determined that the habitat is substantially degraded such that this species is unlikely to utilise the development site.
Anthochaera phrygia	Regent Honeyeater (Breeding)	N/A	High	CE	CE	This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The development site is not within an important breeding area for the species (National Recovery Plan).
Burhinus grallarius	Bush Stone-curlew	Fallen/standing dead timber including logs	High	E	Not Listed	Habitat features for this species are not present in the development site. Critical habitat components such as fallen or standing dead timber are not present in the development site. No individuals have been recorded within 5km of the development site.
Caladenia tessellata	Thick Lip Spider Orchid	N/A	Moderate	E	V	Field surveys of the development site was conducted during flowering season (September to November) and did not identify this species. This species occurs in grassy sclerophyll woodlands which were not recorded within the development site. Furthermore, this species is only known from old records in Sydney area.
Callocephalon fimbriatum	Gang-gang Cockatoo (Breeding)	N/A	High	V	Not Listed	This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The development site does not contain breeding habitat such as Eucalypt trees with hollows >9cm in diameter and shrubs that are suitable for the species to utilise the site.
Callocephalon fimbriatum - endangered population	Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai Local	Hornsby and Ku-ring-gai LGAs	High	E	Not Listed	Although the development site is located within the Hornsby LGA and there are records for this species within 1.7 km away, the development site does not contain suitable habitat for this species.

Species	Common Name	Habitat constraints/ Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
	Government Areas					
Calyptorhynchus lathami	Glossy Black-Cockatoo (Breeding)	N/A	High	V	Not Listed	This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The development site does not contain larger patches of intact vegetation or trees with large hollows that are suitable for the species to utilise the site.
Camarophyllopsis kearneyi	-	Lane Cove Bushland Park	High	E	Not Listed	The Development Site is not in within Lane Cove Bushland Park (it is located 22 km away to the south-east of the Development Site). This species is unlikely to occur within the Development Site.
Cercartetus nanus	Eastern Pygmy-possum		High	V	Not Listed	Habitat present is substantially degraded such that this species is unlikely to utilise the development site. There is no nesting habitat present or preferred foraging habitat such as *Banksia* sp. present. No individuals have been recorded within 5km of the development site.
Chalinolobus dwyeri	Large-eared Pied Bat	Cliffs Within 2km of rocky areas containing caves, overhangs, escarpment, outcrops, or crevices, or within 2km of old mines or tunnels	Very High	V	V	Habitat features associated with this species (caves) are not present in the development site. There is no suitable breeding habitat such as caves, overhangs, mines or culverts present for the species to utilise the site.
Epacris purpurascens var. *purpurascens*	-	N/A	Moderate	V	Not Listed	The presence of this species was not identified (conspicuous species) and it was determined that the habitat is substantially degraded such that this species is unlikely to utilise the development site.
Galium australe	Tangled Bedstraw	N/A	High	E	Not Listed	The presence of this species was not identified (conspicuous species) and it was determined that the habitat is substantially degraded such that this

Species	Common Name	Habitat constraints/ Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
						species is unlikely to utilise the development site.
Grammitis stenophylla	Narrow-leaf Finger Fern	N/A	Moderate	E	Not Listed	The presence of this species was not identified (conspicuous species) and it was determined that the habitat is substantially degraded such that this species is unlikely to utilise the development site.
Grevillea parviflora subsp. *parviflora*	Small-flower Grevillea	N/A	High	V	V	The presence of this species was not identified (conspicuous species) and it was determined that the habitat is substantially degraded such that this species is unlikely to utilise the development site.
Grevillea parviflora subsp. *supplicans*	-	N/A	High	E	Not Listed	The presence of this species was not identified (conspicuous species) and it was determined that the habitat is substantially degraded such that this species is unlikely to utilise the development site.
Gyrostemon thesioides	Gyrostemon thesioides	N/A	High	E	Not Listed	The presence of this species was not identified (conspicuous species) and it was determined that the habitat is substantially degraded such that this species is unlikely to utilise the development site.
Heleioporus australiacus	Giant Burrowing Frog	N/A	Moderate	V	V	Habitat features associated with this species are not present on the development site. The development site does not contain suitable waterbodies for this species to utilise the site.
Hibbertia puberula	Hibbertia puberula	N/A	High	E	Not Listed	Habitat features associated with this species are not present on the development site.
Hibbertia spanatha	Julian's Hibbertia	N/A	N/A	CE	CE	The presence of this species was not identified (conspicuous species) and it was determined that the habitat is substantially degraded such that this species is unlikely to utilise the development site.
Hibbertia superans	Hibbertia superans	Other Ridgetops	High	E	Not Listed	The presence of this species was not identified (conspicuous species) and it was determined that the habitat is substantially degraded such that this

Species	Common Name	Habitat constraints/ Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
						species is unlikely to utilise the development site.
Hieraaetus morphnoides	Little Eagle (Breeding)	N/A	Moderate	V	Not Listed	This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The development site does not contain suitable breeding habitat.
Hoplocephalus bungaroides	Broad-headed Snake (Breeding)	The south west margins of the region	Very High	E	V	This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The development site does not contain suitable breeding habitat.
Hygrocybe anomala var. *ianthinomarginata*	-	Lane Cove Bushland Reserve	High	V	Not Listed	The development site is not in within Lane Cove Bushland Reserve (it is located 22 km away to the south-east of the development site). This species is unlikely to occur within the development site.
Hygrocybe aurantipes	-	Lane Cove Bushland Reserve	High	V	Not Listed	The development site is not in within Lane Cove Bushland Reserve (it is located 22 km away to the south-east of the development site). This species is unlikely to occur within the development site.
Hygrocybe austroprateensis	-	Lane Cove Bushland Reserve	High	E	Not Listed	The development site is not in within Lane Cove Bushland Reserve (it is located 22 km away to the south-east of the development site). This species is unlikely to occur within the Development Site
Hygrocybe collucera		Lane Cove Bushland Reserve	High	E	Not Listed	The development site is not in within Lane Cove Bushland Reserve (it is located 22 km away to the south-east of the Development Site). This species is unlikely to occur within the Development Site
Hygrocybe griseoramosa		Lane Cove Bushland Reserve	High	E	Not Listed	The development site is not in within Lane Cove Bushland Reserve (it is located 22 km away to the south-east of the Development Site). This species is unlikely to occur within the Development Site
Hygrocybe lanecovensis		Lane Cove Bushland Reserve	High	E	Not Listed	The development site is not in within Lane Cove Bushland Reserve (it is located 22 km away to the south-east of the Development Site). This species is

Species	Common Name	Habitat constraints/ Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
						unlikely to occur within the Development Site
Hygrocybe reesiae		Lane Cove Bushland Reserve	High	V	Not Listed	The development site is not in within Lane Cove Bushland Reserve (it is located 22 km away to the south-east of the Development Site). This species is unlikely to occur within the Development Site
Hygrocybe rubronivea		Lane Cove Bushland Reserve	High	V	Not Listed	The development site is not in within Lane Cove Bushland Reserve (it is located 22 km away to the south-east of the Development Site). This species is unlikely to occur within the Development Site
Lathamus discolor	Swift Parrot (Important foraging areas)		Moderate	E	CE	ELA has received emailed confirmation from OEH to confirm that the development site is not located within mapped important areas.
Litoria aurea	Green and Golden Bell Frog	Semi-permanent/ ephemeral wet areas Within 1km of wet areas|swamps Within 1km of swamp|waterbodies Within 1km of waterbody	High	E	V	Habitat features associated with this species are not present on the development site. Although the development site is located within 1 km of waterbody/ streams, there are no suitable pools, swamps or fringing vegetation within the development site which may contain suitable habitat for this species
Lophoictinia isura	Square-tailed Kite (Breeding)	N/A	Moderate	V	Not Listed	This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The development site does not contain breeding habitat that is suitable for the species to utilise the site. No nests were observed during field surveys.
Meridolum corneovirens	Cumberland Plain Land Snail	N/A	High	E	Not Listed	Habitat features associated with this species are not present in the development site. This species occurs within Cumberland Plain Woodland and associated shale vegetation communities. The development site

Species	Common Name	Habitat constraints/ Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
						does not support these habitat features.
Miniopterus australis	Little Bentwing-bat (Breeding)	N/A	Very High	V	Not Listed	This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The development site does not contain breeding habitat such as caves that are suitable for the species to utilise the site.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat (Breeding)	N/A	Very High	V	Not Listed	This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The development site does not contain breeding habitat such as caves, tunnels, mines or culverts.
Myotis macropus	Southern Myotis	Hollow bearing trees Within 200 m of riparian zone|other bridges, caves or artificial structures within 200 m of riparian zone	High	V	Not Listed	Habitat present is substantially degraded such that this species is unlikely to utilise the development site. Habitat within the development site is isolated and disturbed with a higher likelihood of this species using adjoining vegetation in better condition. Additionally, the nearest drainage line (approximately 100 m away from the development site is only ephemeral in nature. Additionally, no HBTs will be removed in the bushland area.
Ninox connivens	Barking Owl (Breeding)	N/A	High	V	Not Listed	This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The development site does not contain suitable breeding habitat.
Ninox strenua	Powerful Owl (Breeding)	N/A	High	V	Not Listed	This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The development site does not contain suitable breeding habitat.
Persoonia hirsuta	Hairy Geebung	N/A	High	E	E	The presence of this species was not identified (conspicuous species) and it was determined that the habitat is substantially degraded such that this species is unlikely to utilise the development site.

Species	Common Name	Habitat constraints/ Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
Petaurus norfolcensis	Squirrel Glider	N/G	High	V	Not Listed	Habitat present is substantially degraded such that this species is unlikely to utilise the development site. Habitat in the development site is isolated and disturbed with a higher likelihood of this species using adjoining vegetation in better condition. Additionally, this species has a strong preference for old growth forests which does not include the development site. Additionally, there are no BioNet records for this species within a 5 km radius of the development site.
Phascolarctos cinereus	Koala (Breeding)	N/A	High	V	V	This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. Habitat present is substantially degraded such that this species is unlikely to utilise the site for breeding.
Pimelea curviflora var. *curviflora*	Pimelea curviflora var. curviflora	N/A	High	V	V	The presence of this species was not identified (conspicuous species) and it was determined that the habitat is substantially degraded such that this species is unlikely to utilise the development site.
Pomaderris prunifolia – endangered population	Endangered population in Parramatta, Auburn, Strathfield and Bankstown LGA	N/A	High	E	V	The development site is not located within the LGA for this endangered population. Furthermore, the presence of this species was not identified (conspicuous species) and it was determined that the habitat is substantially degraded such that this species is unlikely to utilise the development site.
Pommerhelix duralensis	Dural Woodland Snail	Other Leaf litter and shed bark or within 50m of litter or bark|Rocky areas Rocks or within 50m of rocks|Fallen /standing	High	E	E	Habitat present is substantially degraded such that this species is unlikely to utilise the development site. Habitat in the development site is isolated and disturbed with a higher likelihood of this species using adjoining vegetation in better condition. Additionally, this species has specific habitat requirements which were not recorded within the development site.

Species	Common Name	Habitat constraints/ Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
		dead timber including logs Including logs and bark or within 50m of logs or bark				
Pseudophryne australis	Red-crowned Toadlet	N/A	Moderate	V	Not Listed	Habitat features associated with this species are not present on the development site. The development site does not contain suitable drainage lines for this species to utilise the site.
Pteropus poliocephalus	Grey-headed Flying-fox (Breeding)	N/A	High	V	V	This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The development site does not contain any breeding sites that are suitable for the species to utilise.
Syzygium paniculatum	Magenta Lilly Pilly	N/A	Moderate	E	V	The presence of this species was not identified (conspicuous species) and it was determined that the habitat is substantially degraded such that this species is unlikely to utilise the development site.
Tetratheca glandulosa	Tetratheca glandulosa	N/A	High	V	Not Listed	Habitat features associated with this species (such as ridgetops with shale-sandstone transitional soils) are not present on the development site. The field surveys were conducted during flowering times (July – November) however, this species and its habitat was not identified within the development site.
Tyto novaehollandiae	Masked Owl (Breeding)	N/A	High	V	Not Listed	This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The development site does not contain habitat such as trees with large hollows that are suitable for the species to utilise the site for breeding.
Wahlenbergia multicaulis –	Tadgell's Bluebell in the LGAs of Auburn, Bankstown,	Other Land situated in damp,	High	E	Not Listed	This species has two populations recorded in northern Sydney (Thornleigh and Mt Ku-ring-gai), which does not include the development site area. Habitat features associated with

Species	Common Name	Habitat constraints/ Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
endangered population	Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield	disturbed sites				this species includes Hawkesbury soil landscapes, which was not recorded within the Development Site.

CE = Critically Endangered; E = Endangered; E2 = Endangered Population; V = Vulnerable

2.6.1 Targeted surveys

Due to the high level of modification of vegetation within the development site and lack of potential habitat, targeted surveys were not conducted for species credit species. Justification for the exclusion of species credit species is provided Table 12.

However, targeted surveys were conducted for potential roosting habitat for threatened and non-threatened microbat species within the roof cavity of one of the residential dwellings to be demolished (Figure 4). Some microbat species are dual credit species which only breeding habitat considered for Species credits. None of the dual credit species are known to breed in man-made structures such as roof cavities. However, under Section 9.2.1 of the BAM, the accessor must take into consideration Prescribed Biodiversity Impacts including any man-made structures which may be roosting habitat for the following threatened microbat species:

- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail Bat)
- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
- *Miniopterus australis* (Little Bentwing-bat)
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat).

The methodology and results for the microbat surveys are detailed in the Prescribed Biodiversity Impact Assessment Section 3.1.3.

2.6.2 Use of local data

The use of local data is not proposed.

2.6.3 Expert reports

Expert reports have not been prepared as part of this BDAR.

3. Stage 2: Impact assessment (biodiversity values)

3.1 Avoiding impacts

3.1.1 Locating a project to avoid and minimise impacts on vegetation and habitat

The proposed Concept Plan and Stage 1 development has utilised the existing building footprint and will involve modification to existing building or construction of new development in predominately cleared or fragmented environments. Areas of high biodiversity values have been retained where possible. Justifications on how the development aims to avoid and minimise impacts is outlined in Table 13.

Table 13: Locating a project to avoid and minimise impacts on vegetation and habitat

Approach	How addressed	Justification
Locating the project in areas where there are no biodiversity values	The project (i.e. the proposed development footprint) has utilised existing development areas, cleared land and planted gardens to minimise impacts on areas with the highest biodiversity value. Areas of biodiversity values have been retained where possible within the subject site.	Prior to the preparation of the Concept Plan ELA prepared an ecological constraints assessment which identified potential biodiversity values and constraints. This information was fed into the Concept Plan to ensure that the proposed development avoided impacts upon areas of highest biodiversity values, where possible. The Concept Plan has incorporated this ecological advice and concentrated the development in the northern section of the subject site to reduce impacts to areas of high biodiversity values. The project has utilised areas with existing development, open space (i.e. the sporting oval) and areas of landscaped plantings and minimised the removal of native vegetation from within the site. While a small amount of native remnant vegetation (PCT 1281) will be removed (0.09 ha) this area is in low condition due to weeds and the works in this area will involve the construction of a bush chapel and minimal removal of shrubs and ground cover species which are predominately exotic species. No canopy will be removed. These weed removal activities will result in an improved ecological outcome for the PCT 1281. The remaining vegetation to be removed includes urban landscaped vegetation (0.48 ha) and planted native vegetation PCT 1237 (0.46 ha) which is not considered remnant native vegetation. Areas with higher biodiversity values including remnant native vegetation PCT 1237 and PCT 1281 will be retained within the subject site. The project has ensured that only one HBT will be removed and the remaining ten HBTs located within the subject site will be retained.
Locating the project in areas where the native vegetation or threatened species habitat is in the poorest condition	The project has been located to utilise areas where native vegetation and threatened species habitat is in the poorest condition.	The project has been located to utilise areas in the north of the subject site comprised of existing buildings, cleared lands, exotic plantings and lower condition vegetation. This placement minimises removal of vegetation from the south of the subject site which contains higher quality remnant vegetation and potential threatened species habitat.
Locating the project in areas that avoid habitat for species and vegetation in high threat categories	The project has been located to avoid removal of vegetation in high threat categories.	The project has concentrated the impacts in vegetation which are not listed as part of a TEC. The majority of the vegetation within the development site (5.16 ha) does not conform to a TEC. The majority of the vegetation retained in the subject site does contain vegetation mapped as part of a TEC.

Approach	How addressed	Justification
(e.g. an EEC or CEEC), indicated by the biodiversity risk weighting for a species		The development site has utilised areas of lower biodiversity value where possible. Areas of lower biodiversity value includes planted vegetation. Under the project, only minor amount of vegetation in high threat categories (EEC or CEEC) will be removed. A small amount (0.002 ha) of PCT 1237 (Blue Gum High Forest) in the form of one single remnant *Eucalyptus pilularis* has been mapped under the BC Act, will require the trimming of several outer branches for the project. The tree is located 10 m from the proposed buildings and will be retained within the subject site with careful mitigation measures. A small amount of fringing vegetation within zone 3 PCT 1281 (0.003 ha) will be removed to accommodate the new sporting fields. This area is of lower quality due to the edge effects, weed infestation and lower native resilience in the soil seedbank. Much of this edge has been established from revegetation works. This patch is part of a larger patch of mixed condition PCT 1281 which has been listed as a TEC under the BC Act and EPBC Act. Additionally, 0.09 ha of PCT 1281_weedy vegetation will be removed for the bush chapel. This area will involve the removal of shrub and ground layer only, in an area which is currently comprised of exotic shrubs and ground cover species. This vegetation is also part of a large patch of PCT 1281 which is listed under the BC Act and EPBC Act.
Locating the project such that connectivity enabling movement of species and genetic material between areas of adjacent or nearby habitat is maintained	The project has been located to enable connectivity across the local area.	The project has been located to maintain all current connectivity between areas of vegetation. This will enable continued connectivity across the landscape for mobile fauna species and movement of genetic material.

3.1.2 Designing a project to avoid and minimise impacts on vegetation and habitat

The development has been designed in a way which avoids and minimises impacts as outlined in Table 14.

Table 14: Designing a project to avoid and minimise impacts on vegetation and habitat

Approach	How addressed	Justification
Reducing the clearing footprint of the project	The project has been designed to reduce the clearing footprint of the project.	The placement of the development site footprint has been strategically designed to avoid high biodiversity value areas and utilises mainly cleared or built lands and planted vegetation.
Locating ancillary facilities in areas where there are no biodiversity values	Ancillary features have been located in areas where there are no biodiversity values.	Ancillary features will be located at the northern side of the development site in predominantly cleared areas with limited biodiversity value, avoiding the native vegetation along the southern extent of the subject site. The sporting fields will act as part

Approach	How addressed	Justification
		of the asset protection zone and will reduce the requirement for removal of vegetation within areas of high biodiversity value in the south of the subject site Additionally, temporary ancillary features required during construction (such as stockpiles) will be located in existing cleared areas such as the sporting fields and will not involve the removal of vegetation.
Locating ancillary facilities in areas where the native vegetation or threatened species habitat is in the poorest condition (i.e. areas that have a lower vegetation integrity score)	Ancillary features have been located in areas where native vegetation is in the poorest condition.	Ancillary features will be located at the northern portion of the subject site in predominantly built or cleared lands or in areas where native vegetation has been planted. Native planted vegetation contains a lower vegetation integrity score than the remnant vegetation located in the south of the subject site. A bush chapel has been proposed within TEC vegetation in the south of the development site. The bush chapel will require the installation of outdoor seating area and removal of exotic shrubs and ground cover which is of a benefit to the surrounding TEC. The location of the bush chapel has utilised lower condition vegetation and will retain better quality TEC in the surrounding areas.
Locating ancillary facilities in areas that avoid habitat for species and vegetation in high threat status categories (e.g. an EEC or CEEC)	Ancillary features have been located in areas that avoid habitat for species and vegetation in high threat categories.	The majority of the development site contains exotic and planted native vegetation which does not support vegetation in high threat categories (e.g. EEC or CEEC). The development site contains substantial amount of cleared lands which will be utilised for temporary ancillary facilities and will not impact upon high threat category vegetation.
Providing structures to enable species and genetic material to move across barriers or hostile gaps	The development has been designed to maintain a vegetated corridor enabling movement of species and genetic material.	The project has been designed to retain quality vegetation in the south of the subject site. The development site has been designed so that it does not impact on corridors. Existing vegetated corridors will be maintained with connectivity in all directions, allowing for the continued movement of species and genetic material across the landscape. Given that no corridors will be impacted, additional structures are not necessary.
Making provision for the demarcation, ecological restoration, rehabilitation and/or ongoing maintenance of retained native vegetation habitat on the development site.	Vegetation in the east of the subject site will be retained, enhanced and maintained.	Vegetation to be retained in the subject site (to the south of the development site), will be enhanced and maintained as part of weed removal works.

Approach	How addressed	Justification
Efforts to avoid and minimise impacts through design must be documented and justified	The project has been designed to reduce the clearing footprint of the project.	The placement of the development site footprint has been strategically designed to avoid high biodiversity value areas and utilises mainly cleared lands and degraded vegetation.

3.1.3 Prescribed biodiversity impacts

The list of potential prescribed biodiversity impacts as per the BAM is provided below:

- Occurrences of karst, caves, crevices and cliffs - none occur within the development site
- Occurrences of rock - no rock outcrops or scattered rocks occur within the development site
- Occurrences of human made structures and non-native vegetation – **Yes, see section below**.
- Hydrological processes that sustain and interact with the rivers, streams and wetlands – **Yes**, the headwaters to a first order Strahler stream is located in the south-west corner of the subject site (Figure 1).
- Proposed development for a wind farm and use by species as a flyway or migration route - the project does not involve any wind farm development.

The development site contains both human made structures and non-native vegetation. Additional information regarding consideration of human made structures is provided below. Non-native vegetation was identified and assessed for any potential to provide habitat for threatened flora and fauna species, including presence of HBTs. The development site contains hydrological processes as seen in Figure 1. The development site has the prescribed biodiversity impacts as outlined in Table 16.

A literature review was conducted to identify if buildings or structures that could potentially be utilised as a roosting resource by microchiropteran bats (microbats), resources such as relevant literature and BioNet records of the subject site and surrounding landscape were also utilised during the desktop review. Field surveys were conducted to visually determine if the buildings within the development site contain potential openings, possibly utilised by microbats. Possible threatened microbats surveyed for include:

- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail Bat)
- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
- *Miniopterus australis* (Little Bentwing-bat)
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat).

A historic dwelling was identified with two holes which may provide microbat access into the roof cavity. An anabat ultrasonic device was placed inside the roof cavity for three consecutive nights (9 – 11 November 2018) to determine the presence/absence of microbats and the type of species if present. A visual inspection was also conducted with a high-powered torch; however, this method has limitations due to the cryptic nature of microbats to hide in small cavities in the roof. The weather conditions during field surveys were optimal, mild with no rainfall (Table 15). The targeted surveys were conducted within the seasonal survey period for potential microbat species.

The recordings from the anabat device were analysed by ELA's fauna ecologist Rodney Armistead. No microbat species were recorded during the targeted surveys. It is unlikely that microbat species utilise this dwelling for roosting or breeding habitat.

Table 15: Weather conditions during anabat targeted survey

Date	Rainfall (mm)	Minimum temperature °C	Maximum temperature °C
9 November 2018	0	7.5	22.5
10 November 2018	0	15.3	23.2
11 November 2018	0	10.0	24.8

Sourced from Bureau of Meteorology station number 066124 Parramatta

Table 16: Prescribed biodiversity impacts

Prescribed biodiversity impact	Description in relation to the development site	Threatened species or ecological communities effected
Impacts of development on the habitat of threatened species or ecological communities associated with human made structures.	The development site contains a number of existing buildings. The majority of the buildings are recently constructed (within the last 20 years) and do not provide potential microbat roosts. There was one historic building present, however, targeted surveys did not record microbat roosting within the roof cavity.	Potential roosting habitat for threatened microbat *Saccolaimus flaviventris* (Yellow-bellied Sheath-tail Bat) and *Falsistrellus tasmaniensis* (Eastern False Pipistrelle), *Miniopterus australis* (Little Bentwing-bat) and *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat) although none were recorded during targeted surveys.
Impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation	The development site contains nectar producing non-native vegetation canopy, in formal gardens which will be removed as part of the proposed development. The development site contains non-native vegetation for common urban arboreal mammals (possums) which provides foraging opportunities for threatened nocturnal bird species. The development will result in a reduction in the extent of foraging habitat and reduction in availability of their prey items.	Potential foraging habitat for other threatened microbat species above non-native vegetation canopy. Potential foraging habitat for *Pteropus poliocephalus* (Grey-headed Flying Fox (GHFF). Potential foraging habitat for *Ninox strenua* (Powerful Owl).
Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range	The proposed development will require the removal of non-native vegetation from within the development site. The development will result in a minor reduction in the extent of existing non-native vegetation within the development site which provides stepping stone habitat between urban fragmented patches of vegetation.	Reduction in extent of potential foraging habitat for GHFF. Reduction in extent of potential habitat for Powerful Owl. Reduction in extent of foraging habitat for other threatened microbats.

Prescribed biodiversity impact	Description in relation to the development site	Threatened species or ecological communities effected
Impacts of development on movement of threatened species that maintains their lifecycle	The proposed development will result in reduction of vegetation within the development site and marginal loss of connectivity for mobile threatened species.	GHFF, Powerful Owl and microbat species.
Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining)	The proposed works is located upslope of the 1st order stream and may result in a decline of water quality.	The 1st order stream does not support water dependent threatened species or water dependent ecological communities. Sydney Turpentine Ironbark Forest TEC is located upslope of the 1st order stream and is not depend upon hydrological flows.

3.1.3.1 Locating a project to avoid and minimise prescribed biodiversity impacts

The development has been located in a way which avoids and minimises prescribed biodiversity impacts as outlined in Table 17.

Table 17: Locating a project to avoid and minimise prescribed biodiversity impacts

Approach	How addressed	Justification
Locating the envelope of surface works to avoid direct impacts on the habitat features	Habitat features including one HBT, foraging habitat for GHFF, Powerful Owl and threatened microbats within the development site will be removed.	The development has avoided impacts to large tracts of vegetation in the south which includes nectar producing native canopy species for GHFF, foraging habitat for Powerful Owl and microbat species. The development has been located in a way to avoid impact to ten HBTs and result in the removal of only one HBT. Targeted surveys have been conducted to ensure that the development will not result in the loss of roosting habitat for Yellow-bellied Sheathtailed Bat or other species which utilised man-made structures.
Locating the envelope of sub-surface works, both in the horizontal and vertical plane, to avoid and minimise operations beneath the habitat features, e.g. locating long wall panels away from geological features of significance or water dependent plant communities and their supporting aquifers	The development will involve the construction of underground carpark	The underground carpark is located in an existing cleared area which does not contain habitat features and is located more than 200 m from the 1st order stream.
Locating the project to avoid severing or interfering with corridors connecting different areas of habitat,	The development will involve the removal of some native and exotic	Although the development has result in the removal of some native and exotic vegetation along the eastern

Approach	How addressed	Justification
migratory flight paths to important habitat or preferred local movement pathways	vegetation which forms a connective corridor along the eastern perimeter.	perimeter, the connectivity will be retained through street verge plantings along the eastern perimeter (Mount Pleasant Avenue). Additionally, the impacts have utilised this area of planted native and exotic vegetation and retained the patch of TEC located along Osbourne Road along the western perimeter instead. The patch of vegetation along the western perimeter will ensure that connectivity is retained.
Optimising project layout to minimise interactions with threatened and protected species and ecological communities, e.g. designing turbine layout to allow buffers around features that attract and support aerial species, such as forest edges, riparian corridors and wetlands, ridgetops and gullies	The development has been strategically placed to avoid impacts to areas of high biodiversity value.	The development has utilised the northern portion of the subject site which includes cleared lands and exiting development footprint and vegetation of low biodiversity values and retained areas of high biodiversity values in the south of the subject site which includes areas of TEC of high quality (STIF).
Locating the project to avoid direct impacts on water bodies	The development has been strategically placed in the north of the subject site to avoid direct impacts to waterbodies located in the south.	The development site will not directly impact upon the 1st order stream located in the south-western corner of the subject site.

3.1.3.2 Designing a project to avoid and minimise prescribed biodiversity impacts

The development has been designed in a way which avoids and minimises prescribed biodiversity impacts as outlined in Table 18.

Table 18: Designing a project to avoid and minimise prescribed biodiversity impacts

Approach	How addressed	Justification
Design of project elements to minimise interactions with threatened and protected species and ecological communities, e.g. designing turbines to dissuade perching and minimise the diameter of the rotor swept area, designing fencing to prevent animal entry to transport corridors	The development design has retained TEC within the subject site and utilised areas with minimal impacts to biodiversity values.	The development design has utilised existing disturbed areas to minimise interactions with threatened species and minimised impacts to TECs located in the south of the subject site which will be retained under the project.
Design of the project to maintain hydrological processes that sustain threatened species and TECs	There are no threatened species and TECS which are depend upon hydrological processes.	The development design is located away from hydrological process and is not anticipated to alter the current hydrological flow regime of the unnamed 1st order stream located in the south-west corner of the subject site. There are no threatened species and TECs which are dependent upon hydrological processes identified

Approach	How addressed	Justification
		within the subject site or development site.
Design of the project to avoid and minimise downstream impacts on rivers, wetlands and estuaries by control of the quality of water released from the site.	The works are unlikely to alter the current hydrological flow of the unnamed 1st order stream.	The development design has been conducted so that hydrological flows will be captured on the sporting fields prior to entering the native vegetation located into the south of the subject site and into the 1st order stream.

3.2 Assessment of Impacts

3.2.1 Direct impacts

The direct impacts of the development on:

- native vegetation are outlined in Table 19
- threatened ecological communities are outlined in Table 20
- removal of one hollow-bearing tree
- prescribed biodiversity impacts are outlined in Section 3.2.2.

Direct impacts including the final project footprint (construction and operation) are shown on Figure 6.

Table 19: Direct impacts to native vegetation

PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Direct impact (ha)
1237	*Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion.*	North Coast Wet Sclerophyll Forests	Wet Sclerophyll Forests (Shrubby sub-formation)	0.46
1281	*Turpentine - Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion*	Northern Hinterland Wet Sclerophyll Forests	Wet Sclerophyll Forests (Grassy sub-formation)	0.09

Table 20: Direct impacts on threatened ecological communities

PCT ID	BC Act			EPBC Act		
	Listing status	Name	Direct impact (ha)	Listing status	Name	Direct impact (ha)
1237	CEEC	Blue Gum High Forest	0.002	N/A*	N/A*	N/A*
1281	EEC	Sydney Turpentine-Ironbark Forest	0.09	CEEC	Turpentine Ironbark Forest	0.09

* Note the PCT 1237 represented in the development site did not satisfy listing requirements under the EPBC Act criteria

3.2.2 Change in vegetation integrity

The change in vegetation integrity as a result of the development is outlined in Table 21.

Table 21: Change in vegetation integrity

Veg Zone	PCT ID	Condition	Area (ha)	Current vegetation integrity score	Future vegetation integrity score	Change in vegetation integrity
2	1237	Native planted	0.46	35.1	0	-35.1
4	1281	Weedy	0.09	39.7	0	-39.7

3.2.3 Indirect impacts

The indirect impacts of the development are outlined in Table 22.

Table 22: Indirect impacts

Indirect impact	Project phase	Nature	Extent	Frequency	Duration	Timing
sedimentation and contaminated and/or nutrient rich run-off	Construction	Runoff during construction works	Confined to development site with sediment fencing	During heavy rainfall or storm events	During rainfall events	Short-term impacts
noise, dust or light spill	Construction	Noise and dust created from machinery (no night works proposed therefore no light spill)	Noise and dust likely to carry beyond development site boundary	Daily, during construction works	Sporadic throughout construction period	Short-term impacts
inadvertent impacts on adjacent habitat or vegetation	Construction	Damage to adjacent habitat or vegetation	Adjacent vegetation	Daily, during construction works	Throughout construction period	Short-term impacts
transport of weeds and pathogens from the site to adjacent vegetation	Construction	Spread of weed seed or pathogens	Potential for spread into adjacent habitat	Daily, during construction works	Sporadic throughout construction period	Potentially long-term impacts
vehicle strike	Construction / operation	Potential for native fauna to be struck by working machinery and moving vehicles	Within access road and development site	Daily, during both construction and operational phases.	Throughout life of project	Short-term impacts
trampling of threatened flora species	Construction / operation	No threatened flora species present	N/A	N/A	N/A	N/A
rubbish dumping	Construction / operation	Illegal dumping by local residents/ construction crews	Potential for rubbish to spread via wind into adjacent vegetation	Potential to occur at any time throughout construction or operational phases	Throughout life of project	Short-term impacts
wood collection	Construction / operation	Removal of wood in vegetation located in the southern extent of the subject site	In southern portion of the subject site	Potential to occur at any time throughout construction or operational phases	Throughout life of project	Short-term impacts

Indirect impact	Project phase	Nature	Extent	Frequency	Duration	Timing
bush rock removal and disturbance	Construction / operation	Removal of rocks in southern vegetation within the subject site	In vegetation in the southern portion of the subject site	Potential to occur at any time throughout construction or operational phases	Throughout life of project	Short-term impacts
increase in predatory species populations	Construction / operation	Potential increase in domestic predatory species due to reduction of vegetation	In vegetation in the southern portion of the subject site	During operational phase	Potential at any point during operation of development	Short-term impacts
increase in pest animal populations	Construction / operation	Potential to increase if introduced	In vegetation in the southern portion of the subject site	Potential to occur at any time throughout construction or operational phases	Throughout life of project	Short-term impacts
increased risk of fire	Construction / operation	Potential due to presence of vegetation retained in the south of the subject site	In vegetation in the southern portion of the subject site	Potential to occur at any time, although, more likely during dry, windy conditions	Throughout life of project	Short-term and long-term impacts
disturbance to specialist breeding and foraging habitat, e.g. beach nesting for shorebirds.	Construction / operation	Runoff during construction works	Confined to development site with sediment fencing	During heavy rainfall or storm events	During rainfall events	Short-term impacts

3.2.4 Prescribed biodiversity impacts

An assessment of impacts of the development on prescribed biodiversity impacts is outlined in Table 23 in accordance with Section 9.2.1of the BAM.

Table 23: Direct impacts on prescribed biodiversity impacts

BAM Criteria	Justification
9.2.1.3 The assessment of the impacts of the development on the habitat of threatened species or ecological communities associated with human made structures	
a) identify the human made structures with potential to be habitat for threatened species or ecological communities	The development site is located within a highly urbanised area. The development will occur over a 30 year staged development. Stage 1 works will involve the demolition of three residential dwellings. The remaining Concept Plan will result in the removal of and redesign of a number of multistorey educational buildings which do not contain small gaps suitable for microbat access into the roof cavity. Only one of the residential dwellings contained potential access for microbats; no microbats were identified during targeted surveys or were considered likely to utilise the dwelling as potential roosting habitat. No other human made structures with potential habitat for threatened species or ecological communities were identified in the development site.
b) identify the species and ecological communities likely to use the habitat	The residential dwelling provides potential roosting habitat for a number of threatened microbat species including: *Saccolaimus flaviventris* (Yellow-bellied Sheathtail Bat) and *Falsistrellus tasmaniensis* (Eastern False Pipistrelle), *Miniopterus australis* (Little Bentwing-bat) and *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat). These species are known to occasionally roost in buildings. There are BioNet records for these species within a 5 km radius for these species. Targeted surveys did not record evidence of microbat activity within the building.
c) describe the nature, extent and duration of short and long-term impacts	The impact involves the permanent removal of three residential dwellings and several multistorey education facilities, of which only one residential dwelling provided potential roosting habitat for microbat species which may utilise it occasionally. The removal of this dwelling may result in a loss of potential roost habitat for microbat species, however, targeted survey did not record evidence of microbat regularly utilising this dwelling. As such these impacts are likely to be minor and alternative roost locations which may occur within the subject site are likely to be are used by microbats under these circumstances.
d) describe, with reference to relevant literature the importance within the bioregion of the habitat of these species or ecological communities	According to literature documented in Australian Bat (Churchill 2009) the preferred roosting habitat of the following species includes:

BAM Criteria	Justification
	• Yellow-bellied Sheathtail Bat – this species will utilise tree hollows or buildings in small groups. There is potential that this species may utilise the building and tree hollows recorded within the development site and within the subject site. • Eastern False Pipistrelle – this species primarily roosts in tree trunks in small groups, however it may occasionally utilise wooden buildings. It is unlikely this species would utilise buildings for maternity roosts due to the presence of hollow-bearing trees within the subject site. • Little Bentwing-bat – this species forms specific maternity roosts in caves. They occasionally utilise buildings in the absence of other alternative roost locations (such as mines, culverts). There is potential that this species may on occasion utilise the residential dwelling as an alternative roost location. • Eastern Bentwing-bat – this species primarily roosts in caves, however, it occasionally roosts in human made structures such as buildings. There is potential that this species may on occasion utilise the residential dwelling as an alternative roost location. Targeted surveys did not record evidence of microbat activity within the building.
e) predict the consequences of the impacts for the local and bioregional persistence of the suite of threatened species and communities likely to use these areas as habitat, with reference to relevant literature and other published sources of information.	While these species of microbats have been known to utilise human structures for roosting, preferred roosting habitat for these species are non-human made structures (tree hollows or caves). Additionally, only one of the species is likely to utilise buildings more regularly including breeding times, this species is the Yellow-bellied Sheathtailed Bat. The other species of microbats may utilise the residential dwelling on occasion while traversing through the landscape or if other alternative roosting resources are not present. It should be noted that the development site provides marginal foraging and alternative roosting habitat in the form of buildings for a number of microbat species. The development site does not contain important habitat for these species. There is potential that the removal of the residential building may impact upon the number of available roosting resources for microbats migrating to breeding or non-breeding habitats such as the two Bentwing species. There is no available literature which has considered the impacts of removal of human made structures on microbat species. The Priority Action Statement for the Yellow-bellied Sheathtail-bat lists several recommended actions for help in the recovery of this species, those pertaining to retention of roosting habitat focus on the retention of large hollow-bearing trees and retention of vegetated areas. The Priority Action Statement for the Little Bentwing Bat and Eastern Bentwing Bat include further investigation of the wintering roosts for these species which includes tree hollows and undertaking restoration activities to create habitat and connectivity in the landscape. There are no mention of the use of buildings for Bentwing Bat species. The habitat within the subject site is unlikely to be important for any of these microbat species.

BAM Criteria	Justification
9.2.1.4 The assessment of the impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation	
a) identify the species and ecological communities likely to use the habitat	Several non-native tree species are present in the development site which have been planted within residential gardens or are invasive weeds. Non-native species which have been identified as potential foraging species for Grey-headed Flying fox are *Syagrus romanzoffiana* (Cocos Palm), *Liquidambar styraciflua*, *Ligustrum lucidum* (Broad-leaved Privet) and *Ligustrum sinense* (Small-leaved Privet). Additionally, non-native vegetation may be utilised by arboreal mammals which comprise prey resources for Powerful Owl.
(b) describe the nature, extent and duration of short and long-term impact	The proposed development will result in the permanent removal of a small number of non-native trees (listed above) which provide potential foraging habitat for Grey-headed Flying-fox and marginal foraging habitat for the threatened microbat species and foraging habitat for Powerful Owl prey resources.
(c) describe, with reference to relevant literature and other reliable published sources of information, the importance within the bioregion of the habitat to these species or ecological communities	These non-native foraging species are in relatively low abundance within the development site and most species would provide only small amounts of secondary foraging habitat. Flowering resources in the form of native planted *Eucalyptus, Melaleuca* and *Callistemon* sp. would more likely be utilised for foraging resources by Grey-headed Flying-fox. *Syagrus romanzoffiana* is known to cause injury and death to flying-foxes due to toxicity of the green fruits and bats becoming entangles in the flower sheaths and frond leaves which can cause death, injury and distress. The removal of this species is therefore likely to be beneficial to the species.
(d) predict the consequences of the impacts for the local and bioregional persistence of the suite of threatened species and communities likely to use these areas as habitat, with reference to relevant literature and other published sources of information.	The consequences of the permanent removal of those species listed above for the local and bioregional persistence of the Grey-headed Flying-fox is predicted to be negligible. Several of the non-native species to be removed (*Syagrus romanzoffiana, Ligustrum sinense, Ligustrum lucidum)* are listed as environmental weeds in the Greater Sydney Regional Strategic Weed Management Plan (2017-2022). There is an abundance of similar habitat within the locality and bioregion, and an abundance of higher quality habitat in the locality and bioregion.
9.2.1.5 The assessment of the impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range must:	
(a) identify the area/s of connectivity joining different areas of habitat that intersect with the subject land and the areas of habitat that are connected according to Paragraph 4.2.1.3	The development site includes predominately disturbed and non-native species. To the south of the development is a large tract of native vegetation retained within the subject site. This area of vegetation connects to riparian corridor along Coups Creek which eventually flows into Lane Cove River and the National Park. To the north, the development site abuts a major arterial road, Pennant Hills Road, which intersects small patches of urban native/exotic vegetation. 500 m north of the development site lies vegetative tributaries to Waitara Creek which flows into Berowra Valley Regional Park.

BAM Criteria	Justification
	The vegetation within the development site is relatively small compared to the native vegetation retained within the subject site and the vegetation connected in the broader landscape. However, due to the presence of major roads, only highly mobile species are likely to utilise the vegetation within the development site.
(b) identify the species and ecological communities likely to benefit from the connectivity	The species most likely to utilise the connectivity would be Grey-headed Flying-fox, microbat species and disbursal of juvenile Powerful Owl. BGHF and STIF species are likely to benefit from the connectivity within the development site with adjacent riparian vegetation along Coups River riparian corridor to the south of the subject site.
(c) describe the nature, extent and duration of short and long-term impacts	The proposed development will result in the permanent removal of 0.47 ha of native and 4.78 ha of exotic vegetation which forms connecting habitat for highly mobile species. Connectivity will be retained within the subject site and in the adjacent broader locality.
(d) describe, with reference to relevant literature and other reliable published sources of information, the importance of the area of connectivity within the bioregion	The connectivity is considered limited except for highly mobile species which easily move across disturbed landscapes. The connecting habitat provides potential foraging habitat for the above listed species, which is part of a fragmented network of urban vegetation within the eastern suburbs. Within the Sydney Basin Bioregion, the removal of 0.47 ha of native and 4.78 ha of exotic vegetation is considered to provide negligible connectivity on a landscape scale. The removal of connecting habitat would not prevent the highly mobile Grey-headed Flying-fox, Powerful Owls or microbats from moving across the landscape in search of foraging resources. The removal of a small amount of connecting habitat from the development site is unlikely to be of importance to any threatened species within the bioregion considering the availability of connectivity retained within the subject site and immediately adjacent to the subject site.
(e) predict the consequences of the impacts for the bioregional persistence of the suite of threatened species and communities currently benefitting from the connectivity with reference to relevant literature and other published sources of information and taking into consideration mobility, abundance, range and other relevant life history factors.	The habitat to be removed forms part of a network or stepping stone habitat in the form of canopy, shrubs and ground layer garden plantings and native species. The vegetation connectivity flows from the south where large tracts of vegetation are retained and abruptly ends in along the northern boundary of the development site which is bounded by Pennant Hills Road. Only highly mobile species are likely to utilise the stepping stone vegetation from the development site north. Under the proposal, canopy species will be retained within the subject site to provide connectivity. The proposed development will not result in a loss of connectivity for the highly mobile species likely to utilise it. The impacts will result in the removal of some weeds to accommodate a bush chapel in areas mapped as TEC. It is likely that the weed removal works will benefit the STIF. The impacts will not result in a loss of connectivity of STIF from adjacent patches.

3.2.5 Mitigating and managing impacts

Measures proposed to mitigate and manage impacts at the development site before, during and after construction are outlined in Table 24.

Table 24: Measures proposed to mitigate and manage impacts

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
Displacement of resident fauna	Minor	Negligible	Pre-clearance survey of trees to be removed and identification/location of habitat trees by a suitably qualified ecologist. Supervision by a qualified ecologist/licensed wildlife handler during tree removal in accordance with best practise methods.	Resident fauna relocated in a sensitive manner	Prior to and during clearing works	Project Manager / Ecologist
Timing works to avoid critical life cycle events such as breeding or nursing	Minor	Negligible	Avoid clearing works in later winter/spring during breeding/nesting period for birds	Impacts to fauna during nesting/nursing avoided	During clearing works	Project Manager
Instigating clearing protocols including pre-clearing surveys, daily surveys and staged clearing, the presence of a trained ecological or licensed wildlife handler during clearing events	Moderate	Minor	Pre-clearance survey of trees to be removed and identification/location of habitat trees by a suitably qualified ecologist. Trees identified for retention should be clearly delineated as a 'No Go' zone with high visibility bunting. Supervision by a qualified ecologist/licensed wildlife handler during tree removal in accordance with best practise methods. Any tree removal is to be undertaken by a suitably qualified and insured arborist.	Any fauna utilising habitat within the development site will be identified and managed to ensure clearing works minimise the likelihood of injuring resident fauna	During clearing works	Project Manager / Ecologist
Installing artificial habitats for fauna in adjacent retained vegetation and habitat or human made structures to replace the habitat resources lost and encourage animals to move from the impacted site, e.g. nest boxes	Minor	Negligible	Any trees removed that have hollows/hollow trunks/fissures should be retained as ground fauna habitat and/or used as replacement hollows and attached to trees within the within the development site/subject site. If it is impractical to use salvaged hollows as replacement tree hollows, compensatory nest boxes should be installed within vegetation to be retained.	Replacement of habitat features removed	Prior to and during clearing works	Project Manager/ Ecologist

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
clearing protocols that identify vegetation to be retained, prevent inadvertent damage and reduce soil disturbance	Moderate	Minor	Vegetation identified for retention should be clearly delineated as a 'No Go' zone with high visibility bunting. No temporary facilities i.e. site offices/toilets/soil stockpiling is to occur within tree protection zone.	Vegetation to be retained outside of the development site boundary will not be disturbed/impacted	Demarcation of vegetation to be set up prior to any works occurring on site and to remain throughout duration of construction works	Project Manager
Sediment barriers or sedimentation ponds to control the quality of water released from the site into the receiving environment	Moderate	Minor	Appropriate controls are to be utilised to manage exposed soil surfaces and stockpiles to prevent sediment discharge into waterways. Soil and erosion measures such as sediment fencing, clean water diversion must be in place prior the commencement of the construction work.	Erosion and sedimentation will be controlled	For the duration of construction works	Project Manager
Programming construction activities to avoid impacts; for example, timing construction activities for when migratory species are absent from the site, or when particular species known to or likely to use the habitat on the site are not breeding or nesting	Minor	Negligible	Timing of construction works should be planned to occur outside of the winter/spring breeding season.	impacts to fauna during nesting/nursing avoided	During clearing works	Project Manager
Hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas	Moderate	Minor	Vehicles, machinery and building refuse should remain only within the development site and not impinge on the areas of retained native vegetation to be retained in the east. Weed management to be undertaken in retained bushland following construction works.	Spread of weeds prevented	Post-construction	Project Manager
Staff training and site briefing to communicate environmental	Minor	Negligible	Construction staff to be briefed prior to work commencing to be made aware of sensitive biodiversity values present and environmental procedures such as:	All staff entering the Development Site are fully aware of all the	To occur for all staff entering/working	Project Manager

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
features to be protected and measures to be implemented			• Importance of retained vegetation areas and 'No Go' zones • Site environmental procedures (vegetation management, sediment and erosion control, exclusion fencing and noxious weeds) • What to do in case of environmental emergency (chemical spills, fire, injured fauna) • Key contacts in case of environmental emergency	ecological values present within the Lot and environmental aspects relating to the development and know what to do in case of any environmental emergencies	at the development site. Site briefings should be updated based on phase of the work and when environmental issues become apparent.	
Development control measures to regulate activity in vegetation and habitat adjacent to residential development including controls on rubbish disposal, wood collection, fire management and disturbance to nests and other niche habitats	Minor	Negligible	Strategy to be developed and implemented as part of the residential development may include: • Signage to indicate areas not to be disturbed i.e. No Go zones • Rubbish disposal guidance • Prohibition of wood collection • Prohibition of bush rock removal • Controls on pet ownership such as prohibitions on allowing pets to roam beyond fenced areas	Strategy to protect vegetation and habitat adjacent to development	To be developed to provide awareness to residents of housing development.	Client
Making provision for the ecological restoration, rehabilitation and/or ongoing maintenance of retained native vegetation habitat on or adjacent to the development site	Minor	Negligible	Landscaping in the Development Site is to use locality derived native species and those found within the PCT present.	Areas within the development site will be landscaped using appropriate species	Throughout construction and following completion of construction activities.	Project Manager

3.2.6 Serious and Irreversible Impacts (SAII)

The development has two candidate entities for Serious and Irreversible Impacts (SAII) values as outlined in Table 25. Detailed consideration of whether impacts on candidate species are serious and irreversible is included for BGHF and STIF in Table 27 and Table 28.

Table 25: Candidate Serious and Irreversible Impacts

Species / Community	Common Name	Principle	Direct impact individuals / area (ha)	Threshold
Blue Gum High Forest in the Sydney Basin Bioregion	Blue Gum High Forest	Principals 1, 2 & 4	0.002 ha	Listed as 'under development' in BioNet
Sydney Turpentine-Ironbark Forest in the Sydney Basin Bioregion	Sydney Turpentine-Ironbark Forest	Principals 1, 2 & 4	0.09 ha	Not yet published

Table 26: Determining whether impacts are serious and irreversible

Determining whether impacts are serious and irreversible	Assessment
Principle 1	
Does the proposal impact on a species, population or ecological community that is a candidate entity because it is in a rapid rate of decline?	Yes
If yes, is the impact in excess of any threshold identified and therefore likely to be serious and irreversible? Note: where candidate entities have no listed threshold, any impact is considered likely to be serious and irreversible	The Thresholds for BGHF and STIF have not been published yet according to the Threatened Biodiversity Data Collection provided in OEH BioNet.
Principle 2	
Does the proposal impact on a species that is a candidate entity because it has been identified as having a very small population size?	No. The proposal will not impact upon threatened flora/fauna species which are a candidate entity species because it has been identified as having a small population size.
If yes, is the impact in excess of any threshold identified and therefore likely to be serious and irreversible? Note: where candidate entities have no listed threshold, any impact is considered likely to be serious and irreversible	N/A
Principle 3	
Does the proposal impact on the habitat of a species or an area of an ecological community that is a candidate entity because it has a very limited geographic distribution?	Yes
If yes, is the impact in excess of any threshold identified and therefore likely to be serious and irreversible? Note: where candidate entities have no listed threshold, any impact is considered likely to be serious and irreversible.	The Thresholds for BGHF and STIF have not been published yet according to the Threatened Biodiversity Data Collection provided in OEH BioNet.
Principle 4	
	Yes

Determining whether impacts are serious and irreversible	Assessment
Does the proposal impact on a species, a component of species habitat or an ecological community that is a candidate entity because it is irreplaceable?	
If yes, is the impact in excess of any threshold identified and therefore likely to be serious and irreversible? Note: where candidate entities have no listed threshold, any impact is considered likely to be serious and irreversible.	The Thresholds for BGHF and STIF have not been published yet according to the Threatened Biodiversity Data Collection provided in OEH BioNet.

Table 27: Evaluation of an impact on a TEC – Blue Gum High Forest

Impact Assessment Provisions	Assessment
1. The area and condition of the TEC to be impacted directly and indirectly by the proposed development	The development will remove 0.002 ha BGHF which is in a degraded condition. The BGHF impacted within the development site is represented by an isolated, single tree (*Eucalyptus pilularis*) in a landscaped garden. The works will result in the removal of outer branches to accommodate a new building structure. The tree will be retained within the subject site.
2. The extent and overall condition of the TEC within an area of 1500 metres, and then 5000 metres, surrounding the proposed development footprint. In the case of strategic biodiversity certification projects, the extent and overall condition of the TEC may be assessed across the IBRA sub region	Within the subject site, 0.46 ha of BGHF will be retained. In addition to what has been mapped within the subject site, there is an estimated 61.66 ha of BGHF within an area of 1,500m, in varying condition (from large tracts to small patches) (mapped by SMCMA, 2016). The removal of 0.002 ha of BGHF within the development site represents 0.003% of the mapped BGHF extent within the 1,500 m radius. Within 5,000 m radius of the development site, there is an estimated 369.57 ha of BGHF that has been mapped with low disturbance condition. The removal of 0.0005 ha of BGHF from within the development site, represents 0.02% of the mapped BGHF extent within the 5,000 m radius.
3. An estimate of the extant area and overall condition of the TEC remaining before and after the impact of the proposed development has been taken into consideration	The development will not result in the overall decline of the condition of BGHF after development.
4. The development proposal's impact on:	
a. Abiotic factors critical to the long-term survival of the TEC; for example, will the impact lead to a reduction of groundwater levels or substantial alteration of surface water patterns; will it alter natural disturbance regimes that the TEC depends upon, e.g. fire, flooding etc.?	The development will not impact abiotic factors critical to the long-term survival of the TEC.
b. Characteristic and functionally important species through impacts such as, but not limited to, inappropriate fire/flooding regimes, removal of under-storey species or harvesting of plants	The development will not impact characteristic and functionally important species outside of the proposed impact area.
c. The quality and integrity of an occurrence of the TEC through threats and indirect impacts including, but not limited to, assisting invasive flora and fauna species to become established or causing regular mobilisation of	The development proposal has the potential to impact upon the health of the isolated *Eucalyptus pilularis* which will remain within the subject site. The development proposal has potential to assist in the spread of invasive species into the patch of BGHF that will be retained within the subject site. These potential impacts will be controlled during the

Impact Assessment Provisions	Assessment
fertilisers, herbicides or other chemicals or pollutants which may harm or inhibit growth of species in the TEC	construction phase and long-term maintenance of the Subject site. These works will retain the quality and integrity of the isolated patch of BGHF.
5. Direct or indirect fragmentation and isolation of an area of the TEC	The development will not result in an increase in the direct or indirect fragmentation or isolation of any areas of BGHF. The impacts occur on an already isolated fragment patch of BGHF. Furthermore, the works will involve pruning of vegetation mapped as BGHF rather than removal of vegetation.
6. The measures proposed to contribute to the recovery of the TEC in the IBRA subregion.	In its current form, the proposed development does not contribute to the recovery of this TEC in the IBRA subregion.

Table 28: Evaluation of an impact on a TEC Sydney Turpentine Ironbark Forest

Impact Assessment Provisions	Assessment
1. the area and condition of the TEC to be impacted directly and indirectly by the proposed development	The development will remove 0.09 ha STIF which is in a degraded, weedy condition. The STIF impacted within the development site is represented by a dominate layer of exotic weeds in the midstorey and ground layer which will be strategically removed for the placement of outdoor seating for the bush chapel. The canopy layer will remain intact and will not be impacted by the proposed bush chapel development.
2. the extent and overall condition of the TEC within an area of 1500 metres, and then 5000 metres, surrounding the proposed development footprint. In the case of strategic biodiversity certification projects, the extent and overall condition of the TEC may be assessed across the IBRA sub region	Within the subject site, 4.12 ha of STIF will be retained. In addition to what has been mapped within the subject site, there is an estimated 75.87 ha of STIF within an area of 1,500m, in varying condition (from large tracts to small patches) (mapped by SMCMA, 2016). The removal of 0.09 ha of STIF within the development site represents 0.12 % of the mapped STIF extent within the 1,500 m radius. Within 5,000 m radius of the development site, there is an estimated 361.71 ha of STIF that has been mapped with low disturbance condition. The removal of 0.09 ha of STIF from within the development site, represents 0.02 % of the mapped STIF extent within the 5,000 m radius.
3. An estimate of the extant area and overall condition of the TEC remaining before and after the impact of the proposed development has been taken into consideration	The development will not result in the overall decline of the condition of STIF after development.
4. the development proposal's impact on:	
a. abiotic factors critical to the long-term survival of the TEC; for example, will the impact lead to a reduction of groundwater levels or substantial alteration of surface water patterns; will it alter natural disturbance regimes that the TEC depends upon, e.g. fire, flooding etc.?	The development proposal will not impact abiotic factors critical to the long-term survival of the TEC as the proposal will only result in the removal of exotic weeds and will not impact upon native vegetation of the installation of the bush chapel.

Impact Assessment Provisions	Assessment
b. characteristic and functionally important species through impacts such as, but not limited to, inappropriate fire/flooding regimes, removal of under-storey species or harvesting of plants	The development will not impact characteristic and functionally important species outside of the proposed impact area.
c. the quality and integrity of an occurrence of the TEC through threats and indirect impacts including, but not limited to, assisting invasive flora and fauna species to become established or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants which may harm or inhibit growth of species in the TEC	The development proposal is located within an area of significant weed infestation which will be removed during the proposed works. The proposed development works have potential to remove or trample regeneration of native vegetation following weed removal. The proposed development works have potential to result in the introduction of new weed plumes into the subject site. These potential impacts will be controlled during the construction phase and long-term maintenance of the subject site. These works will retain the quality and integrity of the isolated patch of STIF.
5. direct or indirect fragmentation and isolation of an area of the TEC	The development will not result in an increase in the direct or indirect fragmentation or isolation of any areas of STIF. The impacts occur within a large patch of STIF which is contiguous with other patches of STIF. The proposed development will not result in isolation or fragment patch of STIF within the subject site.
6. the measures proposed to contribute to the recovery of the TEC in the IBRA subregion.	In its current form, the proposed development does not contribute to the recovery of this TEC in the IBRA subregion.

3.3 Risk assessment

A risk assessment has been undertaken for any residual impacts likely to remain after the mitigation measures (Section Table 24) have been applied. Likelihood criteria, consequence criteria and the risk matrix are provided in Table 29, Table 30 and Table 31 respectively. The risk assessment is provided in Table 32.

Table 29: Likelihood criteria

Likelihood criteria	Description
Almost certain (Common)	Will occur, or is of a continuous nature, or the likelihood is unknown. There is likely to be an event at least once a year or greater (up to ten times per year). It often occurs in similar environments. The event is expected to occur in most circumstances.
Likely (Has occurred in recent history)	There is likely to be an event on average everyone to five years. Likely to have been a similar incident occurring in similar environments. The event will probably occur in most circumstances.
Possible (Could happen, has occurred in the past, but not common)	The event could occur. There is likely to be an event on average every five to twenty years.
Unlikely (Not likely or uncommon)	The event could occur but is not expected. A rare occurrence (once per one hundred years).

Likelihood criteria	Description
Remote (Rare or practically impossible)	The event may occur only in exceptional circumstances. Very rare occurrence (once per one thousand years). Unlikely that it has occurred elsewhere; and, if it has occurred, it is regarded as unique.

Table 30: Consequence criteria

Consequence category	Description
Critical (Severe, widespread long-term effect)	Destruction of sensitive environmental features. Severe impact on ecosystem. Impacts are irreversible and/or widespread. Regulatory and high-level government intervention/action. Community outrage expected. Prosecution likely.
Major (Wider spread, moderate to long term effect)	Long-term impact of regional significance on sensitive environmental features (e.g. wetlands). Likely to result in regulatory intervention/action. Environmental harm either temporary or permanent, requiring immediate attention. Community outrage possible. Prosecution possible.
Moderate (Localised, short-term to moderate effect)	Short term impact on sensitive environmental features. Triggers regulatory investigation. Significant changes that may be rehabilitated with difficulty. Repeated public concern.
Minor (Localised short-term effect)	Impact on fauna, flora and/or habitat but no negative effects on ecosystem. Easily rehabilitated. Requires immediate regulator notification.
Negligible (Minimal impact or no lasting effect)	Negligible impact on fauna/flora, habitat, aquatic ecosystem or water resources. Impacts are local, temporary and reversible. Incident reporting according to routine protocols.

Table 31: Risk matrix

Consequence	Likelihood				
	Almost certain	Likely	Possible	Unlikely	Remote
Critical	Very High	Very High	High	High	Medium
Major	Very High	High	High	Medium	Medium
Moderate	High	Medium	Medium	Medium	Low
Minor	Medium	Medium	Low	Low	Very Low
Negligible	Medium	Low	Low	Very Low	Very Low

Table 32: Risk assessment

Potential impact	Project phase	Risk (pre-mitigation)	Risk (post mitigation)
Vegetation clearing	Construction / operation	Medium	Low
sedimentation and contaminated and/or nutrient rich run-off	Construction	Medium	Low

Potential impact	Project phase	Risk (pre-mitigation)	Risk (post mitigation)
noise, dust or light spill	Construction	Low	Very Low
inadvertent impacts on adjacent habitat or vegetation	Construction	Medium	Low
transport of weeds and pathogens from the site to adjacent vegetation	Construction	Medium	Low
vehicle strike	Construction / operation	Low	Very Low
trampling of threatened flora species	Construction / operation	Low	Very Low
rubbish dumping	Construction / operation	Low	Very Low
wood collection	Construction / operation	Low	Very Low
bush rock removal and disturbance	Construction / operation	Medium	Low
increase in predatory species populations	Construction / operation	Low	Very Low
increase in pest animal populations	Construction / operation	Low	Very low
increased risk of fire	Construction / operation	Medium	Low
disturbance to specialist breeding and foraging habitat, e.g. beach nesting for shorebirds.	Construction / operation	Medium	Low
sedimentation and contaminated and/or nutrient rich run-off	Construction	Low	Very Low

3.4 Adaptive management strategy

This section is required for those impacts that are infrequent, cumulative or difficult to predict. Impacts associated with the proposed development have been considered and addressed **Section 3.2.5** and no further impacts are required to be addressed.

Figure 6: Final project footprint including construction and operation

3.5 Impact summary

Following implementation of the BAM and the BAMC, the following impacts have been determined.

3.5.1 Serious and Irreversible Impacts (SAII)

The development has candidate Serious and Irreversible Impacts (SAII) values as outlined in Table 25 and shown on Figure 7. Detailed consideration of whether impacts on candidate species are serious and irreversible is included in Table 26 and on TECs are included in Table 27 and Table 28.

The development includes two candidates for Serious and Irreversible Impacts (SAII), BGHF and STIF. The threshold for both of these SAIIs has yet to be published by OEH, it cannot be determined with certainty if the proposed development will have a SAII. Only a small amount of (0.002 ha) of BGHF will be removed, this equates to the removal of the outer branches of a remnant *Eucalyptus pilularis* present within the subject site. Additionally, 0.09 ha of STIF in weedy low condition will be impacted.

Table 33: Serious and Irreversible Impacts Summary

Species / Community	Common Name	Principle	Direct impact individuals / area (ha)	Summary
Blue Gum High Forest (BGHF)	Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion.	Principals 1, 2 & 4	0.002	The thresholds for BGHF have not been published by OEH. The proposed development is unlikely to result in a SAII on BGHF
Sydney Turpentine-Ironbark Forest (STIF)	Turpentine - Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion	Principals 1, 2 & 4	0.09	The thresholds for STIF have not been published by OEH. The impacts of the proposed development is unlikely to result in a SAII on STIF

3.5.2 Impacts requiring offsets

The impacts of the development requiring offset for native vegetation are outlined in Table 34 and shown on Figure 8. .

Table 34: Impacts to native vegetation that require offsets

Veg Zone	PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Direct impact (ha)
2	1237	Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion.	North Coast Wet Sclerophyll Forests	Wet Sclerophyll Forests (Shrubby sub-formation)	0.46
4	1281	Turpentine - Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion	Northern Hinterland Wet Sclerophyll Forests	Wet Sclerophyll Forests (Grassy sub-formation)	0.09

3.5.3 Areas not requiring assessment

Areas not requiring assessment include existing buildings, recreational areas (sporting fields), carparks, paths and exotic vegetation. The development site contained build/cleared area or exotic vegetation (4.78 ha) including areas classified as 'Urban Exotics' and shown in Figure 3. These areas were not consistent with any listed PCT, nor did they contain any threatened species, hence further assessment under the BAM was not required. Areas not requiring assessment are shown on Figure 9.

3.5.4 Credit summary

The number of ecosystem credits required for the development are outlined in Table 35. A total of ten (10) ecosystem credits are required for impacts to PCT 1237 and two (2) ecosystem credits for PCT 1281. No candidate species credit species or likely habitat was recorded within the development site; hence no species credits are required to offset the development. A biodiversity credit report is included in Appendix F:.

Table 35: Ecosystem credits required

PCT ID	PCT Name	Vegetation Formation	Direct impact (ha)	Credits required
1237	Sydney Blue Gum – Blackbutt – Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney	Wet Sclerophyll Forests (Shrubby sub-formation)	0.46	10
1281	Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion	Wet Sclerophyll Forests (Grassy sub-formation)	0.09	2

3.6 Consistency with legislation and policy

Additional matters relating to impacts on flora and fauna which are not covered by the BC Act must also be addressed for the proposed development. Potential "Matters of National Environmental Significance" (MNES) in accordance with the EPBC Act have been addressed in Section 3.6.1. Matters relating to Hornsby Council planning instruments have been addressed in Section 3.6.2.

3.6.1 *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

The EPBC Act establishes a process for assessing the environmental impact of activities and developments where "Matters of National Environmental Significance" (MNES) may be affected. Under the Act, any action which "has, will have, or is likely to have a significant impact on a matter of MNES" is defined as a "controlled action", and requires approval from the Commonwealth Department of the Environment (DotE), which is responsible for administering the EPBC Act (DotE 2014).

The process includes conducting an Assessment of Significance for listed threatened species and ecological communities that represent a matter of MNES that will be impacted as a result of the proposed action. Significant impact guidelines (DotE 2014) that outline a number of criteria have been developed by the Commonwealth, to provide assistance in conducting the Assessment of Significance and help decide whether or not a referral to the Commonwealth is required.

A habitat assessment and Likelihood of Occurrence was completed and one MNES Pteropus poliocephalus (Grey-headed Flying-fox) was assessed under the act (Table 36).

Pteropus poliocephalus (Grey-headed Flying-fox)

The Grey-headed Flying-fox (GHFF) is listed as a Vulnerable species under the EPBC Act.

This species utilises a wide variety of habitats (including disturbed areas) for foraging and have been recorded travelling long distances on feeding forays. Fruits and flowering plants of a wide variety of species are the main food source. The species roosts in large 'camps' of up to 200 000 individuals. Camps are usually formed close to water and along gullies, however, the species has been known to form camps in urban areas (DECCW 2009).

The Gordon Grey-headed Flying-fox camp is known from the locality to be within 8 km of the development site (OEH 2017b). The vegetation within the development site provides potential foraging habitat. It is considered likely that this species would use the site on occasion for foraging purposes. According to the National Flying-fox Monitoring Program, no GHFF camps currently occur or have been recorded within the development site (DotE 2018).

Table 36: EPBC Act of Significance for *Pteropus poliocephalus* (Grey-headed Flying-fox)

Criterion	Assessment
Criterion a: lead to a long-term decrease in the size of an important population of a species	The Matters of National Environmental Significance Impact Guidelines 1.1 (Commonwealth of Australia, 2013) defines an important population as a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are: • Key source populations either for breeding or dispersal • Populations that are necessary for maintaining genetic diversity, and/or • Populations that are near the limit of the species range No important populations have been recorded within the development site. The site does not support key source populations for breeding or dispersal, populations necessary for maintaining genetic diversity, or populations near the limit of the species range. According to the National Flying-fox Monitoring Program, no GHFF camps currently occur or have ever been recorded within the development site (DotE 2018). The nearest active GHFF camp occurs approximately 8 km to the south-east of the development site, within Gordon (DotE 2018).
Criterion b: reduce the area of occupancy of an important population	No important populations have been recorded within the development site. Therefore, the proposed works would not reduce the area of occupancy of an important population.
Criterion c: fragment an existing important population into two or more populations	No important populations have been recorded within the development site. The potential foraging habitat to be removed is marginal relative to adjacent potential habitat within the region. Whilst the potential foraging habitat may contribute as a 'stepping stone' for this highly mobile species to other more substantial foraging habitat sites, this function is unlikely to be significantly inhibited by the proposed works. Furthermore, this species has been recorded in urban environments and is likely to continue to forage adjacent to the site and across the broader locality.
Criterion d: adversely affect habitat critical to the survival of a species	Less than half of the potential foraging habitat in canopy trees within the subject site will be removed by the proposal. These individual trees represent a negligible amount of potential foraging resources in the locality. Potential foraging habitat will persist in close proximity to the development site, within the remaining subject site and in large stands of high quality intact native vegetation in Coups Creek riparian corridor adjacent to the Subject site and in the Lane

Criterion	Assessment
	Cove River National Park (approximately 2 km NE from the Development Site). Given that this species is highly mobile (traveling up to 50 km to forage), it is considered unlikely that the works would adversely affect habitat critical to the survival of this species
e: disrupt the breeding cycle of an important population	According to the National Flying-fox Monitoring Program, no GHFF camps currently occur or have ever been recorded within the development site (DotE 2018). The nearest active GHFF camp occurs approximately 8 km to the north-east of the development site, within Gordon (DotE 2018). Thus, no important population of GHFF occurs within the development site, and the proposed works is unlikely to disrupt the breeding cycle of an important population.
Criterion f: Adversely affect habitat critical to the survival of a species; modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The potential foraging habitat to be removed is marginal and of low quality. Given the small amount of potential foraging habitat to be removed, that potential foraging habitat will persist adjacent to the development site and across the locality, and that this species is highly mobile, it is unlikely that the habitat to be removed would cause the species to decline. Furthermore, according to the National Flying-fox Monitoring Program, no GHFF camps currently occur or have ever been recorded within the development site (DotE 2018). The nearest active GHFF camp occurs approximately 8 km to the north-east of the Development Site, within Gordon (DotE 2018). Therefore, no known GHFF roosting camps for this species will be impacted by the proposed works.
Criterion g: Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The proposed works will not result in the establishment of an invasive species that is harmful to GHFF.
Criterion h: Introduce disease that may cause the species to decline	The proposed works will not result in the introduction of a disease that is harmful to the GHFF.
Criterion i: Interfere substantially with the recovery of the species	Considering the above factors, the proposed works will not interfere substantially with the recovery of the species.
Conclusion	In consideration of the above, the proposed works are considered unlikely to have a significant impact on the GHFF.

3.6.2 Hornsby Council Local Environmental Plan 2013 (HLEP)

The HLEP has identified that the subject site contains land identified as 'Biodiversity' as mapped by the HLEP Terrestrial Biodiversity Map (Figure 1).

Clause 6.4 of the HLEP provides provisions for the protection of lands identified as 'Terrestrial Biodiversity'. Development within this area must avoid any significant adverse environmental impact or minimise or mitigate the impact on the biodiversity. This section describes the consistency of the proposed development with clause 6.4. Clause 6.4 (3a) of the HELP states that Council must consider any potential adverse impacts from the proposed development on the matters listed in Table 37.

Table 37: Clause 6.4 of the HLEP

Condition	Response	Environmental impact
a) whether the development is likely to have:		
(i) any adverse impacts on the condition, ecological value and significance of the fauna and flora on the land; and	The proposal will impact on approximately 0.09 ha of the land mapped as 'Biodiversity' which has been identified as a TEC (STIF) in weedy condition. The works will include a bush chapel which links to a historical cemetery. The proposal will not result in a significant impact on any threatened flora or fauna species listed under environmental legislation. Although 0.09 ha of land mapped as 'Biodiversity' will be impacted, an additional 4.12 ha of vegetation will be retained within the subject site. The vast majority (>99%) of the area mapped as 'Biodiversity' will be retained within the subject site. The majority of the STIF vegetation to be retained within the Biodiversity layer is in better condition than that proposed to be impacted. Additionally, the vegetation removed comprise only weeds, with existing native species retained. Therefore, it is expected the proposal will impact positively on the TEC due to the removal of weeds.	Positive
(ii) any adverse impact on the importance of the vegetation on the land to the habitat and survival of native fauna; and	The vegetation within the development site is connected to a large tract of vegetation to the south which eventually extends into Lane Cove National Park. The 0.09 ha of vegetation mapped as 'Biodiversity' is currently highly infested with weeds and has marginal potential to be habitat for threatened species. The proposal will not impact on the vegetation that is likely to be significant for threatened flora and fauna species. The 0.09 ha of land mapped as 'Biodiversity' does not contain any hollow bearing trees and it is unlikely to significantly impact habitat for threatened species. The proposal will improve the condition of the existing vegetation, therefore having a positive impact on threatened flora and fauna within the surrounding area.	Positive
(iii) any potential to fragment, disturb or diminish the biodiversity structure, function and composition of the land; and	The vegetation within the development site is connected to a large tract of vegetation to the south which eventually extends into Lane Cove National Park. The proposed works will not result in a loss of biodiversity structure or function or composition of the land such that the vegetation condition is reduced or species assemblage is diminished. Furthermore, the proposal will not fragment the vegetation.	Positive
(iv) any adverse impacts on the habitat elements providing connectivity on the land; and	The vegetation within the development site and subject site is well connected to a much larger vegetation patch within the surrounding landscape which is also connected to a number of national parks and the vegetation associated with Berowra Valley Regional Park and Lane Cove National Park. The proposal will not fragment the vegetation and will not significantly impact on the vegetation's ability to act as a habitat corridor.	Neutral
(b) any proposed measures to avoid, minimise or mitigate the impacts of the development.	The proposed development has utilised existing development footprint, cleared areas, planted vegetation and low condition TEC and retained areas of higher quality TEC.	Neutral

3.7 Offset options

There are a number of options that can be utilised to offset the required ecosystem credits. These include retiring matching biodiversity credits either through establishing a Biodiversity Stewardship Agreement (offset) on land owned by Loreto Normanhurst (i.e. to the onsite bushland), through purchasing matching credits on the open market, making a payment to the Biodiversity Conservation Trust, or funding biodiversity actions for individual species or communities. However, this last option has some limitations. Due to the small scale of the project, it is likely that making a payment to the Biodiversity Conservation Trust will be the preferred option to retire credits for this redevelopment.

Figure 7: Serious and Irreversible Impacts

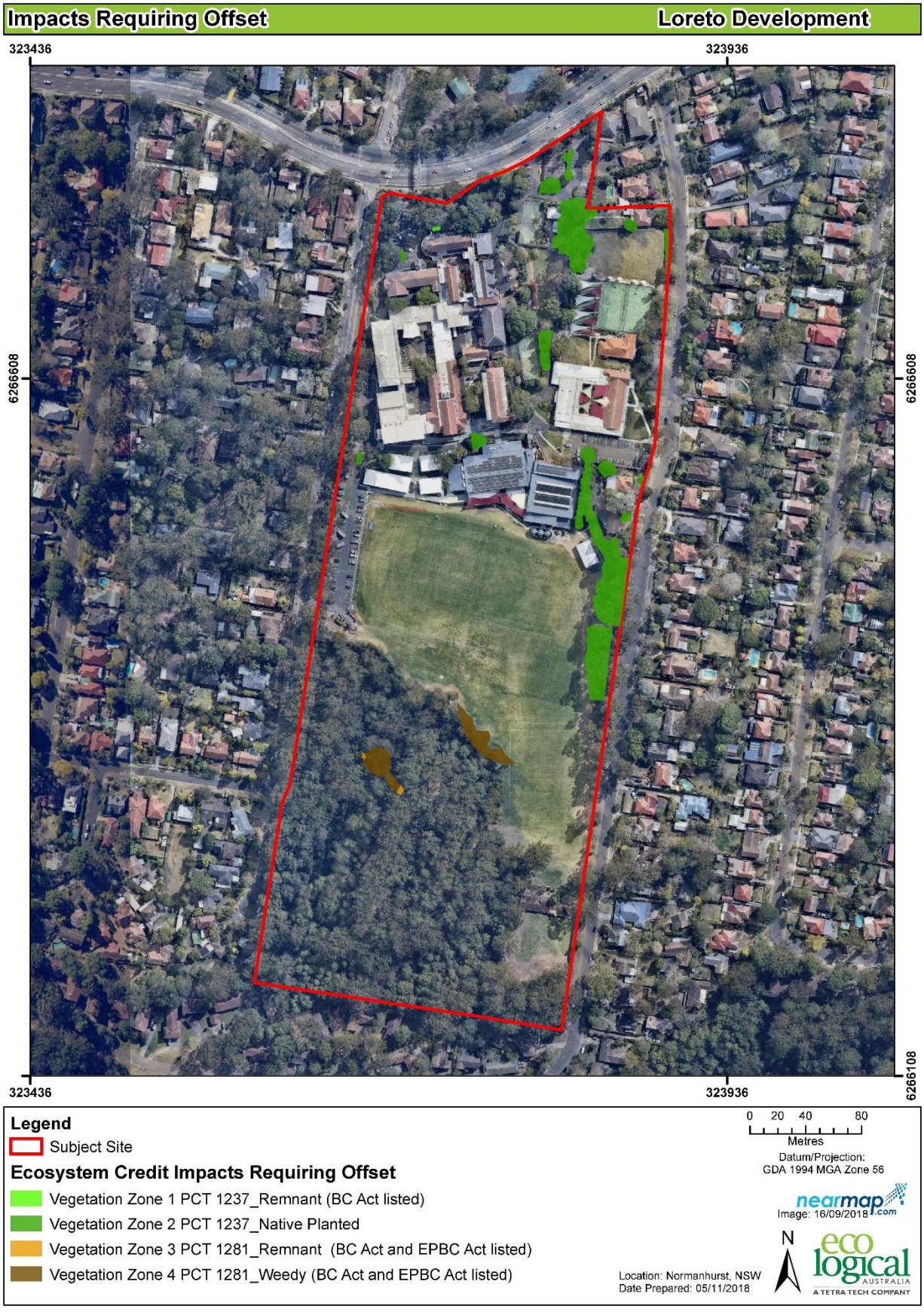

Figure 8: Impacts requiring offset

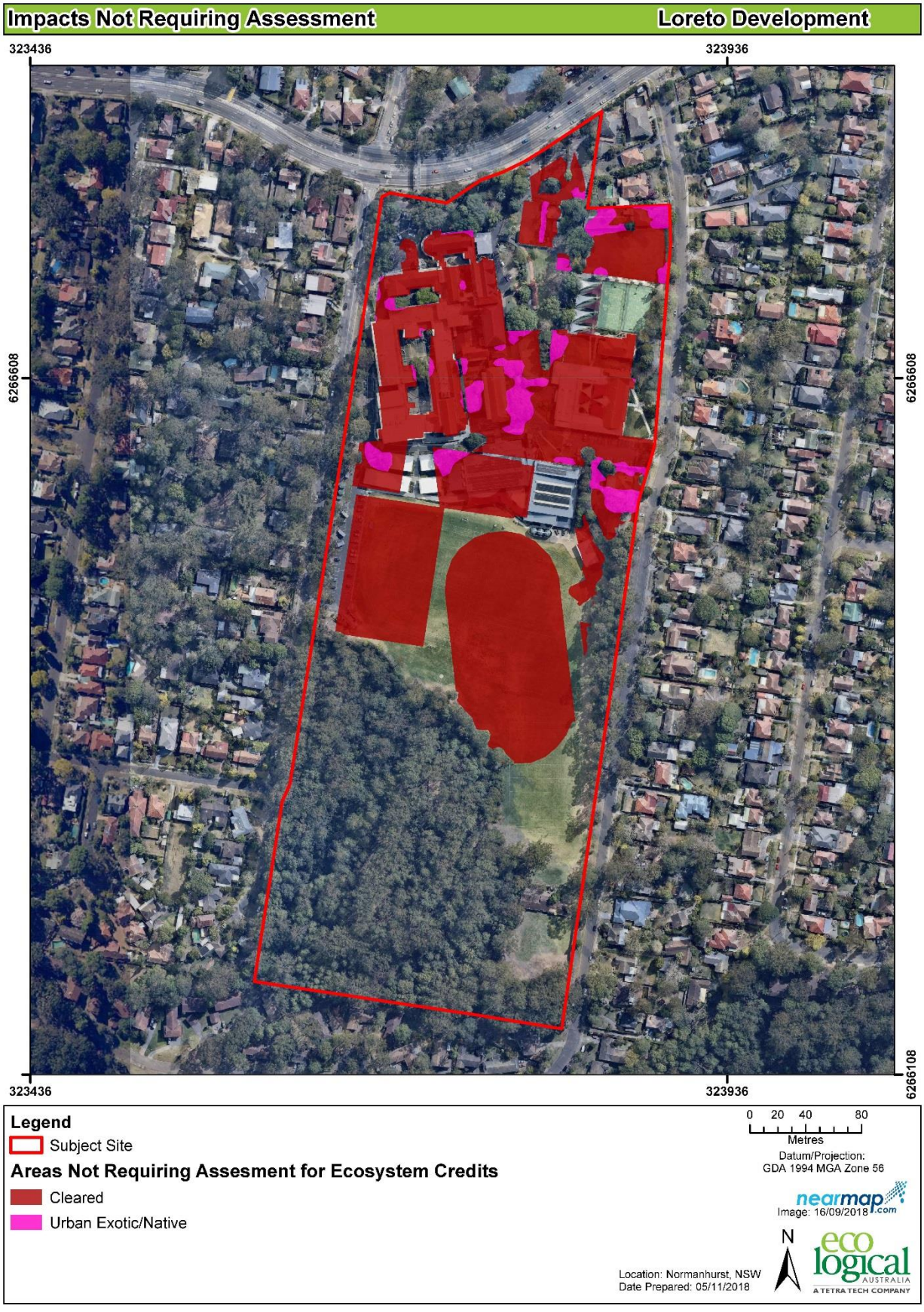

Figure 9: Areas not requiring assessment

Plate 1: Impacts not requiring assessment

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Appendix A: Definitions

Terminology	Definition
Biodiversity credit report	The report produced by the Credit Calculator that sets out the number and class of biodiversity credits required to offset the remaining adverse impacts on biodiversity values at a development site, or on land to be biodiversity certified, or that sets out the number and class of biodiversity credits that are created at a biodiversity stewardship site.
BioNet Atlas	The BioNet Atlas (formerly known as the NSW Wildlife Atlas) is the OEH database of flora and fauna records. The Atlas contains records of plants, mammals, birds, reptiles, amphibians, some fungi, some invertebrates (such as insects and snails) and some fish
Broad condition state:	Areas of the same PCT that are in relatively homogenous condition. Broad condition is used for stratifying areas of the same PCT into a vegetation zone for the purpose of determining the vegetation integrity score.
Connectivity	The measure of the degree to which an area(s) of native vegetation is linked with other areas of vegetation.
Credit Calculator	The computer program that provides decision support to assessors and proponents by applying the BAM, and which calculates the number and class of biodiversity credits required to offset the impacts of a development or created at a biodiversity stewardship site.
Development	Has the same meaning as development at section 4 of the EP&A Act, or an activity in Part 5 of the EP&A Act. It also includes development as defined in section 115T of the EP&A Act.
Development footprint	The area of land that is directly impacted on by a proposed development, including access roads, and areas used to store construction materials.
Development site	An area of land that is subject to a proposed development that is under the EP&A Act.
Ecosystem credits	A measurement of the value of EECs, CEECs and threatened species habitat for species that can be reliably predicted to occur with a PCT. Ecosystem credits measure the loss in biodiversity values at a development site and the gain in biodiversity values at a biodiversity stewardship site.
High threat exotic plant cover	Plant cover composed of vascular plants not native to Australia that if not controlled will invade and outcompete native plant species.
Hollow bearing tree	A living or dead tree that has at least one hollow. A tree is considered to contain a hollow if: (a) the entrance can be seen; (b) the minimum entrance width is at least 5 cm; (c) the hollow appears to have depth (i.e. you cannot see solid wood beyond the entrance); (d) the hollow is at least 1 m above the ground. Trees must be examined from all angles.
Important wetland	A wetland that is listed in the Directory of Important Wetlands of Australia (DIWA) and SEPP 14 Coastal Wetlands
Linear shaped development	Development that is generally narrow in width and extends across the landscape for a distance greater than 3.5 kilometres in length
Local population	The population that occurs in the study area. In cases where multiple populations occur in the study area or a population occupies part of the study area, impacts on each subpopulation must be assessed separately.
Local wetland	Any wetland that is not identified as an important wetland (refer to definition of Important wetland).
Mitchell landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000.

Terminology	Definition
Multiple fragmentation impact development	Developments such as wind farms and coal seam gas extraction that require multiple extraction points (wells) or turbines and a network of associated development including roads, tracks, gathering systems/flow lines, transmission lines
Operational Manual	The Operational Manual published from time to time by OEH, which is a guide to assist assessors when using the BAM
Patch size	An area of intact native vegetation that: a) occurs on the development site or biodiversity stewardship site, and b) includes native vegetation that has a gap of less than 100 m from the next area of native vegetation (or ≤30 m for non-woody ecosystems). Patch size may extend onto adjoining land that is not part of the development site or stewardship site.
Proponent	A person who intends to apply for consent to carry out development or for approval for an activity.
Reference sites	The relatively unmodified sites that are assessed to obtain local benchmark information when benchmarks in the Vegetation Benchmarks Database are too broad or otherwise incorrect for the PCT and/or local situation. Benchmarks can also be obtained from published sources.
Regeneration	The proportion of over-storey species characteristic of the PCT that are naturally regenerating and have a diameter at breast height <5 cm within a vegetation zone.
Remaining impact	An impact on biodiversity values after all reasonable measures have been taken to avoid and minimise the impacts of development. Under the BAM, an offset requirement is calculated for the remaining impacts on biodiversity values.
Retirement of credits	The purchase and retirement of biodiversity credits from an already-established biobank site or a biodiversity stewardship site secured by a biodiversity stewardship agreement.
Riparian buffer	Riparian buffers applied to water bodies in accordance with the BAM
Sensitive biodiversity values land map	Development within an area identified on the map requires assessment using the BAM.
Site attributes	The matters assessed to determine vegetation integrity. They include: native plant species richness, native over-storey cover, native mid-storey cover, native ground cover (grasses), native ground cover (shrubs), native ground cover (other), exotic plant cover (as a percentage of total ground and mid-storey cover), number of trees with hollows, proportion of over-storey species occurring as regeneration, and total length of fallen logs.
Site-based development	a development other than a linear shaped development, or a multiple fragmentation impact development
Species credits	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection.
Subject land	Is land to which the BAM is applied in Stage 1 to assess the biodiversity values of the land. It includes land that may be a development site, clearing site, proposed for biodiversity certification or land that is proposed for a biodiversity stewardship agreement.
Threatened Biodiversity Data Collection	Part of the BioNet database, published by OEH and accessible from the BioNet website.
Threatened species	Critically Endangered, Endangered or Vulnerable threatened species as defined by Schedule 1 of the BC Act, or any additional threatened species listed under Part 13 of the EPBC Act as Critically Endangered, Endangered or Vulnerable.

Terminology	Definition
Vegetation Benchmarks Database	A database of benchmarks for vegetation classes and some PCTs. The Vegetation Benchmarks Database is published by OEH and is part of the BioNet Vegetation Classification.
Vegetation zone	A relatively homogenous area of native vegetation on a development site, land to be biodiversity certified or a biodiversity stewardship site that is the same PCT and broad condition state.
Wetland	An area of land that is wet by surface water or ground water, or both, for long enough periods that the plants and animals in it are adapted to, and depend on, moist conditions for at least part of their life cycle. Wetlands may exhibit wet and dry phases and may be wet permanently, cyclically or intermittently with fresh, brackish or saline water
Woody native vegetation	Native vegetation that contains an over-storey and/or mid-storey that predominantly consists of trees and/or shrubs

Appendix B: Vegetation plot data

Table 38: Species matrix (species recorded by plot)

Stratum	Form	Species name	Exotic (*)	High Threat Weed*	Cover (%) Plot 1	Cover (%) Plot 2	Cover (%) Plot 4	Cover (%) Plot 5**
G	Shrub (SG)	*Acacia falcata*		0	0.1			
G	Shrub (SG)	*Acacia linifolia*		0	1			
M	Tree (TG)	*Acacia parramattensis*		0	8			
G	0	*Agapanthus spp.*	*	0	20	20		
M	Tree (TG)	*Allocasuarina torulosa*		0	5			
U	Tree (TG)	*Angophora costata*		0			5	10
U	Tree (TG)	*Angophora floribunda*		0			1	
G	0	*Anigozanthos sp.*	*	0	0.1			
G	0	*Aristea ecklonii*	*	0				0.1
G	0	*Asparagus aethiopicus*	*	1	10	0.1	0.1	
G	0	*Bidens pilosa*	*	1	0.1			
M	Shrub (SG)	*Breynia oblongifolia*		0			0.1	
M	Shrub (SG)	*Callistemon sp.*		0		10		5
M	Shrub (SG)	*Callistemon sp.*		0	10			
G	Forb (FG)	*Centella asiatica*		0			0.1	
U	0	*Cinnamomum camphora*	*	1			5	
U	Tree (TG)	*Corymbia eximia*		0	10			
U	Tree (TG)	*Corymbia maculata*		0	15			
M	0	*Cotoneaster spp.*	*	1			0.1	
G	Grass & grasslike (GG)	*Cynodon dactylon*		0	0.1	0.5		
G	Forb (FG)	*Dianella caerulea*		0			0.1	
G	Forb (FG)	*Dianella sp.*		0	0.1	0.1		
G	0	*Ehrharta erecta*	*	1	5	0.1	0.1	11
U	Shrub (SG)	*Elaeocarpus reticulatus*		0			1	
G	Grass & grasslike (GG)	*Entolasia marginata*		0	0.1		1	
U	Tree (TG)	*Eucalyptus punctata*		0			10	20
U	Tree (TG)	*Eucalyptus resinifera*		0			5	

Stratum	Form	Species name	Exotic (*)	High Threat Weed*	Cover (%) Plot 1	Cover (%) Plot 2	Cover (%) Plot 4	Cover (%) Plot 5**
U	Tree (TG)	*Eucalyptus saligna*		0	10		15	15
G	0	*Euphorbia cyathophora*	*	0				0.1
G	Other (OG)	*Eustrephus latifolius*		0			0.1	
U	Tree (TG)	*Ficus macrophylla*		0		20		15
U	Tree (TG)	*Ficus rubiginosa*		0		20		
M	0	*Genista monspessulana*	*	1	0.1	0.1		
G	Other (OG)	*Glycine clandestina*		0			0.1	
M	Shrub (SG)	*Grevillea sp.*		0	1			
M	Shrub (SG)	*Grevillea juniperina*		0	11			
M	Tree (TG)	*Grevillea robusta*		0	1			
G	0	*Hedera helix*	*	1	0.1			
G	0	*Hyparrhenia hirta*	*	1	0.1			
M	0	*Jacaranda mimosifolia*	*	0	1	15		
M	0	*Lantana camara*	*	1			5	
G	Grass & grasslike (GG)	*Lepidosperma laterale*		0			5	
M	Shrub (SG)	*Leptospermum polygalifolium*		0	5			
M	0	*Ligustrum lucidum*	*	1			1	
M	0	*Ligustrum sinense*	*	1			30	
M	0	*Lilium formosanum*	*	0			0.1	
M	Shrub (SG)	*Lissanthe strigosa*		0			5	
G	Grass & grasslike (GG)	*Lomandra longifolia*		0	0.1	0.1		
G	0	*Lonicera japonica*	*	1			2	
U	Tree (TG)	*Lophostemon confertus*		0		15		
M	Shrub (SG)	*Melaleuca styphelioides*		0	2			
G	Other (OG)	*Morinda jasminoides*		0			0.1	
M	0	*Morus alba*	*	0	1	1		
M	0	*Ochna serrulata*	*	1	0.5		0.1	
G	0	*Olea europaea*	*	1	0.1		0.1	
M	0	*Olea europaea*	*	1			0.1	
G	Grass & grasslike (GG)	*Oplismenus aemulus*		0	0.01		2	

Stratum	Form	Species name	Exotic (*)	High Threat Weed*	Cover (%) Plot 1	Cover (%) Plot 2	Cover (%) Plot 4	Cover (%) Plot 5**
G	Forb (FG)	*Oxalis spp.*		0				0.1
G	0	*Pennisetum clandestinum*	*	1	0.1			
M	0	*Phoenix spp.*	*	0	0.1	0.1		
M	0	*Phyllostachys aurea*	*	1		0.1		
G	0	*Phyllostachys aurea*	*	1	0.1			
M	Shrub (SG)	*Pittosporum undulatum*		0	0.1		5	
G	0	*Plantago lanceolata*	*	0	0.1			
G	Forb (FG)	*Pratia purpurascens*		0			0.1	
G	Forb (FG)	*Pseuderanthemum variabile*		0			0.1	
G	Fern (EG)	*Pteridium esculentum*		0			5	
G	Shrub (SG)	*Rubus sp.*	*	0			1	
M	0	*Sida rhombifolia*	*	0	0.1			
G	0	*Sonchus asper*	*	0	0.1			
G	0	*Stenotaphrum secundatum*	*	1		1		
G	0	*Strelitzia spp.*	*	0			0.1	
U	Tree (TG)	*Syncarpia glomulifera*		0			20	10
G	Forb (FG)	*Veronica plebeia*		0		0.1		

Tree (TG), Shrub (SG), Grass & Grasslike (GG), Forb (FG), Fern (EG), Other (OG)
* 0 = not a High Threat Weed. 1= High Threat Weed
** note Plot 5 was not used in the credit calculator

Table 39: Vegetation integrity data (Composition, Structure and function)

Plot location data							
Plot no.	PCT	Vegetation Zone	Condition	Zone	Eastings	Northings	Bearing
1	1237	2	Degraded	56	323829	6266693	140
2	1237	2	Degraded	56	323824	6266693	0
4	1281	4	Degraded	56	0323675	6266287	200
5**	1237	2	Degraded	56	0323662	6266580	30

* Note, plot 3 was not used.

** note plot 5 was not entered into the credit calculator

Composition (number of species)						
Plot no.	Tree	Shrub	Grass	Forb	Fern	Other
1	7	8	4	1	0	0
2	3	1	2	2	0	0
4	6	5	3	4	1	3
5*	5	1	0	1	0	0

* note this plot was not used in the credit calculator

Structure (Total cover)						
Plot no.	Tree	Shrub	Grass	Forb	Fern	Other
1	49	30	<1	<1	0	0
2	55	10	1	<1	0	0
4	56	12	8	<1	5	0
5	70	5	0	<1	0	0

Function											
Plot no.	Large Trees	Hollow trees	Litter Cover	Length Fallen Logs	Tree Stem 5-9	Tree Stem 10-1 9	Tree Stem 20-2 9	Tree Stem 30-49	Tree Stem 50-79	Tree Regen	High Threat Weed Cover
1	0	0	65	0	0	1	1	1	1	0	16
2	2	1	60	0	1	1	0	0	0	0	1
4	0	0	84	0	1	1	1	1	1	0	44
5*	0	0	80	0	0	0	1	1	0	0	11

Appendix C: Photos

Plate 2. Plot 1. Left start. Right end.

Plate 3: Plot 2: Left start. Right end

Plate 4: Plot 3 Left start, Right end

Plate 5: Plot 4 Left start, Right end

Appendix D: Other species recorded

Botanic Name	Common Name	High Threat Exotics	WoNS	Exotic/ Native	Study area	Bushland
Acacia baileyana	Cootamundra wattle			E	x	
Acacia decurrens	Black Wattle			N	x	
Acacia implexa				N	x	
Acacia linifolia	White Wattle			N	x	
Acacia myrtifolia	Red-stemmed Wattle			N		X
Acacia parramattensis	Parramatta Wattle			N	x	
Acacia ulicifolia	Prickly Moses			N		X
Acer negundo		Other		E	x	
Adiantum aethiopicum	Common Maidenhair			N		X
Agapanthus praecox	African Lily			E	x	
Allocasuarina torulosa	Forest Oak			N	x	X
Angophora costata	Sydney Red Gum			N		X
Angophora floribunda	Apple			N		X
Anredera cordifolia	Madeira Vine	State - AP		E	x	
Araucaria heterophylla	Norfolk Island Pine			N-Pl	x	
Araujia sericifera	Moth vine, Moth plant	Other			x	
Aristida vagans	Threeawn Speargrass			N		X
Arundo donax	Giant Reed	Regional - AP		E		X
Asparagus aethiopicus	Asparagus fern	State - AP	Y	E	x	X
Asparagus asparagoides	Bridal Creeper	State - AP	Y	E		X
Banksia oblongifolia	Fern-leaved Banksia			N-Pl		X
Bidens pilosa	Cobblers Pegs			E	x	
Blechnum cartilagineum	Gristle Fern			N		X
Brachychiton acerifolius	Flame Tree			N-Pl	x	
Breynia oblongifolia	Coffee Bush			N	x	X
Bromus catharticus	Prairie Grass			E	x	

Botanic Name	Common Name	High Threat Exotics	WoNS	Exotic/ Native	Study area	Bushland
Bursaria spinosa	Blackthorn			N - PL		X
Callistemon sp.				N-Pl	x	X
Camellia sp.				E	x	
Cassytha pubescens				N		X
Casuarina glauca	Swamp Oak			N-Pl	x	
Cenchrus clandestinus	Kikuyu	Other		E	x	
Centella asiatica	Indian Pennywort			N	x	X
Cinnamomum camphora	Camphor Laurel	Other		E	x	X
Clematis aristata	Old Man's Beard			N		X
Conyza bonariensis	Flaxleaf Fleabane			E	x	X
Corymbia maculata	Spotted Gum			N-Pl	x	
Cryptostylis sp.				N		X
Cupressus sp.				E	x	
Cyathea australis	Black Tree-fern			N	x	
Cyathochaeta diandra				N		X
Cynodon dactylon	Couch			E	x	
Desmodium varians				N		X
Dianella caerulea				N	x	X
Dichondra repens	Kidney Weed			N		X
Dodonaea triquetra	Large-leaf Hop-bush			N	x	
Doryanthes excelsa	Gymea Lily			N-Pl	x	
Echinopogon caespitosus	Bushy Hedgehog-grass			N		X
Ehrharta erecta	Panic Veldtgrass			E		X
Elaeocarpus reticulatus	Blueberry Ash			N	x	X
Entolasia marginata	Bordered Panic			N	x	X
Entolasia stricta	Wiry Panic			N		X
Eragrostis curvula	African Lovegrass	Other		E	x	
Erythrina sp.	Coral Tree	Other		E	x	
Eucalyptus grandis	Flooded Gum			N-Pl	x	
Eucalyptus fibrosa	Broad-leaved Ironbark			N		X
Eucalyptus haemastoma	Scribbly Gum			N-Pl	x	
Eucalyptus paniculata	Grey Ironbark			N		X

Botanic Name	Common Name	High Threat Exotics	WoNS	Exotic/ Native	Study area	Bushland
Eucalyptus pilularis	Blackbutt			N	x	X
Eucalyptus punctata	Grey Gum			N	x	X
Eucalyptus resinifera	Red Mahogany			N		X
Eucalyptus saligna	Sydney blue gum			N	x	X
Eucalyptus scias	Large-fruited Red Mahogany			N	x	
Eucalyptus scoparia	White Gum			N-Pl	x	
Eucalyptus sideroxylon	Mugga Ironbark			N- Pl	x	
Eustrephus latifolius	Wombat Berry			N		X
Ficus macrophylla	Moreton Bay Fig			N- Pl	x	
Ficus rubiginosa	Port Jackson Fig			N- Pl	x	
Gahnia aspera				N		X
Genista monspessulana	Montpellier Broom	State - AP		E	x	
Geranium homeanum				N		X
Gleditsia triacanthos	Honey Locust	Other		E	x	
Glycine microphylla				N		X
Glycine tabacina				N		X
Gonocarpus tetragynus				N		X
Grevillea juniperina				N-Pl	x	
Hakea sp.				N-Pl	x	
Hardenbergia violacea	Purple Coral Pea			N		X
Hibbertia aspera	Rough Guinea Flower			N		X
Hibbertia dentata	Trailing Guinea Flower			N		X
Homolanthus populifolius	Bleeding Heart			N		X
Hypochaeris radicata	Catsear			E	x	
Imperata cylindrica	Blady Grass			N	x	
Indigofera australis	Australian Indigo			N-Pl		X
Ipomoea indica	Morning Glory	Other		E		X
Jacaranda mimosifolia				E	x	
Kunzea ambigua	Tick Bush			N - Pl		X
Lagerstroemia archeriana	Crepe Myrtle			E	x	

Botanic Name	Common Name	High Threat Exotics	WoNS	Exotic/ Native	Study area	Bushland
Lagunaria patersonia	Norfolk Island Hibiscus			E	x	
Lantana camara	Lantana	State - AP	Y	E		X
Lasiopetalum ferrugineum				N		X
Lepidosperma laterale				N		X
Leptospermum polygalifolium				N		X
Leucopogon juniperinus	Prickly Beard-heath			N		X
Ligustrum lucidum	Large-leaved Privet	Other		E		X
Ligustrum sinense	Small-leaved Privet	Other		E		X
Lilium formosanum		Other		E		X
Lindsaea linearis	Screw Fern			N		X
Liquidambar styraciflua	Liquidambar			E	x	
Lissanthe strigosa	Native Peach			N		X
Livistona australis	Cabbage Tree Palm			N-Pl	x	
Lomandra longifolia	Spiny-headed Mat-rush			N-Pl	x	
Lomandra multiflora				N		X
Lomandra obliqua				N		X
Lonicera japonica	Japanese Honeysuckle	Other		N		X
Lophostemon confertus	Brush Box			N-Pl	x	
Malus sp.	Apple			E	x	
Mangifera indica	Mango Tree			E	x	
Melaleuca styphelioides	Prickly-leaved Tea Tree			N-Pl	x	
Micrantheum ericoides				N		X
Microlaena stipoides	Weeping Grass			N		X
Monstera deliciosa	Fruit Salad Plant			E		X
Morinda jasminoides	Sweet Morinda			N		X
Myrsine variabilis				N		X
Notelaea longifolia	Mock Olive			N		X
Ochna serrulata	Ochna	Other		E	X	X

Botanic Name	Common Name	High Threat Exotics	WoNS	Exotic/ Native	Study area	Bushland
Olea europaea subsp. *cuspidata*	African Olive	Regional - C		E		X
Opercularia hispida				N		X
Oplismenus aemulus	Australian Basket Grass			N	X	X
Oplismenus imbecillis	Creeping Beard Grass			N		X
Oxalis perennans				N		X
Ozothamnus diosmifolius	White Dogwood			N		X
Pandorea pandorana	Wonga Wonga Vine			N		X
Parsonsia straminea	Common Silkpod			N		X
Paspalum dilatatum	Paspalum			E	X	
Passiflora sp.				E		X
Persoonia linearis	Narrow-leaved Geebung			N		X
Phyllanthus hirtellus	Thyme Spurge			N		X
Pittosporum undulatum				N		X
Plantago debilis				N		X
Plantago lanceolata	Lamb's Tongues			E	X	
Platylobium formosum	Handsome Flat Pea			N		X
Plectranthus parviflorus	Cockspur Flower			N		X
Poa affinis				N		X
Polyscias sambucifolia	Elderberry Panax			N		X
Pratia purpurascens	Whiteroot			N		X
Prunus sp.	Plum Tree			E	X	
Pseuderanthemum variabile	Pastel Flower			N		X
Pteridium esculentum	Bracken			N		X
Rhododendron sp.				E	X	
Robinia pseudocacia	Golden Robinia			E	X	
Rubus fruticosus species aggregate		State - AP	Y	E	X	X
Rubus parvifolius	Native Raspberry			N		X
Senecio madagascariensis	Fireweed	State - AP			X	
Senna pendula	Cassia, Senna	Other			X	
Sida rhombifolia				E	X	
Smilax glyciphylla	Sweet Sarsaparilla			N		X
Solanum aviculare	Kangaroo Apple			N-Pl	X	
Solanum mauritianum	Wild Tobacco	Other		E		X
Strelitzia nicolai	Bird of Paradise			E	X	

Botanic Name	Common Name	High Threat Exotics	WoNS	Exotic/ Native	Study area	Bushland
Syggrus romanoffianum	Cocos Palm	Other		E	X	
Syncarpia glomulifera	Turpentine			N		X
Syzygium paniculatum	Magenta Cherry			N-Pl	X	
Tagetes minuta	Stinking Roger			E	X	
Themeda australis	Kangaroo Grass			N		X
Tradescantia fluminensis	Trad	Other		E		X
Veronica plebeia				N		X
Xanthorrhoea sp.				N		X
Zieria smithii	Sandfly Zieria			N		X

E – Exotic; N – Native. N-Pl = Native Planted.

Family	Common Name	Scientific Name	Observation
Artamidae	Australian Magpie	*Gymnorhina tibicen*	Observed
Artamidae	Grey Butcherbird	*Cracticus torquatus*	Observed
Artamidae	Pied Currawong	*Strepera graculina*	Heard
Cacatuidae	Sulphur-crested Cockatoo	*Cacatua galerita*	Observed
Corcoracidae	White-winged Chough	*Corcorax melanorhamphos*	Heard
Corvidae	Australian Raven	*Corvus coronoides*	Observed
Estrildidae	Red-browed Finch	*Neochmia temporalis*	Observed
Eupetidae	Eastern Whipbird	*Psophodes olivaceus*	Heard
Halcyonidae	Laughing Kookaburra	*Dacelo novaeguineae*	Observed
Meliphagidae	Lewin's Honeyeater	*Meliphaga lewinii*	Heard
Meliphagidae	Noisy Miner	*Manorina melanocephala*	Observed
Monarchidae	Magpie-lark	*Grallina cyanoleuca*	Observed
Psittacidae	Australian King Parrot	*Alisterus scapularis*	Heard
Psittacidae	Eastern Rosella	*Platycercus eximius*	Observed
Psittacidae	Rainbow Lorikeet	*Trichoglossus haematodus*	Observed
Psittaculidae	Musk Lorikeet	*Glossopsitta concinna*	Observed

Appendix E: Anabat results

There were no microbat records on the anabat from 9th – 12th November 2018. Therefore, there is no data to show here.

Appendix F: Biodiversity credit report

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00013237/BAAS18159/19/00013238	Loreto Concept Plan and Stage 1	04/01/2019
Assessor Name	**Report Created**	**BAM Data version ***
Belinda Jane Failes	11/01/2019	6
Assessor Number	* 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.	
BAAS18159		

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

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Candidate SAII	Ecosystem credits
Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion								
2	1237_native_planted	35.1	0.5	0.25	High Sensitivity to Potential Gain	2.50		10
							Subtotal	**10**

BAM Credit Summary Report

Turpentine - Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion								
1	1281_Weedy	39.7	0.1	0.25	High Sensitivity to Potential Gain	2.00	TRUE	2
							Subtotal	**2**
							Total	**12**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Candidate SAII	Species credits

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