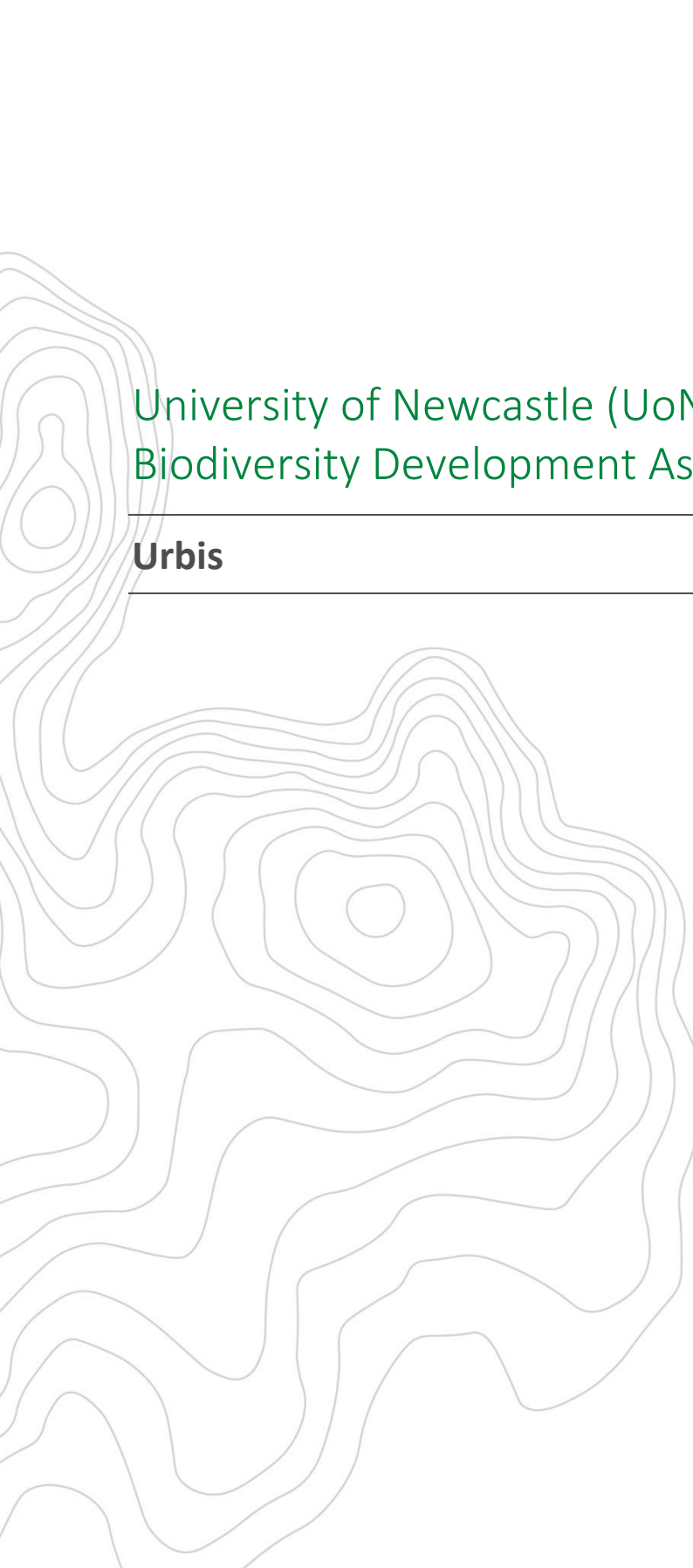


A stylized topographic map with green contour lines is positioned on the left side of the page, extending from the top to the bottom. The lines represent elevation and are more densely packed in some areas, creating a sense of depth and terrain.

University of Newcastle (UoN) STEMM Biodiversity Development Assessment Report

Urbis

DOCUMENT TRACKING

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Template 2.8.1

Executive Summary

Eco Logical Australia Pty Ltd (ELA) was engaged by Urbis on behalf of the University of Newcastle (UoN) to prepare a Biodiversity Development Assessment Report (BDAR) for the construction of a new STEMM building within the UoN Callaghan campus. This new building will provide new facilities and enhance existing sites to offer state-of-the-art research and teaching spaces to encourage and support the collaboration of industry and multidisciplinary education, learning and research. The Development Site comprises one Lot being Lot 1 DP1188100 owned by Newcastle University Campus.

The proposed development is considered State Significant Development (SSD) and therefore a BDAR is required to assess the vegetation clearing under the NSW *Biodiversity Conservation Act 2016* (BC Act). 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.

Prior to the proposed STEMM building construction activities, a series of Enabling Works relating to the relocation and augmentation of services (water, electricity, telecommunications, gas and road access) have been assessed. This has included the proposed establishment, removal, upgrade and / or diversion of existing utilities, as well as the demolition of the existing buildings and removal of the associated vegetation. These works can be carried out / are permissible without consent under Part 3 of the State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) and have been assessed separately to the STEMM works by way of a formal Ecological Assessment completed for incorporation into a REF document.

The Development Site is 1.6 ha in size and currently comprises of existing university buildings. The vegetation present within the Development Site comprises of a mixed remnant native and planted canopy, with landscaped areas using mainly native species planted in and around footpaths, paved recreational areas and roads which are regularly maintained and managed for aesthetics and amenity. One highly modified and disturbed Plant Community Type (PCT) is present being 1590 *Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest*. This PCT does not correspond to any Threatened Ecological Communities (TECs).

Due to the highly disturbed and modified nature of the Development Site, targeted surveys were not conducted for the majority of Species Credit Species. Targeted surveys were undertaken within the Development Site for *Petaurus norfolcensis* (Squirrel Glider) listed as Vulnerable under the BC Act. Meander surveys throughout the Development Site were conducted for conspicuous species and incidental/opportunistic data was collected for any threatened flora and fauna. Random meanders throughout the Development Site were undertaken and no threatened species habitat or individuals were recorded.

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). A total of 1 ecosystem credit is required for impacts to PCT 1590. No species credits are required.

One Matter of National Environmental Significance (MNES) was identified as potentially being adversely affected by the proposed works. The 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 as part of a larger home range. An assessment of the Commonwealth Significant Impact Criteria (Commonwealth of Australia 2013) was undertaken for the Grey-headed Flying-fox and concluded that the project would not have a significant impact on this species.

All impacts to MNES have been avoided as far as practicable and all impacts have been assessed in accordance with Commonwealth guidelines. Mitigation strategies have been put into place to manage potential impacts to MNES.

Contents

1. Stage 1: Biodiversity assessment.....	1
1.1 Introduction	1
1.1.1 General description of the Development Site	1
1.1.2 Legal description and ownership	1
1.1.3 Development Site footprint.....	1
1.1.4 Sources of information used.....	1
1.2 Legislative context	5
1.3 Landscape features	5
1.3.1 IBRA regions and subregions	5
1.3.2 Mitchell Landscapes.....	6
1.3.3 Rivers and streams.....	6
1.3.4 Wetlands.....	6
1.3.5 Connectivity features.....	6
1.3.6 Areas of geological significance and soil hazard features.....	6
1.3.7 Site context	7
1.4 Native vegetation.....	7
1.4.1 Survey effort	7
1.4.2 Plant Community Types present.....	7
1.4.3 Exotic vegetation zone.....	8
1.4.4 Vegetation integrity assessment	10
1.5 Threatened species	14
1.5.1 Ecosystem credit species	14
1.6 Species credit species	15
1.6.1 Targeted surveys.....	22
1.6.2 Use of local data	22
1.6.3 Expert reports	22
2. Stage 2: Impact assessment (biodiversity values)	23
2.1 Avoiding impacts.....	23
2.1.1 Locating a project to avoid and minimise impacts on vegetation and habitat.....	23
2.1.2 Designing a project to avoid and minimise impacts on vegetation and habitat	24
2.1.3 Prescribed biodiversity impacts.....	24
2.2 Assessment of Impacts.....	25
2.2.1 Direct impacts	25
2.2.2 Change in vegetation integrity.....	25
2.2.3 Indirect impacts	25
2.2.4 Prescribed biodiversity impacts.....	29
2.2.5 Mitigating and managing impacts	29
2.2.6 Serious and Irreversible Impacts (SAII)	33
2.3 Risk assessment	33

2.4 Adaptive management strategy.....	35
2.5 Impact summary	35
2.5.1 Serious and Irreversible Impacts (SAII)	35
2.5.2 Areas not requiring assessment	35
2.5.3 Impacts requiring offsets	35
2.5.4 Credit summary	35
2.6 Consistency with legislation and policy.....	39
2.6.1 <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act).....	39
2.7 Offset options	41
3. References	42
Appendix A: Definitions.....	43
Appendix B: Vegetation plot data	46
Appendix C: Plot Photos	48
Appendix D: Biodiversity credit report	50

List of Figures

Figure 1: Site Map.....	3
Figure 2: Location Map	4
Figure 3: Biometric Vegetation Plots and Survey effort.....	11
Figure 4: Plot locations	12
Figure 5: Plant Community Types and native vegetation extent	13
Figure 6: Direct impacts to PCT	28
Figure 7: Areas not requiring assessment	37
Figure 8: Impacts requiring offset	38

List of Tables

Table 1: Legislative context	5
Table 2: Mitchell Landscapes.....	6
Table 3: Full floristic and vegetation integrity plots	7
Table 4: Plant Community Types	8
Table 5: PCT selection justification.....	8
Table 6: Vegetation integrity	10
Table 7: Predicted ecosystem credit species.....	14
Table 8: Candidate species credit species	16
Table 9: Weather conditions	22
Table 10: Targeted threatened species survey effort	22
Table 11: Locating a project to avoid and minimise impacts on vegetation and habitat	23
Table 12: Designing a project to avoid and minimise impacts on vegetation and habitat	24
Table 13: Direct impacts to native vegetation	25

Table 14: Change in vegetation integrity	25
Table 15: Indirect impacts	26
Table 16: Measures proposed to mitigate and manage impacts	30
Table 17: Likelihood criteria	33
Table 18: Consequence criteria	33
Table 19: Risk matrix	34
Table 20: Risk assessment	34
Table 21: Impacts to native vegetation that require offsets	35
Table 22: Ecosystem credits required	36
Table 23: EPBC Act of Significance for <i>Pteropus poliocephalus</i> (Grey-headed Flying-fox)	39
Table 24: Species matrix (species recorded by plot)	46
Table 25: Vegetation integrity data (Composition, Structure and function)	47

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
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
GHFF	Grey-headed Flying-Fox
HBT	Hollow-bearing Tree
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

Abbreviation	Description
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
REF	Review of Environmental Factors
SEPP	State Environmental Planning Policy
TEC	Threatened Ecological Community
VIS	Vegetation Information System
WM Act	NSW Water Management Act 2000

1. Stage 1: Biodiversity assessment

1.1 Introduction

This Biodiversity Development Assessment Report (BDAR) has been prepared by Lily Gorrell, an accredited person (BAAS17101) under the NSW *Biodiversity Conservation Act 2016* (BC Act) and peer reviewed by Gordon Patrick (BAAS18171) who is also an accredited person under the BC Act.

This BDAR has been prepared to address the biodiversity impacts of the proposed upgrades to the University of Newcastle (UoN), Callaghan, NSW STEMM building (Lot 1 DP 1188100).

1.1.1 General description of the Development Site

The Development Site comprises of existing university buildings, access pathways and managed lawns and gardens. The University Ring Road borders the Development Site to the south, McMullin Lane to the east and pathways, buildings and open space to the north and west. A native canopy is present scattered throughout the Development Site dominated by *Corymbia maculata* (Spotted Gum) and *Eucalyptus fibrosa* (Red Ironbark)

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

1.1.2 Legal description and ownership

The Development Site comprises one Lot being Lot 1 DP1188100 owned by Newcastle University Campus. The Development Site has a site area of approximately 1.6 ha.

1.1.3 Development Site footprint

The Development Site currently comprises of existing university buildings. The construction of a new STEMM building within the University of Newcastle Callaghan campus is to provide new facilities and enhance existing sites to offer state-of-the-art research and teaching spaces to encourage and support the collaboration of industry and multidisciplinary education, learning and research.

The Development Site boundary (**Figure 1**) includes both the operational and construction footprint associated with all temporary construction facilities and infrastructure.

Prior to the proposed STEMM building construction activities, a series of Enabling Works relating to the relocation and augmentation of services (water, electricity, telecommunications, gas and road access) have been assessed. This has included the proposed establishment, removal, upgrade and / or diversion of existing utilities.

Prior to STEMM building construction activities, the UoN Enabling Works (which also includes the demolition of the existing buildings and removal of the associated vegetation), can be carried out / are permissible without consent under Part 3 of the State Environmental Planning Policy (Infrastructure) 2007 (ISEPP).

These enabling works have been assessed separately to the STEMM works by way of a formal Ecological Assessment completed for incorporation into an REF document.

1.1.4 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 2018a)
- *Environment Protection and Biodiversity Conservation Act 1999* EPBC Act Protected Matters Search Tool 5 km database search (DotE 2018)
- Eco Logical Australia 2019. *University of Newcastle STEMM project - Enabling Works Ecological Assessment*. Prepared for Urbis.
- ArborSafe 2019. *Arboricultural Impact Assessment – STEMM Building, University of Newcastle*. Prepared for Urbis
- Aerial mapping (SIXMaps)
- Additional GIS datasets including soil, topography, geology and drainage.

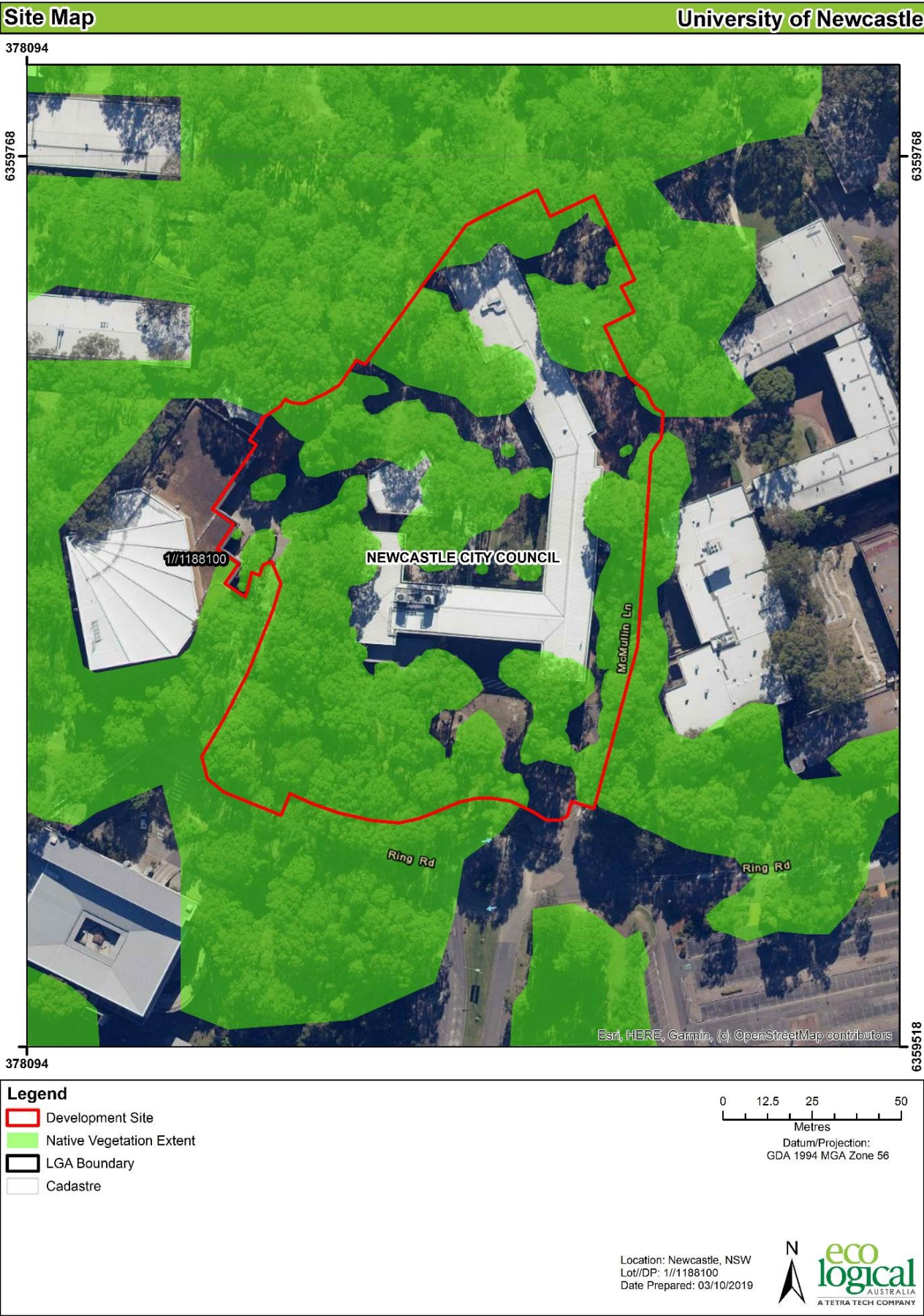


Figure 1: Site Map

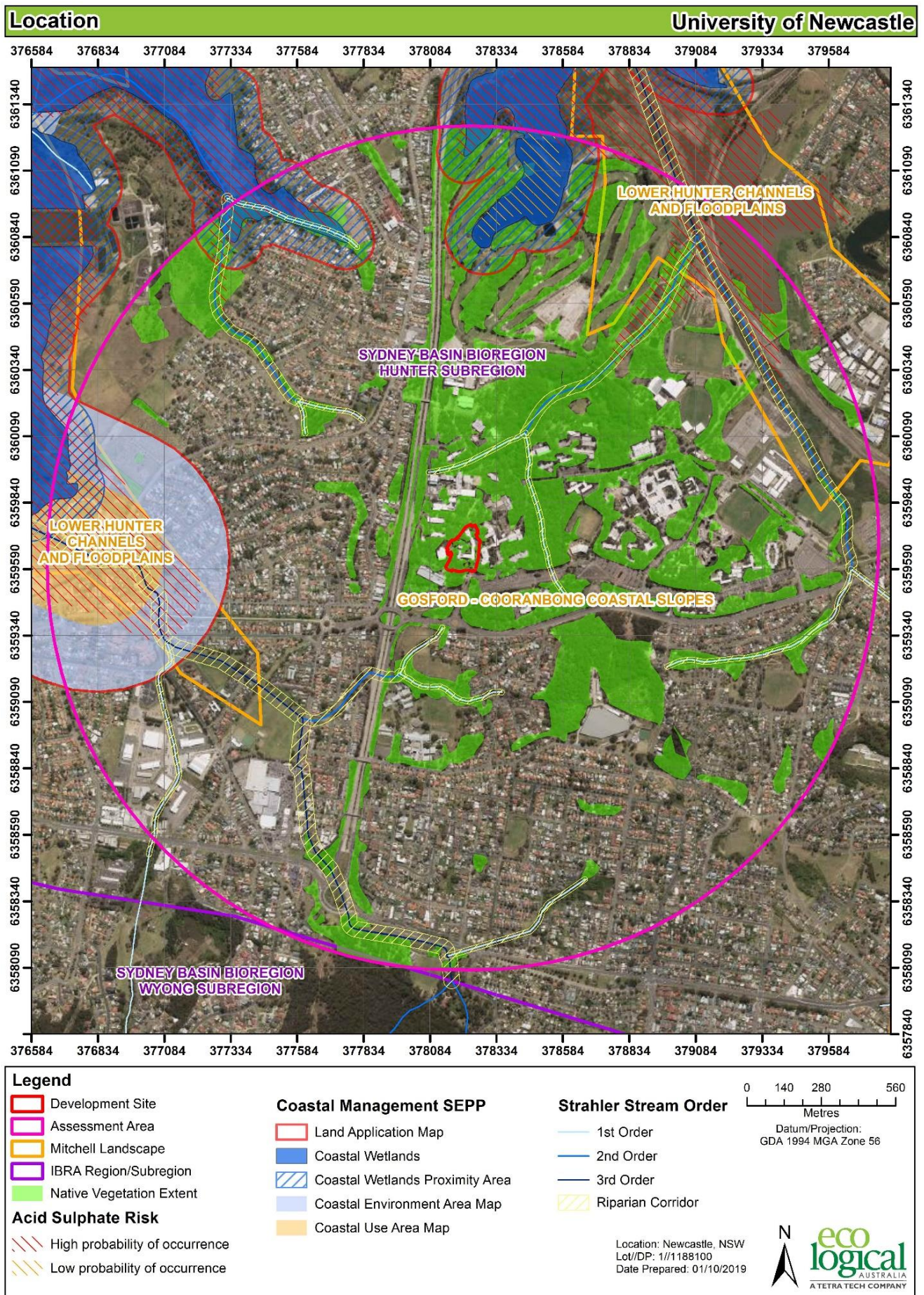


Figure 2: Location Map

1.2 Legislative context

Table 1: Legislative context

Name	Relevance to the project	Report Section
Commonwealth		
Environmental Protection and Biodiversity Conservation Act 1999	Matters of national Environmental Significance have not been identified on or near the Development Site. An assessment for the EPBC Act listed Vulnerable <i>Pteropus poliocephalus</i> (Grey-headed Flying-fox) was undertaken and not considered likely to impact this species.	Section 2.6.1
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 for this development.	N/A
Water Management Act 2000	The Development Site is situated on relatively flat / gently sloping ground and is not situated in close proximity to any mapped waterways. Therefore, a Controlled Activity Approval under s91 of the WM Act is not required.	N/A
Planning Instruments		
SEPP Coastal Management 2018	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
SEPP (Infrastructure) 2007	This SEPP relates to infrastructure or services augmentation / modification / renewal which are permissible without consent under Part 3 of the SEPP.	N/A
Newcastle Council Development Control Plan 2012 (NDCP)	Newcastle Development Control Plan (DCP) 2012, specifically Section 5.03 Vegetation Management and 5.03.07 Newcastle University Callaghan Campus applies to subject site / STEMM development site.	N/A

1.3 Landscape features

1.3.1 IBRA regions and subregions

The Development Site falls within the North Coast Basin Interim Biogeographic Regionalisation for Australia (IBRA) region and Karuah Manning subregion.

1.3.2 Mitchell Landscapes

The Development Site falls within Mitchell landscapes being Gosford – Cooranbong Coastal Slopes (DECC 2002) (**Table 2**).

Table 2: Mitchell Landscapes

Mitchell landscape	Description	Area within Development Site (ha)
Gosford – Cooranbong Coastal Slopes	Coastal fall of the Sydney Basin, rolling hills and sandstone plateau outliers of Triassic Narrabeen sandstones, extensive rock outcrop and low cliffs along ridge margins, general elevation 0 to 75m. Texture-contrast soils on lithic sandstones and shales. Loamy sand alluvium along creeks. Organic sand and mud in lagoons and swamps. Open forest and woodland of Smooth-barked Apple (<i>Angophora costata</i>), Red Bloodwood (<i>Corymbia gummifera</i>), Brown Stringybark (<i>Eucalyptus capitellata</i>), Sydney Peppermint (<i>Eucalyptus piperita</i>), Spotted Gum (<i>Corymbia maculata</i>), Bastard Mahogany (<i>Eucalyptus carnea</i>), Northern Grey Ironbark (<i>Eucalyptus siderophloia</i>) and Grey Gum (<i>Eucalyptus punctata</i>) on hills and slopes. Small areas of closed forest with; Turpentine (<i>Syncarpia glomulifera</i>)	1.6

1.3.3 Rivers and streams

The Development Site does not contain any rivers or streams as determined under the Strahler stream order classification.

1.3.4 Wetlands

The Development Site does not contain any wetlands.

1.3.5 Connectivity features

The Development Site contains the connectivity features shown in **Figure 2**. Very minimal narrow connections are present within the Development Site, adjoining to vegetation within adjacent land to the north and south.

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. Very minimal connectivity is present for less mobile species such as reptiles and mammals.

1.3.6 Areas of geological significance and soil hazard features

The Development Site does not contain areas of geological significance or soil hazard features. The Acid Sulphate Soils Risk mapping has been checked, and the Development Site has been mapped as having 'Low probability of Occurrence'.

The Contaminated Lands register has been checked and results did not identify any contaminated lands within proximity to the Development Site.

1.3.7 Site context

1.3.7.1 Method applied

The site based method has been applied to this development.

1.3.7.2 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 22 % (173 ha).

1.3.7.3 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.

1.4 Native vegetation

1.4.1 Survey effort

On the 10 September 2019 ELA Ecologist Lily Gorrell undertook a survey of the Development Site. Survey included a walkover of the site to assess habitat suitability and completion of two full-floristic and vegetation integrity plots (BAM plots) (**Figure 3; Figure 4 and Table 3**).

Due to the highly modified nature of the Development Site, the two plots were situated in the areas considered most suitable, however, paths etc were unavoidable.

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

Table 3: Full floristic and vegetation integrity plots

Veg Zone	PCT ID	PCT Name	Condition	Area (ha)	Plots required	Plots surveyed
1	1590	Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest	Moderate	0.09	1	2

1.4.2 Plant Community Types present

One PCT was identified in the Development Site (**Table 4, Figure 5**). This PCT is not representative of any Endangered Ecological Community (EEC) as listed under the BC Act (2016) or the EPBC Act (1999). Justification for the selection of PCTs occurring within the Development Site is based on an analysis of full-floristic plot data and is provided in **Table 5** and outlined in Section **1.4.3.1**. The vegetation present within the Development Site is highly disturbed and modified, comprising of remnant native trees with *Corymbia maculata* (Spotted Gum) and *Eucalyptus fibrosa* (Red Ironbark) dominating and scattered *Eucalyptus umbra* (Broad-leaved White Mahogany), *Eucalyptus punctata* (Grey Gum), *Eucalyptus acmenoides* (White Mahogany) and *Syncarpia glomulifera* (Turpentine). Numerous other (primarily native) tree species were also present as planted specimens, namely, *Eucalyptus pilularis* (Blackbutt), *Eucalyptus botryoides* (Bangalay), *Eucalyptus saligna* (Sydney Blue Gum), *Corymbia eximia* (Yellow Bloodwood) and *Melaleuca quinquenervia* (Broad-leaved Paperbark).

The majority of the Development Site comprises landscaped areas using mainly native species, which are regularly maintained and managed for aesthetics and amenity. The dominant native species planted

throughout the gardens is *Lomandra longifolia* (Spiny-head mat-rush). The Development Site also contains numerous footpaths, paved areas and roads.

1.4.3 Exotic vegetation zone

Exotic vegetation comprised a mix of planted ornamental species including *Archontophoenix cunninghamiana* (Brigalow Palm), *Ulmus parvifolia* (Chinese Elm), shrub species including *Nandina domestica* (sacred bamboo) with a groundlayer comprising species such as *Plantago lanceolata* (Ribwort plantain), *Cenchrus pennisetiformis* (Kikuyu), *Agapanthus* spp. *Soliva sessilis* (Bindi weed) and *Ehrharta erecta* (Panic veldtgrass).

Table 4: Plant Community Types

PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Area within Development Site (ha)	Percent cleared
1590	Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest	Hunter-Macleay Dry Sclerophyll Forests	Dry Sclerophyll Forests (shrub/grass sub formation)	0.09	48%

Table 5: PCT selection justification

PCT ID	PCT Name	Selection criteria	Justification
1590	Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest	IBRA region, subregion, soil landscape, elevation, vegetation formation and vegetation class and floristic composition	This PCT has been accepted as the best fit PCT for vegetation located within the Development Site based on floristic analysis, presence of key canopy species <i>Corymbia maculata</i> (Spotted Gum) and <i>Eucalyptus fibrosa</i> (Red Ironbark) and soil landscape and elevation.

1.4.3.1 PCT selection justification

In determining the PCT for the Development Site, various attributes were considered in combination to assign vegetation to the best fit PCT. As the vegetation present is highly modified from its natural state the following attributes were considered including; dominant species in the canopy stratum and landscape position.

The Landscape position was a key consideration as this PCT occurs on flats; low rises (hillslopes) and low ranges of the lower Hunter Valley and Central Coast at lower elevations which matches with the location of the Development Site, and this PCT in the landscape.

The location of the Development Site was also considered in the context of the IBRA region, being Sydney Basin, the vegetation formation, being Dry Sclerophyll Forests (shrub/grass sub formation) and the vegetation class, being Hunter-Macleay Dry Sclerophyll Forests and determined that this community falls within all three criteria. While these are fairly broad criteria (and there are any number of PCTs that fall within these) they are still determining factors used to narrow down to this PCT selection.



Plate 1: Plot 1 (PCT 1590)



Plate 2: Plot 2 (PCT 1590)

1.4.3.2 Threatened Ecological Communities Justification

The remnant native vegetation of this section of the UoN comprises of Plant Community Type (PCT) 1590 - Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest, which was previously referred to as MU 15 - Coastal Foothills Spotted Gum - Ironbark Forest by Eco-biological (2011). The PCT is not representative of any Endangered Ecological Community as listed under the Biodiversity Conservation Act 2016 (BC Act) or the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act).

PCT 1590 is the corresponding PCT for MU 15 - Coastal Foothills Spotted Gum – Ironbark Forest at this location. It is noted that some portions of the UoN campus and nearby remnant bushland areas were previously incorrectly mapped as being Lower Hunter Spotted Gum Ironbark Forest EEC (due to similar species composition and structure). At the location of the proposed STEMM works and across similar vegetation types of the University the remnant vegetation represents a canopy dominated by Spotted Gum (*Corymbia maculata*) with only scattered other remnant native eucalypt tree species. This correlates to MU 15 and subsequently PCT 1590.

Note: recent information provided by the NSW Threatened Species Scientific Committee (31/05/2019) in regard to the Final Determination for Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions; specifically, Section 4.6, discounts PCT 1590 as being included as part of the EEC.

1.4.4 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 6**. Note that the vegetation integrity scores are out of a maximum 100 being 'benchmark' condition.

Table 6: Vegetation integrity

Veg Zone	PCT ID	Condition	Area (ha)	Composition Condition Score	Structure Condition Score	Function Condition Score	Current vegetation integrity score
1	1590	Disturbed	0.09	9.1	11.8	60	18.6

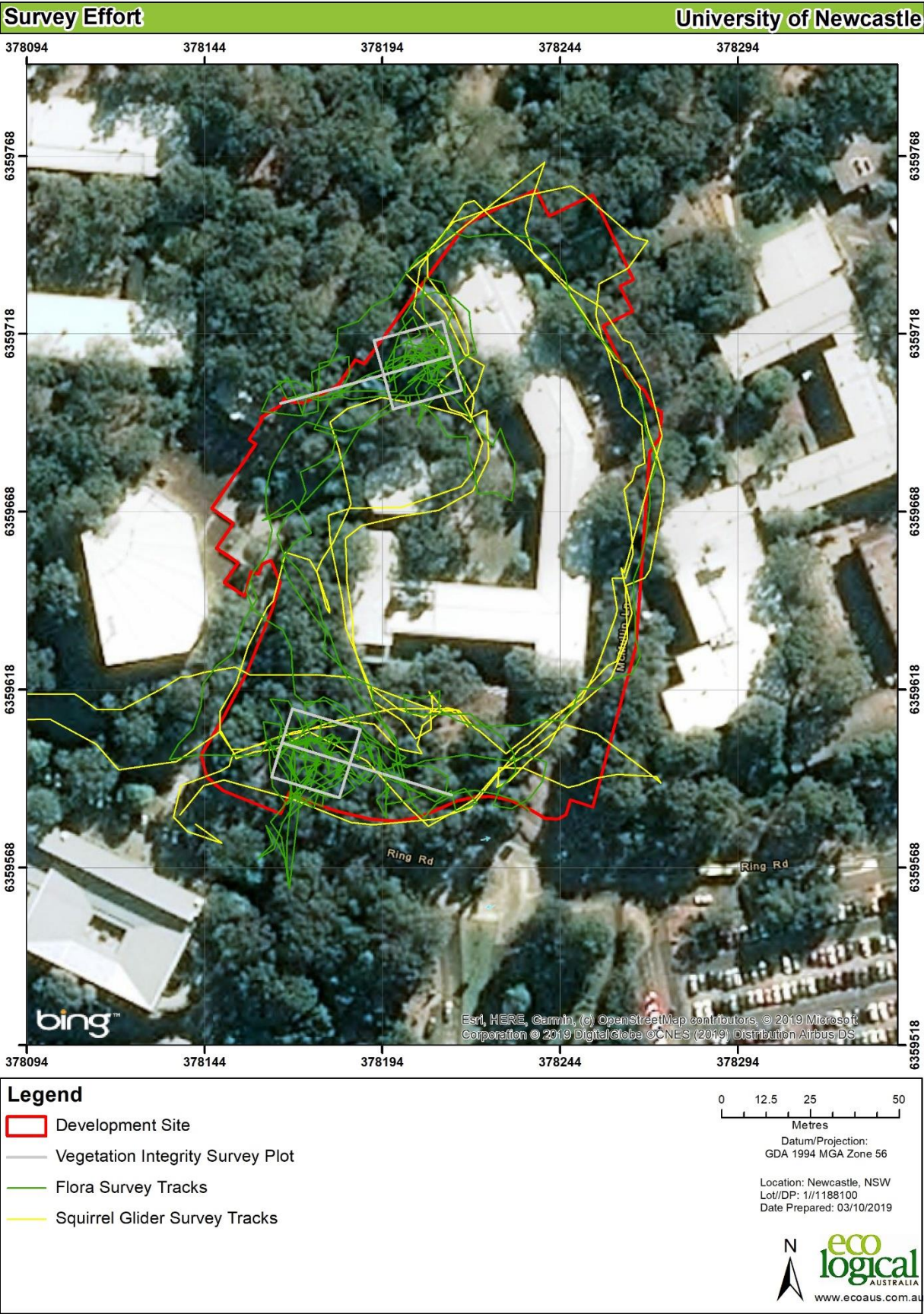


Figure 3: Biometric Vegetation Plots and Survey effort

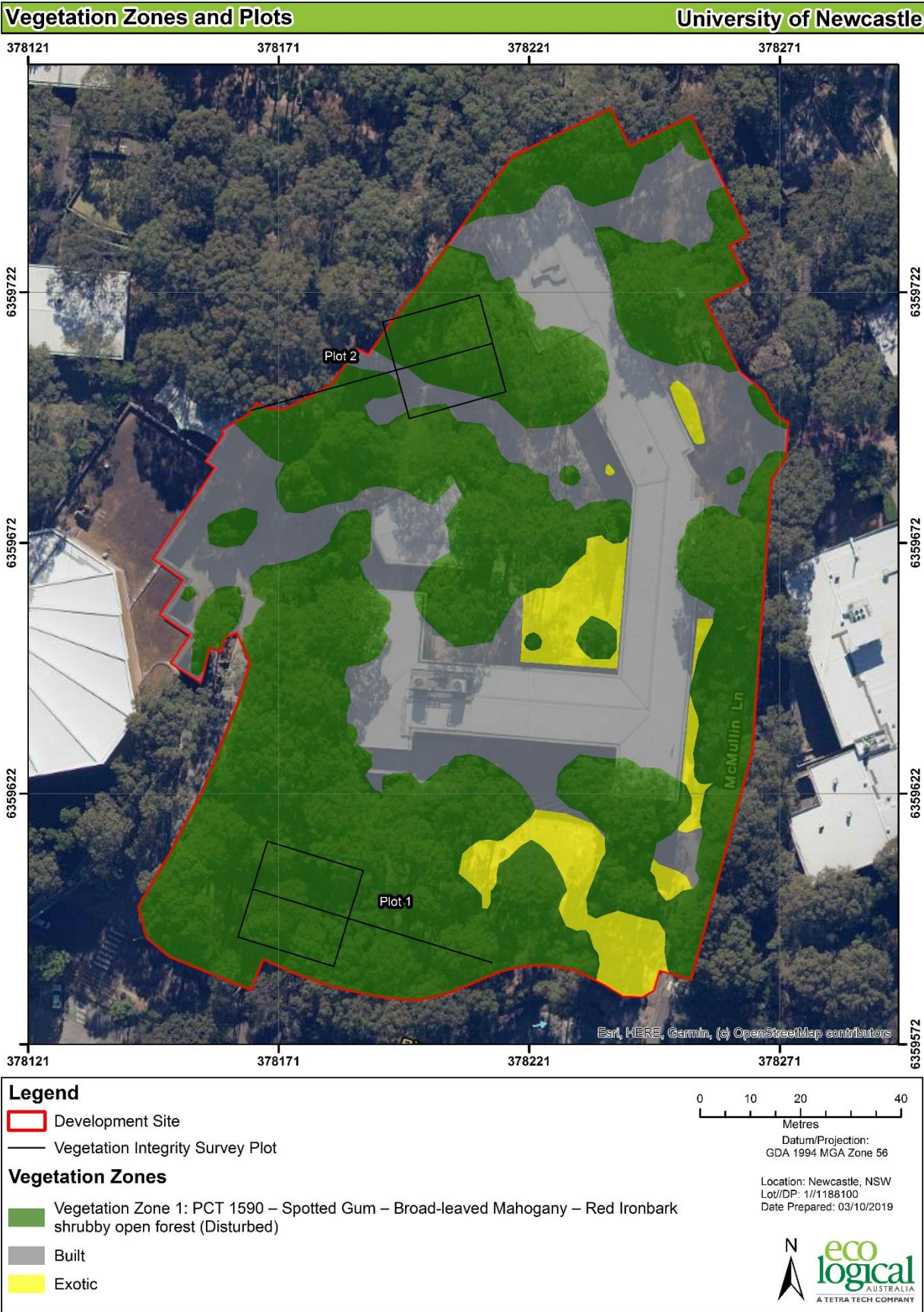


Figure 4: Plot locations

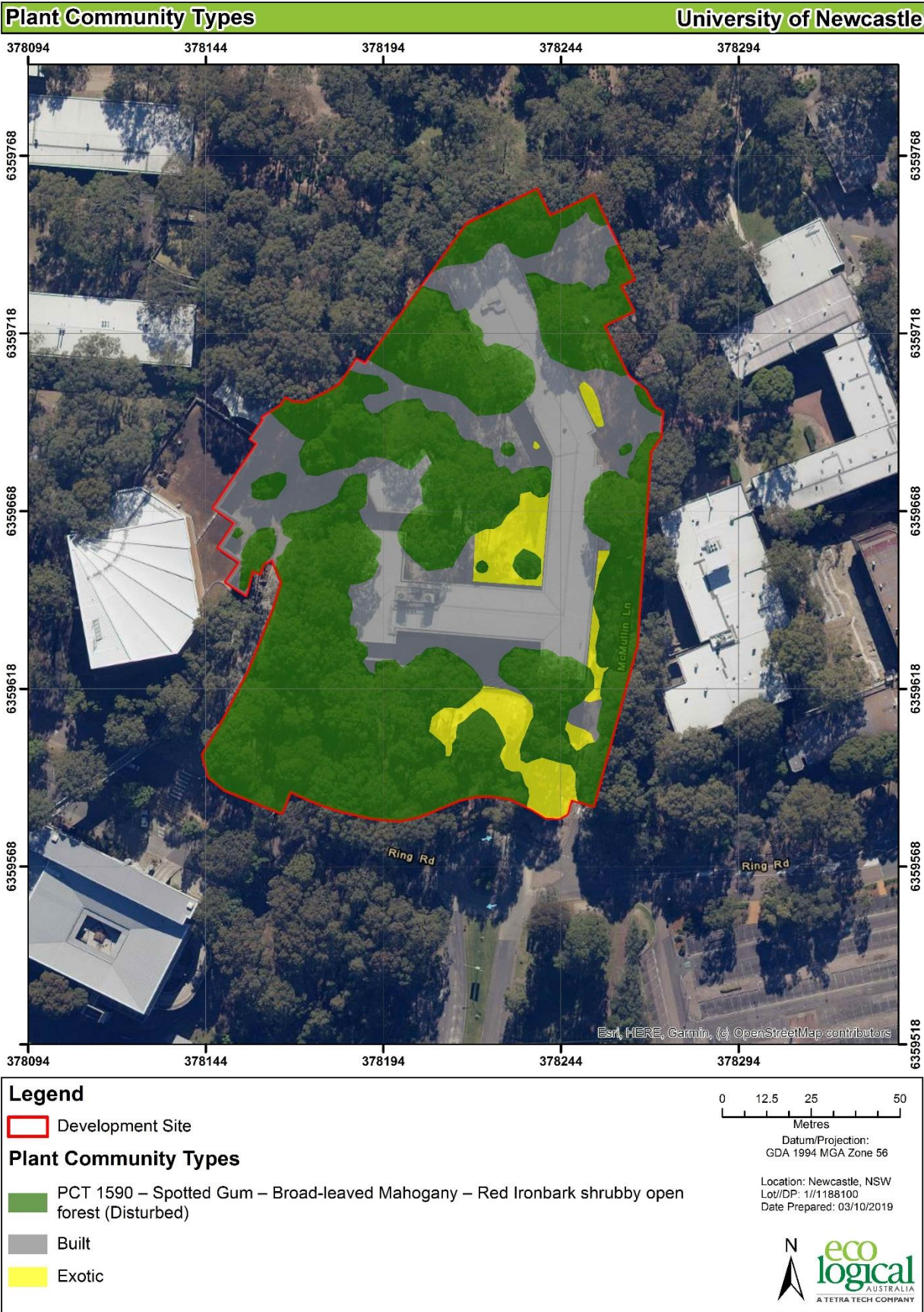


Figure 5: Plant Community Types and native vegetation extent

1.5 Threatened species

1.5.1 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 7**.

Table 7: Predicted ecosystem credit species

Species	Common Name	Sensitivity to gain class	NSW listing status	EPBC listing status
<i>Ninox connivens</i>	Barking Owl	High	Vulnerable	N/A
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	Moderate	Vulnerable	N/A
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	High	Vulnerable	N/A
<i>Stagonopleura guttata</i>	Diamond Firetail	Moderate	Vulnerable	N/A
<i>Mormopterus norfolkensis</i>	Eastern Coastal Free-tailed Bat	High	Vulnerable	N/A
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	Moderate	Vulnerable	N/A
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	High	Vulnerable	N/A
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler (Eastern subspecies)	Moderate	Vulnerable	N/A
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	High	Vulnerable	Vulnerable
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern form)	Moderate	Vulnerable	N/A
<i>Phascolarctos cinereus</i>	Koala	High	Vulnerable	Vulnerable
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	High	Vulnerable	N/A
<i>Miniopterus australis</i>	Little Bent-winged Bat	High	Vulnerable	N/A
<i>Hieraaetus morphnoides</i>	Little Eagle	Moderate	Vulnerable	N/A
<i>Glossopsitta pusilla</i>	Little Lorikeet	High	Vulnerable	N/A
<i>Tyto novaehollandiae</i>	Masked Owl	High	Vulnerable	N/A
<i>Grantiella picta</i>	Painted Honeyeater	Moderate	Vulnerable	Vulnerable
<i>Ninox strenua</i>	Powerful Owl	High	Vulnerable	N/A
<i>Anthochaera phrygia</i>	Regent Honeyeater	High	Critically Endangered	Critically Endangered
<i>Petroica boodang</i>	Scarlet Robin	Moderate	Vulnerable	N/A
<i>Chthonic sagittata</i>	Speckled Warbler	High	Vulnerable	N/A
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	High	Vulnerable	Endangered
<i>Lophoictinia isura</i>	Square-tailed Kite	Moderate	Vulnerable	N/A
<i>Lathamus discolor</i>	Swift Parrot	Moderate	Endangered	Critically Endangered
<i>Neophema pulchella</i>	Turquoise Parrot	High	Vulnerable	N/A
<i>Daphoenositta chrysoptera</i>	Varied Sittella	Moderate	Vulnerable	N/A
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	High	Vulnerable	N/A

Species	Common Name	Sensitivity to gain class	NSW listing status	EPBC Listing status
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	High	Vulnerable	N/A

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

1.6 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 8. An assessment of those candidate Species credit species identified has been undertaken to determine likelihood of those species to occur based on the absence of necessary habitat components or habitat constraints. The justification for exclusion of these species is presented in **Table 8** below.

Two factors have been considered when justifying exclusion of candidate species. In accordance with BAM section 6.4.1.17 (a) habitat present on the Development Site is considered substantially degraded such that certain species are unlikely to utilise the Development Site. The vegetation present within the Development Site comprises of a mixed native and planted canopy, with landscaped areas using mainly native species planted in and around footpaths, paved recreational areas and roads which are regularly maintained and managed for aesthetics and amenity.

Additionally, in accordance with BAM section 6.4.1.10, habitat constraints identified in the Threatened Biodiversity Data Collection have been used to assess habitat on the Development Site for certain candidate species with justification provided where relevant.

Although a number of the below species were not included in the assessment, surveys throughout the Development Site did not identify these species as occurring.

Table 8: Candidate species credit species

Species	Common Name	Habitat limitations	Constraints/	Geographic	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
<i>Callistemon linearifolius</i>	Netted Bottle Brush				High	V	N/A	In accordance with BAM section 6.4.1.17 (a) habitat present is substantially degraded such that this species is unlikely to utilise the Development Site. The vegetation present within the Development Site comprises of a mixed native and planted canopy, with landscaped areas using mainly native species planted in and around footpaths, paved recreational areas and roads which are regularly maintained and managed for aesthetics and amenity.
<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid				High	V	V	In accordance with BAM section 6.4.1.17 (a) habitat present is substantially degraded such that this species is unlikely to utilise the Development Site.
<i>Cynanchum elegans</i>	White-flowered Wax Plant				High	E	E	In accordance with BAM section 6.4.1.17 (a) habitat present is substantially degraded such that this species is unlikely to utilise the Development Site.
<i>Dromaius novaehollandiae</i> - endangered population		Component of subregion that occurs within NSW North Coast Bioregion or Port Stephens LGA only			Moderate	EP	N/A	In accordance with BAM section 6.4.1.17 (a) habitat present is substantially degraded such that this species is unlikely to utilise the Development Site.
<i>Eucalyptus glaucina</i>	Slaty Red Gum				High	V	V	In accordance with BAM section 6.4.1.17 (a) habitat present is substantially degraded such that this species is unlikely to utilise the Development Site.
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Small-flower Grevillea				High	V	V	In accordance with BAM section 6.4.1.17 (a) habitat present is substantially degraded such that this species is unlikely to utilise the Development Site.
<i>Pterostylis chaetophora</i>					Moderate	V	N/A	In accordance with BAM section 6.4.1.17 (a) habitat present is substantially degraded such that this species is unlikely to utilise the Development Site.
<i>Rutidosis heterogama</i>	Heath Wrinklewort				High	V	V	In accordance with BAM section 6.4.1.17 (a) habitat present is substantially degraded such that this species is unlikely to utilise the Development Site.

Species	Common Name		Habitat limitations	Constraints/	Geographic	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
<i>Tetradlea juncea</i>	Black-eyed Susan					High	V	V	In accordance with BAM section 6.4.1.17 (a) habitat present is substantially degraded such that this species is unlikely to utilise the Development Site.
<i>Anthochaera phrygia</i>	Regent Honeyeater		Breeding - As per mapped areas			High	CE	CE	This is a dual credit species, and only a species credit species when mapped as an important area. The Development Site is not within the draft mapped important areas. Email confirmation received from BAM Support on 23.9.2019
<i>Burhinus grallarius</i>	Bush Stone-curlew		Fallen/standing dead timber including logs			High	E	N/A	In accordance with BAM section 6.4.1.17 (a) habitat present is substantially degraded such that this species is unlikely to utilise the Development Site.
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo		Hollow-bearing trees - Eucalypt tree species with hollows greater than 9 cm diameter			High	V	N/A	In accordance with BAM section 6.4.1.10, habitat constraints identified in the Threatened Biodiversity Data Collection have been used to assess habitat on the Development Site for this species. Habitat features for this species are not present on the Development Site. Breeding habitat, identified as Hollow-bearing trees - Eucalypt tree species with hollows greater than 9 cm diameter and suitable for breeding are not present on the Development Site.
<i>Calyptrorhynchus lathamii</i>	Glossy Cockatoo	Black-	Breeding habitat - Living or dead tree with hollows greater than 15cm diameter and greater than 5m above ground			High	V	N/A	In accordance with BAM section 6.4.1.10, habitat constraints identified in the Threatened Biodiversity Data Collection have been used to assess habitat on the Development Site for this species. Habitat features for this species are not present on the Development Site. Breeding habitat, identified as Living or dead tree with hollows greater than 15cm diameter and greater than 5m above ground are not present on the Development Site.
<i>Cercartetus nanus</i>	Eastern possum	Pygmy-				High	V	N/A	In accordance with BAM section 6.4.1.17 (a) habitat present is substantially degraded such that this species is unlikely to utilise the Development Site.
<i>Haliaeetus leucogaster</i>	White-bellied Eagle	Sea-	Breeding habitat - Living or dead mature trees within suitable vegetation within 1km			High	V	N/A	In accordance with BAM section 6.4.1.10, habitat constraints identified in the Threatened Biodiversity Data Collection have been used to assess habitat on the Development Site for this

Species	Common Name	Habitat limitations	Constraints/	Geographic	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
		of a rivers, lakes, large dams or creeks, wetlands and coastlines						species. Habitat features for this species are not present on the Development Site. Breeding habitat, identified as Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines are not present on the Development Site.
<i>Hieraetus morphnoides</i>	Little Eagle	Breeding habitat - Nest trees - live (occasionally dead) large old trees within vegetation.			Moderate	V	N/A	In accordance with BAM section 6.4.1.10, habitat constraints identified in the Threatened Biodiversity Data Collection have been used to assess habitat on the Development Site for this species. Habitat features for this species are not present on the Development Site. Breeding habitat, identified as Nest trees - live (occasionally dead) large old trees within vegetation is not present on the Development Site.
<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake				High	V	N/A	In accordance with BAM section 6.4.1.17 (a) habitat present is substantially degraded such that this species is unlikely to utilise the Development Site.
<i>Lathamus discolor</i>	Swift Parrot	Breeding - As per mapped areas			Moderate	E	CE	This is a dual credit species, and only a species credit species when mapped as an important area. The Development Site is not within the draft mapped important areas. Email confirmation received from BAM Support on 23.9.2019
<i>Litoria aurea</i>	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	The Development Site does not comprise Semi-permanent/ephemeral wet areas, however, there is potential that the Development Site is within 1km of wet areas, swamps or waterbodies, however, in accordance with BAM section 6.4.1.17 (a) habitat present is substantially degraded such that this species is unlikely to utilise the Development Site.
<i>Litoria brevipalmata</i>	Green-thighed Frog				Moderate	V	N/A	In accordance with BAM section 6.4.1.17 (a) habitat present is substantially degraded such that this species is unlikely to utilise the Development Site.
<i>Lophoictinia isura</i>	Square-tailed Kite	Nest trees			Moderate	V	N/A	In accordance with BAM section 6.4.1.10, habitat constraints identified in the Threatened Biodiversity Data Collection have been used to assess habitat on the Development Site for this

Species	Common Name	Habitat limitations	Constraints/	Geographic	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
								species. Habitat features for this species are not present on the Development Site. Breeding habitat, identified as Nest trees are not present on the Development Site.
<i>Miniopterus australis</i>	Little Bentwing-bat	Breeding habitat - Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding			Very high	V	N/A	In accordance with BAM section 6.4.1.10, habitat constraints identified in the Threatened Biodiversity Data Collection have been used to assess habitat on the Development Site for this species. This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. Traverses of the Development Site did not identify any habitat suitable for breeding. Breeding habitat, identified as Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding are not present on the Development Site.
<i>Miniopterus oceanensis</i>	orianae Large Bent-winged Bat	Breeding - Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records			High	V	N/A	In accordance with BAM section 6.4.1.10, habitat constraints identified in the Threatened Biodiversity Data Collection have been used to assess habitat on the Development Site for this species. This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. Traverses of the Development Site did not identify any habitat suitable for breeding. Breeding habitat, identified as Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding are not present on the Development Site.
<i>Myotis macropus</i>	Southern Myotis	Hollow bearing trees Within 200 m of riparian zone Bridges, caves or artificial structures within 200 m of riparian zone			High	V	N/A	In accordance with BAM section 6.4.1.10, habitat constraints identified in the Threatened Biodiversity Data Collection have been used to assess habitat on the Development Site for this species. This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. Traverses of the Development Site did not identify any habitat suitable for breeding. No open water suitable for foraging is present within the Development Site.

Species	Common Name	Habitat limitations	Constraints/	Geographic	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
<i>Ninox connivens</i>	Barking Owl	Breeding habitat - Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground.			High	V	N/A	In accordance with BAM section 6.4.1.10, habitat constraints identified in the Threatened Biodiversity Data Collection have been used to assess habitat on the Development Site for this species. Habitat features for this species are not present on the Development Site. Breeding habitat, identified as living or dead trees with hollows greater than 20cm diameter and greater than 4m above the ground are not present on the Development Site.
<i>Ninox strenua</i>	Powerful Owl	Breeding habitat - Living or dead trees with hollow greater than 20cm diameter			High	V	N/A	In accordance with BAM section 6.4.1.10, habitat constraints identified in the Threatened Biodiversity Data Collection have been used to assess habitat on the Development Site for this species. Habitat features for this species are not present on the Development Site. Breeding habitat identified as living or dead trees with hollows greater than 20cm diameter are not present on the Development Site.
<i>Ozothamnus tessellatus</i>					Moderate	V	V	In accordance with BAM section 6.4.1.17 (a) habitat present is substantially degraded such that this species is unlikely to utilise the Development Site.
<i>Persoonia pauciflora</i>	North Rothbury Persoonia				High	CE	CE	In accordance with BAM section 6.4.1.17 (a) habitat present is substantially degraded such that this species is unlikely to utilise the Development Site
<i>Petaurus norfolcensis</i>	Squirrel Glider				High	V	N/A	Targeted surveys undertaken
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	Hollow bearing trees			High	V	N/A	The Development Site does not comprise Hollow bearing trees suitable for this species. Additionally, in accordance with BAM section 6.4.1.17 (a) habitat present is substantially degraded such that this species is unlikely to utilise the Development Site.
<i>Phascolarctos cinereus</i>	Koala				High	V	V	In accordance with BAM section 6.4.1.17 (a) habitat present is substantially degraded such that this species is unlikely to utilise the Development Site

Species	Common Name	Habitat limitations	Constraints/	Geographic	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
<i>Planigale maculata</i>	Common Planigale				High	V	N/A	In accordance with BAM section 6.4.1.17 (a) habitat present is substantially degraded such that this species is unlikely to utilise the Development Site
<i>Prostanthera cineolifera</i>	Singleton Mint Bush				High	V	V	In accordance with BAM section 6.4.1.17 (a) habitat present is substantially degraded such that this species is unlikely to utilise the Development Site
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	Breeding camps			High	V	V	In accordance with BAM section 6.4.1.10, habitat constraints identified in the Threatened Biodiversity Data Collection have been used to assess habitat on the Development Site for this species. Habitat features for this species are not present on the Development Site. No camps are present on the Development Site.
<i>Tyto novaehollandiae</i>	Masked Owl	Breeding habitat- Living or dead trees with hollows greater than 20cm diameter.			High	V	N/A	In accordance with BAM section 6.4.1.10, habitat constraints identified in the Threatened Biodiversity Data Collection have been used to assess habitat on the Development Site for this species. Habitat features for this species are not present on the Development Site. Breeding habitat, identified as living or dead trees with hollows greater than 20cm diameter are not present on the Development Site.
<i>Vespadelus troughtoni</i>	Eastern Cave Bat	Caves. Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, crevices or boulder piles, or within two kilometres of old mines, tunnels, old buildings or sheds.			Very high	V	N/A	In accordance with BAM section 6.4.1.10, habitat constraints identified in the Threatened Biodiversity Data Collection have been used to assess habitat on the Development Site for this species. Habitat features for this species are not present on the site. No caves are present. Traverses of the Development Site did not identify any habitat suitable for breeding.

1.6.1 Targeted surveys

Due to the highly disturbed and modified nature of the Development Site, targeted surveys were not conducted for the majority of Species credit species outlined in **Table 8**. Targeted surveys were undertaken within the Development Site for *Petaurus norfolcensis* (Squirrel Glider) listed as Vulnerable under the BC Act as this species is considered to utilise disturbed and fragmented habitats and records of this species have been recorded at the John Hunter Hospital, approximately 5km to the south of the Development Site. Meander surveys throughout the Development Site were conducted for conspicuous species and incidental/opportunistic data was collected for any threatened flora and fauna.

Random meanders throughout the Development Site were undertaken (**Figure 3**) and no threatened species habitat or individuals were recorded.

Weather conditions during survey are outlined in **Table 9** and survey effort is outlined in

Table 10.

Table 9: Weather conditions

Survey type	Date	Rainfall (mm)	Minimum temperature 0c	Maximum temperature 0c
Flora & BAM plots	10/09/2019	0	10	17.3
Squirrel Glider targeted surveys	11/10/2019 14/10/2019	& 0	10.8 & 13.8	19.7 & 23

Table 10: Targeted threatened species survey effort

Targeted taxa	Targeted species	threatened	Survey techniques	Survey effort per habitat type
Mammals	<i>Petaurus norfolcensis</i> (Squirrel Glider)		Spotlighting & habitat assessment	1 person over 1 hour, repeated over 2 nights

1.6.1.1 Targeted Survey results

Following completion of targeted surveys, no threatened species were identified as occurring within the development site, therefore no further assessment has occurred.

1.6.2 Use of local data

The use of local data is not proposed.

1.6.3 Expert reports

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

2. Stage 2: Impact assessment (biodiversity values)

2.1 Avoiding impacts

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

As part of the works associated with the removal of vegetation for the construction of the UoN STEM building (works associated with this BDAR), considerable previous work has been undertaken as part of the Enabling Works package and the Demolition works in order to minimise impacts to any significant vegetation present, including several mature canopy species. In order to do this the UoN engaged an arborists services (ArborSafe) to undertake a risk assessment and have, where possible avoided and minimised impacts to mature canopy species.

The current Development Site is already the site of the existing sciences building (McMullin Building), and minimal clearing is required to construct the new STEM building as part of this BDAR. Due to the implementation of the Enabling Works and the already highly modified and disturbed nature of the Development Site; areas of higher biodiversity values have been retained on site where possible. Justifications on how the development aims to avoid and minimise impacts is outlined in **Table 11**.

Table 11: 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	Utilising areas of footpaths, recreational concrete areas and roads.	The selection of Development Site comprises an existing building(s). Every effort has been made to limit clearing required to only a portion of the native and planted canopy and maintained gardens and lawns.
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 selection of Development Site comprises an existing building(s). Every effort has been made to limit clearing required to only a portion of the native and planted canopy and maintained gardens and lawns.
Locating the project in areas that avoid habitat for species and vegetation in high threat categories (e.g. an EEC or CEEC), indicated by the biodiversity risk weighting for a species	The project has been located to avoid removal of vegetation in high threat categories.	The selection of Development Site comprises an existing building(s). Every effort has been made to limit clearing required to existing native and planted canopy and maintained gardens and lawns. No impacts to EEC vegetation or threatened species habitat will occur as part of this BDAR.
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 selection of Development Site comprises an existing building(s). Connectivity values will not be impacted as part of the proposed works. Connectivity in all directions through corridors running north-south will not be impacted.

2.1.2 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 12**.

Table 12: 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 occurs within the footprint of the existing building; and clearing of vegetation for the BDAR works has been reduced as far as practicable.
Locating ancillary facilities in areas where there are no biodiversity values	Ancillary features have been addressed as part of separate works – Enabling Works	N/A
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 addressed as part of separate works – Enabling Works	N/A
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 addressed as part of separate works (Enabling Works), however, no significant habitat for species or impacts to high threat status categories e.g. EEC or CEEC will occur	N/A
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 to either side of the proposed BDAR footprint enabling movement of species and genetic material.	The placement of the Development Site footprint occurs primarily within the footprint of the existing building; and clearing of vegetation for the BDAR works will not impact on the movement of genetic material as vegetation exist to the east and west and can move along north-south corridors surrounding the Development Site.
Making provision for the demarcation, ecological restoration, rehabilitation and/or ongoing maintenance of retained native vegetation habitat on the Development Site.	Vegetation to be retained within the Development Site footprint will be retained where feasible and will be enhanced and maintained.	The placement of the Development Site footprint occurs primarily within the footprint of the existing building; and clearing of vegetation for the BDAR works has been reduced as far as practicable. Any existing vegetation to be retained will be enhanced and maintained.
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 selection of Development Site comprises an existing building(s). Every effort has been made to limit clearing required to existing native and planted canopy and maintained gardens and lawns.

2.1.3 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 occur within the Development Site
- Occurrences of human made structures and non-native vegetation – present, however, assessed as part of separate works (**Section 1.1.3**).
- Hydrological processes that sustain and interact with the rivers, streams and wetlands – none occur within the Development Site
- 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.

2.2 Assessment of Impacts

2.2.1 Direct impacts

The direct impacts of the development on native vegetation are outlined in **Table 13** and is shown on **Figure 6**.

Table 13: Direct impacts to native vegetation

PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Direct impact (ha)
1590	Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest	Hunter-Macleay Sclerophyll Forests	Dry Dry Sclerophyll Forests (shrub/grass formation) sub	0.09

2.2.2 Change in vegetation integrity

The change in vegetation integrity as a result of the development is outlined in **Table 14**.

Table 14: Change in vegetation integrity

Veg Zone	PCT ID	Condition	Area (ha)	Current vegetation integrity score	Future vegetation integrity score	Change in vegetation integrity
1	1590	Degraded	0.09	18.6	0	-18.6

2.2.3 Indirect impacts

The indirect impacts of the development are outlined in **Table 15**.

Table 15: 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 ring 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	No wood present	N/A	N/A	N/A	N/A
bush rock removal and disturbance	Construction / operation	No bush rock present	N/A	N/A	N/A	N/A
increase in predatory species populations	Construction / operation	Potential increase in domestic predatory	Due to the already disturbed nature of the Development Site,	During operational phase	Potential at any point during operation of development	Short-term impacts

Indirect impact	Project phase	Nature	Extent	Frequency	Duration	Timing
		species due to reduction of vegetation	proposed works are unlikely to exacerbate predatory species populations			
increase in pest animal populations	Construction / operation	Potential to increase if introduced	Due to the already disturbed nature of the Development Site, proposed works are unlikely to exacerbate pest animal populations	Potential to occur at any time throughout construction or operational phases	Throughout project	life of Short-term impacts
increased risk of fire	Construction / operation	Limited potential due to access roads, buildings and pathways	Due to the already modified nature of the Development Site, including buildings, paths etc, it is unlikely the proposed works will exacerbate risk of fire	Potential to occur at any time, although, more likely during dry, windy conditions	Throughout project	life of Short-term and long-term impacts



2.2.4 Prescribed biodiversity impacts

The development does not have any prescribed biodiversity impacts.

2.2.5 Mitigating and managing impacts

Measures proposed to mitigate and manage impacts at the Development Site before, during and after construction are outlined in **Table 16**.

Table 16: 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 habitat trees (trees with hollows or nests) 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 of habitat trees in late winter/spring during breeding/nesting period for birds where feasible.	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 habitat trees to be removed and identification/location of habitat trees by a suitably qualified ecologist. The western boundary of the Development Site is to be clearly delineated as a 'No Go' zone (lower side of old access track) with high visibility fencing to prevent any direct or indirect impacts occurring to the threatened species <i>C. dowlingii</i> habitat. Supervision by a qualified ecologist/licensed wildlife handler during habitat tree removal in accordance with best practise methods. Any tree removal to be undertaken by the civil works contractor as part of the subdivision works.	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 subject site/study area. 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
clearing protocols that identify vegetation to be retained, prevent	Moderate	Minor	Vegetation identified for retention should be clearly delineated as a 'No Go' zone with high visibility bunting.	Vegetation to be retained outside of the	Demarcation of vegetation to be	Project Manager

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
inadvertent damage and reduce soil disturbance			No temporary facilities i.e. site offices/toilets/soil stockpiling is to occur within tree protection zone.	Development Site boundary will not be disturbed/impacted	set up prior to any works occurring on site and to remain throughout duration of construction works	
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, particularly along the southern boundary of the Development Site. .	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 clearing works should be planned to occur outside of the winter/spring breeding season, where feasible.	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	All weeds currently present will be managed and removed from site following best practise guidelines prior to construction occurring. During construction works, hygiene protocols will be required to prevent the spread of weeds or pathogens between infected areas and uninfected areas, including weed seed washdown areas. Any weeds identified as re-germinating during the construction period will be controlled and removed off site. Vehicles, machinery and building refuse should remain only within the Development Site and not impinge on the areas	Spread of weeds prevented	Post-construction	Project Manager

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
			of retained native vegetation outside of the Development Site.			
Staff training and site briefing to communicate environmental features to be protected and measures to be implemented	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: - 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	All staff entering the Development Site are fully aware of all the ecological values present within the Lot and environmental aspects relating to the development and know what to do in case of any environmental emergencies	To occur for all staff entering/working at the Development Site. Site briefings should be updated based on phase of the work and when environmental issues become apparent.	Project Manager
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 / Landscape Architect

2.2.6 Serious and Irreversible Impacts (SAIL)

No Serious and Irreversible Impacts (SAIL) candidate species or PCTs have been identified on the Development Site as occurring, therefore no further assessment of SAIL values has been undertaken.

2.3 Risk assessment

A risk assessment has been undertaken for any residual impacts likely to remain after the mitigation measures (**Table 16**) have been applied. Likelihood criteria, consequence criteria and the risk matrix are provided in **Table 17**, **Table 18** and **Table 19** respectively. The risk assessment is provided in **Table 20**.

Table 17: 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 every one 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).
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 18: 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 19: 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 20: 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
noise, dust or light spill	Construction	Low	Very Low
inadvertent impacts on adjacent habitat or vegetation	Construction	Low	Very 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	Low	Very 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	Low	Very Low
disturbance to specialist breeding and foraging habitat, e.g. beach nesting for shorebirds.	Construction / operation	Low	Very Low

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

2.4 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 2.2.5** and no further impacts are required to be addressed.

2.5 Impact summary

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

2.5.1 Serious and Irreversible Impacts (SII)

The development does not have any Serious and Irreversible Impacts (SII).

2.5.2 Areas not requiring assessment

Areas not requiring assessment as part of this BDAR include all works associated with the Enabling Works, demolition and clearing works associated with placement of services and utilities. The impacts associated with these works have been assessed under other legislative provisions discussed in **Section 1.1.3**.

Exotic vegetation and buildings, footpaths etc. have not been assessed. These areas were not consistent with any listed PCT, nor did they contain any threatened species, or threatened species habitat, hence further assessment under the BAM was not required. Areas not requiring assessment are shown on **Figure 7**.

2.5.3 Impacts requiring offsets

The impacts of the development requiring offset for native vegetation are outlined in **Table 21** and shown on **Figure 8**.

Table 21: Impacts to native vegetation that require offsets

Veg Zone	PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Direct impact (ha)
1	1590	Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest	Hunter-Macleay Dry Sclerophyll Forests	Dry Sclerophyll Forests (shrub/grass sub formation)	0.09

2.5.4 Credit summary

The number of ecosystem credits required for the Development Site are outlined in **Table 22**. A total of 1 ecosystem credit is required for impacts to PCT 1590. A biodiversity credit report is included in **Appendix D**.

Table 22: Ecosystem credits required

PCT ID	PCT Name	Vegetation Formation		Direct impact (ha)	Credits required
1590	Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest	Dry Forests	Sclerophyll (shrub/grass sub formation)	0.09	1

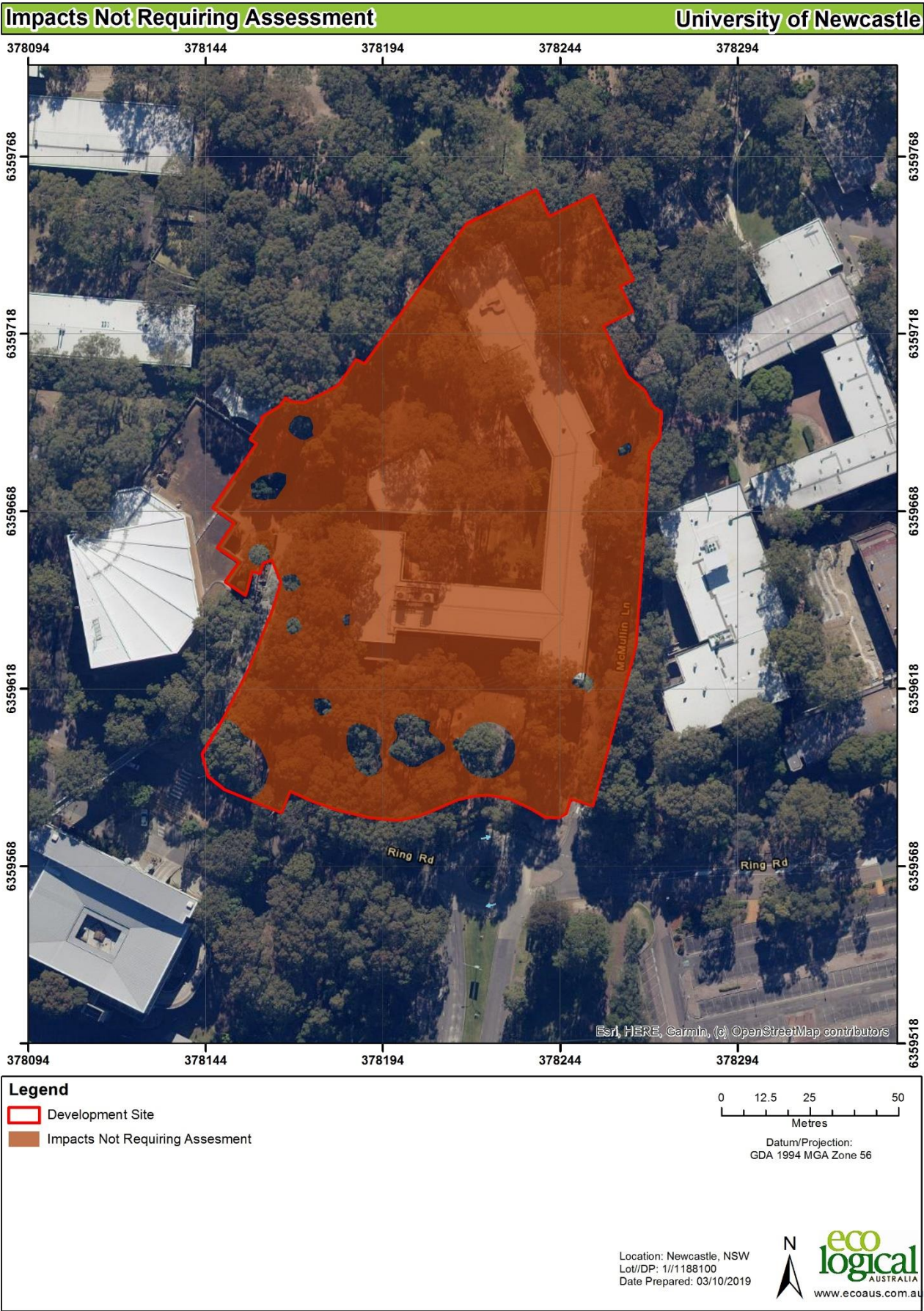


Figure 7: Areas not requiring assessment

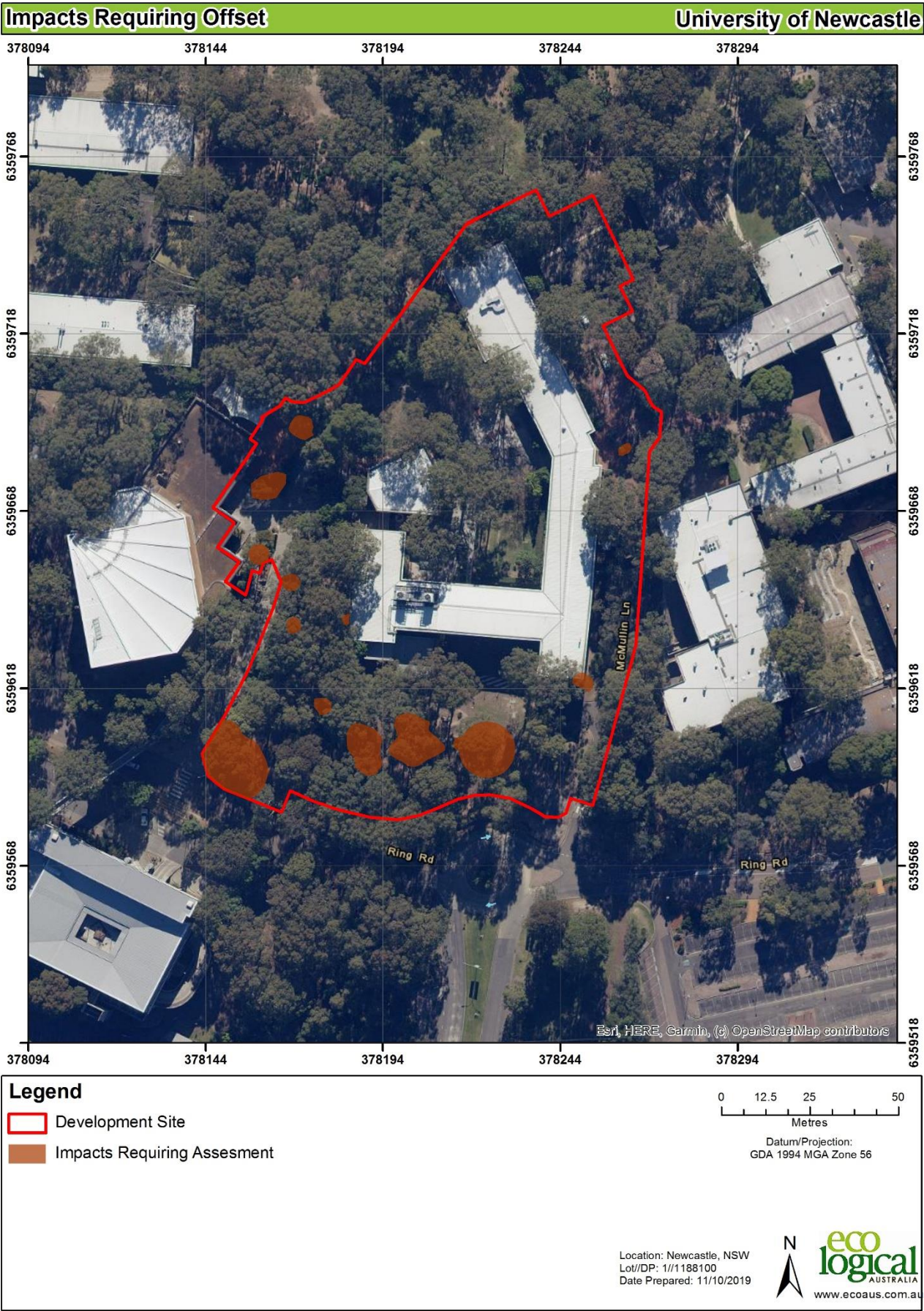


Figure 8: Impacts requiring offset

2.6 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 below.

2.6.1 *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 Impact 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 23**).

2.6.1.1 *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).

It is considered that the vegetation within the Development Site may provide a very minimal amount of 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). The nearest active GHFF camp occurs approximately 5 km to the south of the Development Site in Blackbutt Reserve (99), Newcastle (DotE 2018).

Table 23: 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

Criterion	Assessment
	or have ever been recorded within the Development Site (DotE 2018). The nearest active GHFF camp occurs approximately 5 km to the south of the Development Site, within Blackbutt Reserve (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 (0.09 ha) 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	A minimal amount (0.09 ha) of the potential foraging habitat in canopy trees within the Development 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. 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.
Criterion 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 5 km to the south of the Development Site, within Blackbutt Reserve (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 5 km to the south of the Development Site, within Blackbutt Reserve (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.

2.7 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 UoN; 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. Currently, this last option has some limitations and is not deemed appropriate for this project.

Due to the low number of credits required, being one (1) ecosystem credit, payment into the Biodiversity Conservation Trust is the most likely and suitable option and the easiest option to retire credits for this development.

Note: As an additional compensatory measure to the above offset option, it is understood that UoN will utilise the obligations as set out in the Newcastle Development Control Plan (DCP) 2012, specifically Section 5.03 Vegetation Management and 5.03.07 Newcastle University Callaghan Campus. Where the objectives are:

1. To improve the quality of vegetation on the Callaghan Campus.
2. To maintain the 'bushland campus' identity of the Callaghan Campus.
3. To ensure appropriate regeneration works are undertaken for vegetation which is removed or pruned for the purpose of a development.

Compensatory works for vegetation removal at the Callaghan Campus will be undertaken in accordance with the University of Newcastle Tree Management Procedure (October 2018) and with reference to the Newcastle Urban Forest Technical Manual (February 2018).

3. References

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Office of Environment and Heritage (OEH) 2015. *Threatened Species Profiles*. Available at: <http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10616>

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Office of Environment and Heritage (OEH). 2018a. Threatened Species Database (5 km radius search). OEH Sydney, NSW. (Data viewed November 2018).

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.
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

Terminology	Definition
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.
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.

Terminology	Definition
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 24: Species matrix (species recorded by plot)

Species	Growth Form Group	Exotic	High Threat Weeds	Plot 1		Plot 2	
				Cover	Abundance	Cover	Abundance
<i>Corymbia maculata</i>	Tree (TG)			15	3	15	2
<i>Eucalyptus fibrosa</i>	Tree (TG)			8	1		
<i>Lomandra longifolia</i>	Grass & grasslike (GG)			3	50	1	10
<i>Ehrharta erecta</i>		*	1	8	2000		
<i>Soliva sessilis</i>		*		2	500	.1	10
<i>Oxalis</i> spp.	Forb (FG)			.1	20		
<i>Lysimachia arvensis</i>		*		.1	10		
<i>Dichondra repens</i>	Forb (FG)			.1	100		
<i>Sonchus oleraceus</i>		*		.1	20		
<i>Veronica plebeia</i>	Forb (FG)			.1	20		
<i>Senecio madagascariensis</i>		*	1	.1	2		
<i>Plantago lanceolata</i>		*		.1	5		
<i>Microlaena stipoides</i>	Grass & grasslike (GG)			5	1000		
<i>Eucalyptus acmenoides</i>	Tree (TG)			5	2		
<i>Pittosporum undulatum</i>	Shrub (SG)					10	6
<i>Agapanthus</i> spp.		*				15	100
<i>Syzygium</i> spp.	Shrub (SG)					.2	1
<i>Cenchrus clandestinus</i>		*				1	100
<i>Cupaniopsis</i> spp.	Tree (TG)					.1	1
<i>Nandina domestica</i>		*				.2	2
Shrub (SG)**		*				.2	2
<i>Ulmus parvifolia</i>		*				.2	1

Tree (TG), Shrub (SG), Grass & Grasslike (GG), Forb (FG), Fern (EG), Other (OG)

* 0 = not a High Threat Weed. 1= High Threat Weed

** unidentified exotic planted shrub

Table 25: Vegetation integrity data (Composition, Structure and function)

Composition						Structure						Function																
Plot	PCT	condition class	easting	northing	bearing	Tree	Shrub	Grass	Forbs	Ferns	Other	Tree	Shrub	Grass	Forb	Fern	Other	Large Trees	Hollow trees	Litter Cover	Fallen Logs	Tree Stem 5to10	Tree Stem 10to20	Tree Stem 20to30	Tree Stem 30to50	Tree Stem 50to80	Tree Regen	High Threat Exotic
Plot 1	1590	Modified/ disturbed	378170	6359539	95	3	0	2	3	0	0	28	0	8	0.3	0	0	4	0	64	0	1	1	1	1	1	0	8.1
Plot 2	1590	Modified/ disturbed	378214	6359643	240	2	2	1	0	0	0	15.1	10.2	1	0	0	0	2	0	34	0	0	0	1	0	1	0	0

Appendix C: Plot Photos



Plate 3: Plot one start



Plate 4: Plot one end



Plate 5: Plot two start



Plate 6: Plot two end

Appendix D: Biodiversity credit report

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00017516/BAAS17101/19/00017517	UoN BDAR Assessment	05/05/2020
Assessor Name	Report Created	BAM Data version *
	08/05/2020	26
Assessor Number	BAM Case Status	Date Finalised
	Finalised	08/05/2020
Assessment Revision	Assessment Type	
0	Major Projects	

* 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.

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	Potential SAI	Ecosystem credits
Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest								
1	1590_Low	18.6	0.1	0.25	High Sensitivity to Potential Gain	1.50		1
							Subtotal	1
							Total	1

Species credits for threatened species

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