Western Sydney University Milperra Campus Redevelopment Ecological Assessment

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Project Name	Western Sydney University Milperra Campus Redevelopment Ecological Assessment
Project Number	22SYD - 2900
Project Manager	Diane Campbell
Accredited Assessor Certification	I certify that this report has been prepared on the basis of the requirements of, and information provided under, the Biodiversity Assessment Method and s.6.15 of the BC Act.In preparing this assessment I have acted in accordance with the Accredited BAM Assessor Code of Conduct.I declare that I have considered the circumstances and there is no actual, perceived, or potential conflict of interest.  Diane Campbell (BAAS 17069) 5 October 2022
Prepared by	Ronnie Hill, Scott Chrystal
Reviewed by	Diane Campbell
Approved by	David Bonjer
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Template 2.8.1

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Abbreviations

Abbreviation	Description
AoBV	Areas of Outstanding Biodiversity Value
BAM-C	Biodiversity Assessment Methodology Calculator
BAM	Biodiversity Assessment Methodology
BC Act	*Biodiversity Conservation Act 2016*
BC Regulation	Biodiversity Conservation Regulation 2017
BDAR	Biodiversity Development Assessment Report
BOS	Biodiversity Offset Scheme
BV	Biodiversity Values
ELA	Eco Logical Australia
EP&A Act	*Environmental Protection and Assessment Act 1979*
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999*
FM Act	*Fisheries Management Act 1994*
HBT	Hollow Bearing Tree
GIS	Geographic Information System
GPS	Global Positioning System
LWD	Large Woody Debris
Koala Habitat Protection SEPP	*State Environmental Planning Policy 44 – Koala Habitat Protection*
MNES	Matters of National Environmental Significance
SB	Sydney Basin
SAII	Serious and Irreversible Impacts
PCT	Plant Community Type
SAII	Serious and Irreversible Impact
TEC	Threatened Ecological Community
WM Act 2000	*Water Management Act 2000*
WSU	Western Sydney University

1. Introduction

Eco Logical Australia (ELA) was engaged by Mirvac to provide an ecological assessment to inform a planning proposal seeking to rezone the Western Sydney University (WSU) Milperra campus for residential, business, recreation and conservation uses (Figure 1). The lot boundary area comprises the greater part of the Western Sydney University campus at 2 Bullecourt Avenue, Milperra (Lot 1 DP 101147 and lot 105 in DP 1268911; Figure 2).

1.1 Description of the proposal

Western Sydney University (WSU) is embarking on a large scale, transformative initiative, seeking evolution of the University's current 'suburban' campus network into a hybrid campus model which includes both suburban and consolidated city centre vertical campuses, acknowledging the ability of both campuses to service certain aspects of course delivery and research. This Strategy was endorsed by the University Board of Trustees in June 2017, and signifies a new direction for the University's delivery and provision of education and research. The relocation of the Milperra Campus to Bankstown CBD supports this model, as well as supporting a long standing strategic action and direction. Existing courses and offerings at the Milperra Campus will be relocated to the Bankstown city centre campus, or in some instances to Liverpool. Furthermore, the proposal will ensure that the University is in a more accessible location to the broader student catchment, with the new city centre campus providing Metro, Train and Bus accessibility with the services and amenities of Bankstown city centre readily available for students. An agreement between WSU and the City of Canterbury Bankstown has been signed which will see the relocation of the WSU Milperra Campus.

As such, it is proposed that the site be repurposed to allow for reinvestment into WSU's new campuses and its education and research offerings, consistent with the University's objects and functions under the *Western Sydney University Act 1997*.

The WSU Milperra Campus is currently used as one of eleven WSU Campuses throughout metropolitan Sydney. The site has an area of 19.6 ha and is bounded by Bullecourt Avenue to the north, Horsley Road to the east, M5 Motorway to the south, and Ashford Avenue to the west. Two non-campus uses are located within this bounded area, including the council operated hockey field to the north-west corner of the site, and Mt St Joseph's Catholic School, occupying a third of the street frontage to Horsley Road to the east. In addition, protected remnant Cumberland Plain Woodland (classified as a critically endangered ecological community) is positioned in the north east corner of the site.

The campus is currently used for the purpose of tertiary education, student accommodation, administrative functions, and student parking. In 2016, the campus supported approximately 8,166 students, 195 academic staff and 128 professional staff.

A Master Plan has been prepared for the WSU Milperra campus in support of the University's transformative initiative, driven by improving the amenity of the local area for existing and future residents. Centred on creating a great place to live, the Master Plan provides open space for passive and active recreation, a walkable and cycle friendly neighbourhood with shops, services, and a diverse range of dwelling types to support affordability, and respond to the changing household and age profile in the district. The Master Plan is accompanied by a Planning Proposal that seeks to amend the land

use, height of buildings, floor space ratio, biodiversity, minimum lot size and special provisions controls under the Bankstown Local Environmental Plan 2015.

Figure 1 Proposed Masterplan

1.2 S1 & S2 of the BAM

Whilst Planning Proposals do not trigger the Biodiversity Offset Scheme under the Biodiversity Conservation Act 2016, the planning authority has requested that the Planning Proposal address Stage 1 and 2 (S1 & S2) of the Biodiversity Assessment Method (BAM).

Stage 1 and Stage 2 of the BAM has been prepared by Ronnie Hill and reviewed by Diane Campbell an Accredited Person (BAAS17069) to apply the BAM under the NSW BC Act. All credit calculations have been undertaken using the BAM Calculator (BAMC) version 54 in case number 00035337/ BAAS17069/22/00035338.

1.3 Key Terms

The following terminology has been used in this report:

- *Development site*: the area to be directly affected by the proposal.
- *Lot boundary*: the area encompassed within Lot 1 DP 101147 and lot 105 in DP 1268911.
- *Assessment area*: A buffer area of 1500 m around the Development site.

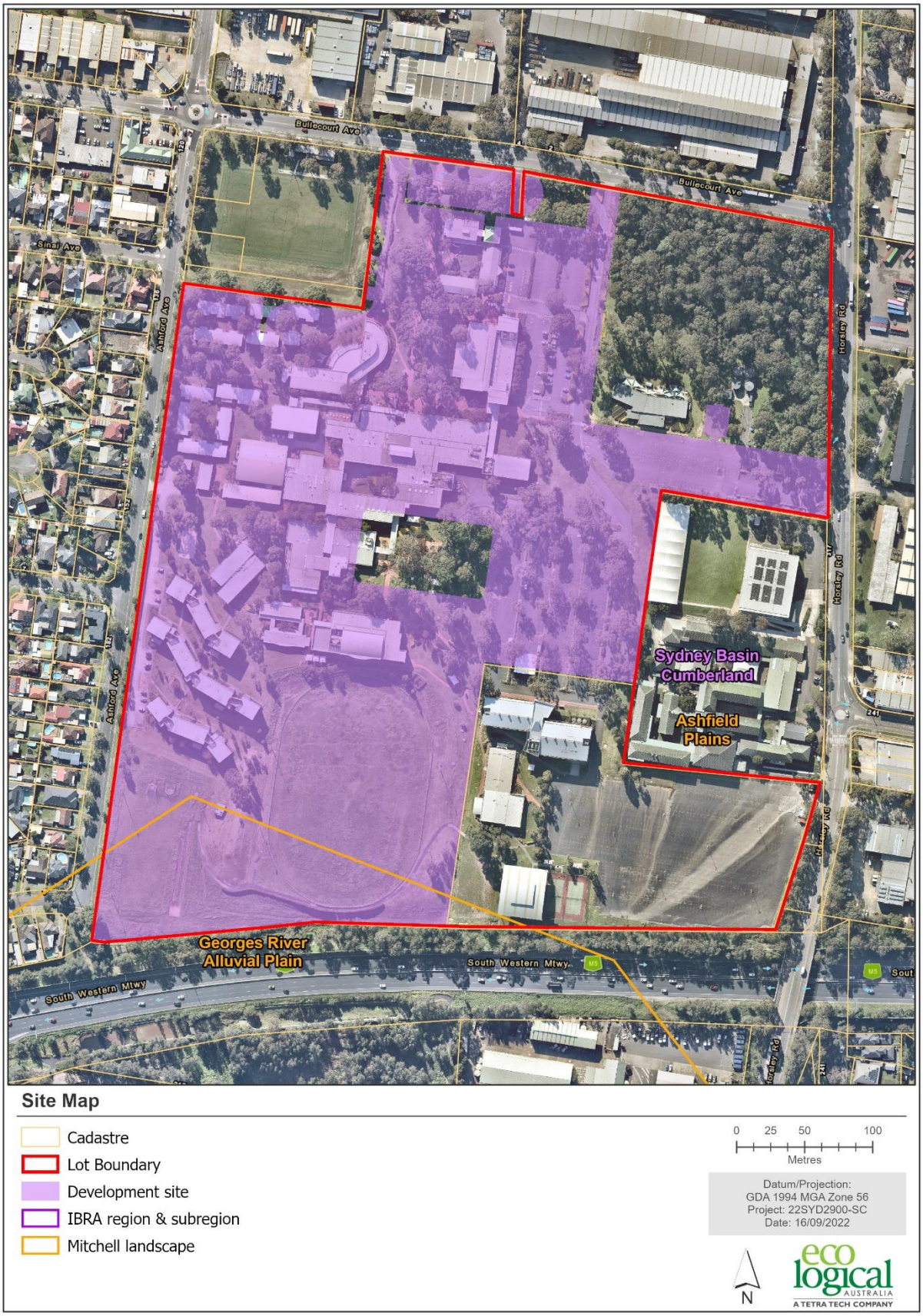

Figure 2: Site map

2. Legislative Context

Table 1: Legislation and context

Name	Relevance to the project
	Commonwealth
Environmental Protection and Biodiversity Conservation Act 1999	The Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999) aims to protect Matters of National Environmental Significance (MNES), including vegetation communities and species listed under the EPBC Act. If a development is likely to have a significant impact on MNES, it is likely to be considered a 'Controlled Action' by the Commonwealth and requires assessment and approval by the Commonwealth in order to proceed. One Threatened Ecological Community (TEC) listed under the EPBC Act 1999, Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest, has been mapped within the study area. Field survey has identified that a patch within the Development site (0.02 ha) meets the Commonwealth definition. A significant impact assessment for the removal of this TEC in accordance with the significant impact guidelines (DotE 2013) will need to accompany the formal biodiversity assessment at DA stage, however 0.02 ha is considered a relatively minor impact to this community.
	State
Environmental Planning and Assessment Act 1979	The planning proposal is proposed under Part 3 of the EP&A Act.
Biodiversity Conservation Act 2016	The BC Act 2016, under section 7.3, outlines the assessment requirements to determine whether proposed development (Part 4 of the EP&A Act 1979) is likely to significantly affect threatened species or ecological communities, or their habitats, and whether the BOS will be triggered. A Planning Proposal is not 'development' and therefore doesn't require assessment under Part 7 of the BC Act, however the planning authority has requested preparation of a report that addresses Stage 1 and 2 of the Biodiversity Assessment Method. If development were to proceed consistent with this Planning Proposal, it would trigger both the area clearing threshold (>0.5 ha) and the Biodiversity Values (BV) mapping and the BAM must be applied and a BDAR is required.
Fisheries Management Act 1994 (FM Act)	The site does not contain fish habitat and therefore no further assessment or approvals under this legislation is required.
Water Management Act 2000 (WM Act 2000)	The site does not contain waterfront land and therefore no further assessment is required under this Act.
	Planning Instruments
State Environmental Planning Policy Biodiversity and Conservation 2021	The lot boundary area is not located within a Local Government Area to which Chapters 3 and 4 Koala Habitat Protection applies. In September 2022 following finalisation of the Cumberland Plain Conservation Plan, the SEPP was amended to include Chapter 13 Strategic Conservation Planning. The site is not within the area subject to Chapter 13.
Bankstown Local Environment Plan 2015	The lot boundary area is zoned as SP2 'Educational Establishment' under the Bankstown LEP. The study area is not located on land shown on the Terrestrial Biodiversity Maps of the Bankstown LEP 2015. However draft maps for an amended Bankstown LEP show the entire site affected by a Terrestrial Biodiversity Map. The Planning Proposal for the comprehensive LEP states:

Name	Relevance to the project
	Apply the BLEP Terrestrial Biodiversity Map to the Canterbury Bankstown LGA, subject to the integration of current land use strategies (in accordance with the Terrestrial Biodiversity Map in Part 4). Based on the current land use strategies, the proposed amendment protects areas of high biodiversity significance and the ecological processes necessary for their continued existence.

3. Methodology

3.1 Literature Review and Database Search

A review of readily available databases pertaining to the ecology and environmental features of the Assessment area, and existing vegetation mapping was conducted to identify records of threatened species, populations and communities and their potential habitat. Databases and vegetation mapping that were reviewed included:

- BioNet (Atlas of NSW Wildlife) database search (5 km) threatened species, populations and ecological communities listed under the BC Act 2016 (November 2022)
- EPBC Act 1999 Protected Matters Search Tool (5 km) for threatened and migratory species, populations and ecological communities listed under the Commonwealth EPBC Act 1999 (November 2022)
- NSW Threatened Species Profiles (DPIE 2022)
- Local Planning Reports
    - Bankstown Local Environmental Plan 2015
    - Bankstown Biodiversity Strategy 2015-2025
- Vegetation Mapping
    - The Native Vegetation of the Sydney Metropolitan Area (OEH 2016)
- Previous reports
    - Western Sydney University Milperra Campus Redevelopment - Ecological Assessment. (ELA 2018).
    - Western Sydney University Milperra Campus Redevelopment Preliminary Ecological Assessment (ELA 2020)

3.2 Field Survey

Field surveys were conducted by ELA ecologists Toni Frecker (BAM Accredited Assessor), Stacey Wilson and Diane Campbell (BAM Accredited Assessor) between the dates of 31 October 2019 and July 25, 2022.

Field surveys were conducted to:

- Identify vegetation types including delineating Plant Community Type(s) (PCTs) across the lot boundary
- Determine the condition zones of PCTs present, presence of any threatened ecological communities, and other native vegetation within the lot boundary area
- The collection of vegetation data using the BAM was undertaken and their cover-abundance were recorded
- Conduct targeted threatened species surveys for selected species listed under the BC and/or EPBC Acts.

A total of four full-floristic vegetation plots was surveyed to verify Plant Community Types (PCTs) and their condition within the lot boundary area. Three of these were required to operate the BAM Calculator (BAM-C) in section 4 and 6.

When habitat features were present, they were marked spatially using a handheld GPS unit. The habitat features present (i.e. hollow bearing tree), tree species, type of feature and abundance of habitat features were noted. Opportunistic sightings of all fauna present within the study area were recorded.

4. BAM – Stage 1

4.1 Landscape

The Development site is situated within the Cumberland subregion of the Sydney Basin IBRA region and occurs within the Mitchell Landscapes of Ashfield Plains and Georges River Alluvial Plain. The land within the Development site is predominantly flat with slight undulations, where elevation ranges between 4 – 22 m Australian Height Datum (AHD). The Development site has been historically cleared for infrastructure with minor amounts of vegetation remaining. Surrounding land uses are primarily residential and industry.

The site-based method was applied for this assessment; therefore, the Assessment area is the 1,500 m buffer surrounding the outside edge of the boundary of the Development site.

The landscape features considered for this assessment are presented in Table 2 and Figure 3.

Table 2: Landscape features

Landscape feature	Development site	Assessment area	Data source
IBRA Region(s)	Sydney Basin (SB)		Interim Biogeographic Regionalisation for Australia, Version 7
IBRA Subregion(s)	Cumberland		Interim Biogeographic Regionalisation for Australia, Version 7
Rivers and streams	There are no rivers or streams that intersect the Development site.	There are a number of first and second order streams in the north and south of the Assessment area, all of which flow west into the Georges River.	NSW DPIE Strahler Stream Order 08/09/2022
Estuaries and wetlands	The Assessment area does not contain any mapped wetlands.		SEED NSW Wetlands mapping
Connectivity of different areas of habitat	Areas of connectivity are mapped on the Location map.		Aerial imagery
Geological features of significance and soil hazard features	No soil hazards or significant geological features are present.	No soil hazards or significant geological features are present.	Aerial imagery SEED – NSW 1500K Simplified Surface Geology
Areas of Outstanding Biodiversity Value (AoBV)	No registered AoBV occurs within the Development site.	No registered AoBV occurs within the Assessment area.	Register of Declared Areas of Outstanding Biodiversity Value (DPIE 2022)
NSW (Mitchell) Landscapes	• Ashfield Plains • Georges River Alluvial Plain.	• Ashfield Plains • Georges River Alluvial Plain.	NSW (Mitchell) Landscapes Version 2

Landscape feature	Development site	Assessment area	Data source
Percent (%) native vegetation extent	There are no differences between the mapped vegetation extent and the aerial imagery. The Development site is approximately 19.6 ha and contains approximately 2.95 ha of woodland (with 0.58 ha to be removed) and 2.1 ha of landscaped native vegetation (with 1.67 ha to be removed). The Assessment area is approximately 1036 ha and contains approximately 107.80 ha of native vegetation (10.41 %).		Calculated using aerial imagery and ArcGIS software

Figure 3: Location map

4.2 Native Vegetation

The majority of the Development site is located on land that has been historically cleared for infrastructure. Areas containing vegetation are mostly modified, with remnant areas containing a diminished understory or having undergone various landscape management. Planted and landscaped native vegetation also occurs across the Development site.

4.2.1 Plant Community Types present

One PCT consisting of varying condition zones was identified within the Development site and is presented in Table 3. Other vegetation types include 2.10 ha of landscaped native vegetation and 0.44 ha of exotic vegetation that does not conform to a native PCT occur within the Development site.

PCT 849 is 93% cleared based on information contained within the NSW Government BioNet Vegetation Information System.

Table 3: Plant Community Types Present

PCT ID	PCT Name	Condition	Vegetation Class	Vegetation Formation	Area Removed (ha)	Area Retained (ha)	Total (ha)
849	Cumberland shale plains woodland	Good	Coastal Valley Grassy Woodland	Grassy Woodlands	0.02	1.93	1.95
849	Cumberland shale plains woodland	Landscaped	Coastal Valley Grassy Woodland	Grassy Woodlands	0.55	0.11	0.66
849	Cumberland shale plains woodland	Low	Coastal Valley Grassy Woodland	Grassy Woodlands	0.01	0.33	0.34
na	Exotic		na	na	0.38	0.07	0.44
na	Landscaped native vegetation		na	na	1.67	0.42	2.10
Total					**2.63**	**2.86**	**5.49**

4.2.2 Plant Community Type selection justification

In determining the PCT for the Development site, various attributes were considered in combination to assign vegetation to the best fit PCT (Table 4). Attributes included dominant species in each stratum and relative abundance, community composition, soils and landscape position. Reference was made to the PCT descriptions in the BioNet Vegetation Classification and the final scientific determinations for TECs. Possible PCT options were:

- PCT 849: Cumberland shale plains woodland
- PCT 850: Cumberland shale hills woodland.

Both these PCTs occupy similar soil types and present an analogous floristic composition in each stratum. This includes:

- Grassy woodland formation with the presence of the characteristic canopy species, *Eucalyptus tereticornis* (Forest Red Gum) and *Eucalyptus moluccana* (Grey Box)

- Occurs on shale soils in the Cumberland IBRA sub-region.

However, PCT 850 is described as occurring on shale hills at elevations between 50 and 350 metres above sea level. Whereas PCT 849 is described as occurring along gentle inclines at elevations less than 150 meters above sea level (Tozer M. et al.), which aligns more closely with the landscape within the Development site.

Table 4: Potential PCTs

Selected PCT ID	PCT Name	Other PCT options
849	Cumberland shale plains woodland	850

4.2.3 Threatened Ecological Communities

Assessment of each PCT was undertaken to determine if any of the vegetation communities present were consistent with Threatened Ecological Communities (TECs) listed under the BC Act and/or the EPBC Act.

To determine a candidate list of potential TECs, a spatial search was conducted using the species siting search in BioNet and the Protected Matters Search Tool (PMST). Any potential TECs that were predicted in the BAM-C were also considered. Based on this review, seven candidate TECs were identified as potentially occurring. Of these seven TECs, many were associated with vegetation communities that were not present within the Development site.

Based on the location and assemblage of species, one TEC listed under the BC and EPBC Acts was identified as potentially occurring within the Development site:

- Cumberland shale plains woodland (BC and EPBC Act).

Assessment of the eligibility of the vegetation patches within the Development site meeting this listing was completed with reference to the final determination under the BC Act and approved conservation advice under the EPBC Act. Details and key diagnostic features of this assessment are given in section 4.2.3.1 and 4.2.3.2. This assessment determined that this TEC listed is present within the Development site. Details of the extent of this TEC is given in Table 5 and shown on Figure 5.

4.2.3.1 Cumberland shale plains woodland (BC Act)

Assessment of the final determination for Cumberland shale plains woodland in the Sydney Basin Bioregion (DPE, 2011), a Critically Endangered Ecological Community (CEEC) under the BC Act, determined that this TEC occurred within the Development site. Patches of PCT 849 'Low' and 'Good' met the criteria for the CEEC under the BC Act. However, patches of PCT 849 'Landscaped' did not, as the vegetation in these areas wouldn't respond to assisted natural regeneration, due to the natural soil and associated seedbank being absent.

4.2.3.2 Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (EPBC Act)

Patches of PCT 849 'Low' did not meet the key diagnostic characteristics set out by the Commonwealth Listing Advice on Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (DAWE 2009) for the following reasons:

- Each patch (defined as a discrete and continuous area that comprises the ecological community) was <0.5 ha in size.
- Perennial understory native vegetation (including vascular plant species of the ground and shrub layers) cover was <30% for each patch.

The patch of PCT 849 'Good' met the EPBC listing criteria.

Table 5: Threatened Ecological Communities

PCT ID	BC Act			EPBC Act		
	Listing status	Name	Area (ha)	Listing status	Name	Area (ha)
849	CE	Cumberland shale plains woodland	0.03	CE	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	0.02

4.3 Vegetation integrity assessment

4.3.1 Vegetation zones

A total of three vegetation zones were identified on the Development site based on the broad condition states of PCT 849. A total of four vegetation integrity survey plots were collected within the Development site consistent with the BAM (Table 6). Descriptions of vegetation zones associated with a native PCT are provided in Table 7 to Table 9.

Areas of non-native vegetation did not correspond to any recognised PCT and have been mapped as Exotic vegetation in Figure 4. Areas mapped as Landscaped native vegetation mostly consisted of *Corymbia citriodora* (Lemon-scented Gum) and *Stenocarpus sinuatus* (Firewheel Tree) which are not endemic to the Sydney Basin. And as such, this vegetation zone was assessed using the streamlined assessment module for planted native vegetation in accordance with Appendix D of BAM 2020 (Section 4.4).

Table 6: Vegetation zones and vegetation integrity survey plots collected within areas of vegetation to be removed on the Development site

Vegetation Zone	PCT ID	PCT Name	Condition	Area (ha)	Patch Size	Vegetation Integrity Survey Plots required	Vegetation Integrity Survey Plots collected
1	849	Cumberland shale plains woodland	Good	0.02	107.8	1	1
2	849	Cumberland shale plains woodland	Low	0.01	107.8	1	2
3	849	Cumberland shale plains woodland	Landscaped	0.55	107.8	1	1
			Total	0.58	107.8	3	3

4.3.2 Patch size

Patch size was calculated using available vegetation mapping for all patches of intact native vegetation on and adjoining the Development site. Patch size was assigned to one of four classes (<5 ha, 5-24 ha, 25-100 ha or ≥100 ha). A patch size of approximately 107.8 ha was determined for the Development site. Therefore, the ≥100 ha class was used for this assessment.

Table 7: Zone 1 PCT 849 Good Condition

849 - Cumberland shale plains woodland (Good)	
Vegetation formation/class	Grassy Woodlands/ Coastal Valley Grassy Woodlands
Conservation status: **BC Act**	CEEC: Cumberland Plain Woodland in the Sydney Basin Bioregion
Conservation status: **EPBC Act**	CEEC: Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest
Description	This PCT occurs on the gradual slopes and shale sediments of the Development site. This vegetation zone was limited to a patch (1.95 ha) in the northeast of the lot boundary. A small portion (0.02 ha) of this patch is proposed to be removed identified within the development site provided.. The dominant canopy species that occurs within this vegetation zone was *Eucalyptus moluccana*, *Eucalyptus tereticornis* and *Eucalyptus fibrosa* (Red Ironbark). Midstory consisted of a sparse cover of *Ozothamnus diosmifolius* (Rice Flower), *Bursaria spinosa* (Blackthorn) and various *Acacia spp*. The groundcover was dominated by native grasses and herbs including, *Themeda triandra* (Kangaroo Grass), Microlaena stipoides (Weeping Grass), *Entolasia marginata* (Bordered Panic), *Lomandra longifolia* (Basket Grass), *Brunoniella australis* (Blue Trumpet) and *Grona varians* (Slender Tick-trefoil). Small numbers of exotic species are present including the High Threat Weed (HTW) species, *Asparagus asparagoides* (Bridal Creeper), *Ochna serrulata* (Ochna) and *Senecio madagascariensis* (Fireweed).
Characteristic canopy trees	*Eucalyptus moluccana, Eucalyptus tereticornis, Eucalyptus fibrosa*
Characteristic mid-storey	*Ozothamnus diosmifolius, Bursaria spinosa, Acacia spp*
Characteristic groundcovers	*Themeda triandra, Microlaena stipoides, Entolasia marginata, Lomandra longifolia, Brunoniella australis, Grona varians*
Mean native richness	35
Exotic species / HTW cover	*Asparagus asparagoides, Ochna serrulata, Senecio madagascariensis* / 0.7
Condition	Good condition
Variation and disturbance	Little disturbance from encroaching exotic species
No. sites sampled	1
Threatened flora species	*Acacia pubescens*
Fauna habitats	Sufficient vegetation cover and litter for ground mammals, reptiles and birds. Hollow Bearing Trees (HBTs), Large Woody Debris (LWD) and large trees. Primary (*Eucalyptus tereticornis)* and secondary (*Eucalyptus moluccana*) Koala (*Phascolarctos cinereus*) feed trees.

Composition	Structure	Function	Vegetation Integrity Score
62.1	87.5	80.5	75.9

849 - Cumberland shale plains woodland (Good)

Table 8: Zone 2 PCT 849 Low Condition

849 - Cumberland shale plains woodland (Low)	
Vegetation formation/class	Grassy Woodlands/ Coastal Valley Grassy Woodlands
Conservation status: **BC Act**	CEEC: Cumberland Plain Woodland in the Sydney Basin Bioregion
Conservation status: **EPBC Act**	This vegetation zone did not meet the description of the CEEC as set out by the Commonwealth approved conservation advice (DAWE 2009).
Description	This PCT occurs on the gradual slopes and shale sediments of the Development site. This vegetation zone was limited to a moderate patch (0.34 ha) in the northeast of the lot boundary within the development footprint provided. A small portion (0.01 ha) of this patch is proposed to be removed. The dominant canopy species that occurs within this vegetation zone was *Eucalyptus crebra* (Narrow-leaved Ironbark) and *Eucalyptus tereticornis*. No midstory species are present. Groundcover is currently mown and consists of a mixture of native and exotic grass species including *Cynodon dactylon* (Couch Grass), *Ehrharta erecta* (Panic Veldtgrass), *Microlaena stipoides*, *Paspalum dialatum* (Dallis Grass), *Poa annua* (Annual Bluegrass), *Sporobolous africanus* (Parramatta grass). A low diversity of native herbs and forbs including *Dichondra repens* (Kindey Weed) and *Oxalis perennan* was recorded. A high proportion of exotic species occurs within the groundcover of this zone, including the HTW species, *Paspalum dialatum, Ehrharta erecta* and *Senecio madagascariensis*.
Characteristic canopy trees	*Eucalyptus crebra, Eucalyptus tereticornis*
Characteristic mid-storey	Nil
Characteristic groundcovers	*Cynodon dactylon*, *Ehrharta erecta*, *Microlaena stipoides*, *Paspalum dialatum*, *Poa annua*, *Sporobolous africanus*, *Dichondra repens*, *Oxalis perennan*
Mean native richness	7.5
Exotic species / HTW cover	*Paspalum dialatum, Ehrharta erecta, Senecio madagascariensis* / 7.7
Condition	Low condition
Variation and disturbance	Disturbance from previous clearing and current management (mowing). High proportion of exotic species.
No. sites sampled	2
Threatened flora species	Nil
Fauna habitats	Flowering canopy trees for arboreal animals. Presence of a Primary (*Eucalyptus tereticornis)* Koala feed tree. Presence of HBTs.

Composition	Structure	Function	Vegetation Integrity Score
24.9	66.3	53.8	44.6

849 - Cumberland shale plains woodland (Low)

Table 9: Zone 3 PCT 849 Landscaped Condition

849 - Cumberland shale plains woodland (Landscaped)			
Vegetation formation/class	Grassy Woodlands/ Coastal Valley Grassy Woodlands		
Conservation status: BC Act	This vegetation zone did not meet the description of the CEEC as set out by the final determination (DPE 2011).		
Conservation status: EPBC Act	This vegetation zone did not meet the description of the CEEC as set out by the Commonwealth approved conservation advice (DAWE 2009).		
Description	This PCT occurs on the gradual slopes and shale sediments of the Development site. This vegetation zone was spread across the Development site. Approximately 0.55 ha of this vegetation zone is proposed to be removed in the north of the site, with a smaller area (0.11 ha) to be retained within the Central Park.. The dominant canopy species that occurs within this vegetation zone consist of planted *Eucalyptus crebra* and *Eucalyptus sideroxylon* (Mugga Ironbark). No midstory species are present. Groundcover management ranges from mown to mulched areas, occasionally in a combination. Where groundover occurs, a high proportion of exotic species was recorded with dominant species such as *Ehrharta erecta, Poa annua*, *Sporobolous africanus*, *Cenchrus clandestinus* (Kikuyu), *Cynodon dactylon*.		
Characteristic canopy trees	*Eucalyptus crebra, Eucalyptus sideroxylon*		
Characteristic mid-storey	Nil		
Characteristic groundcovers	*Ehrharta erecta, Poa annua, Sporobolous africanus, Cenchrus clandestinus, Cynodon dactylon.*		
Mean native richness	7.5		
Exotic species / HTW cover	*Cenchrus clandestinus, Ehrharta erecta,* / 45		
Condition	Landscaped condition		
Variation and disturbance	Disturbance from previous clearing, plantings and current management (mowing and mulching). High proportion of exotic species.		
No. sites sampled	1		
Threatened flora species	Nil		
Fauna habitats	Flowering canopy trees for arboreal animals.		
Composition	**Structure**	**Function**	**Vegetation Integrity Score**
9.9	72.8	41.9	31.1

849 - Cumberland shale plains woodland (Landscaped)

4.3.3 Assessing vegetation integrity

A vegetation integrity assessment using the BAM-C was undertaken and the results are outlined in Table 10.

Table 10: Vegetation integrity scores

Veg Zone	PCT ID	Condition	Area (ha)	Composition Condition Score	Structure Condition Score	Function Condition Score	Presence of Hollow bearing trees	Current vegetation integrity score
1	849	Good	0.02	62.1	87.5	80.5	Y	75.9
2	849	Low	0.01	24.9	66.3	53.8	Y	44.6
3	849	Landscaped	0.55	9.9	72.8	41.9	N	31.1

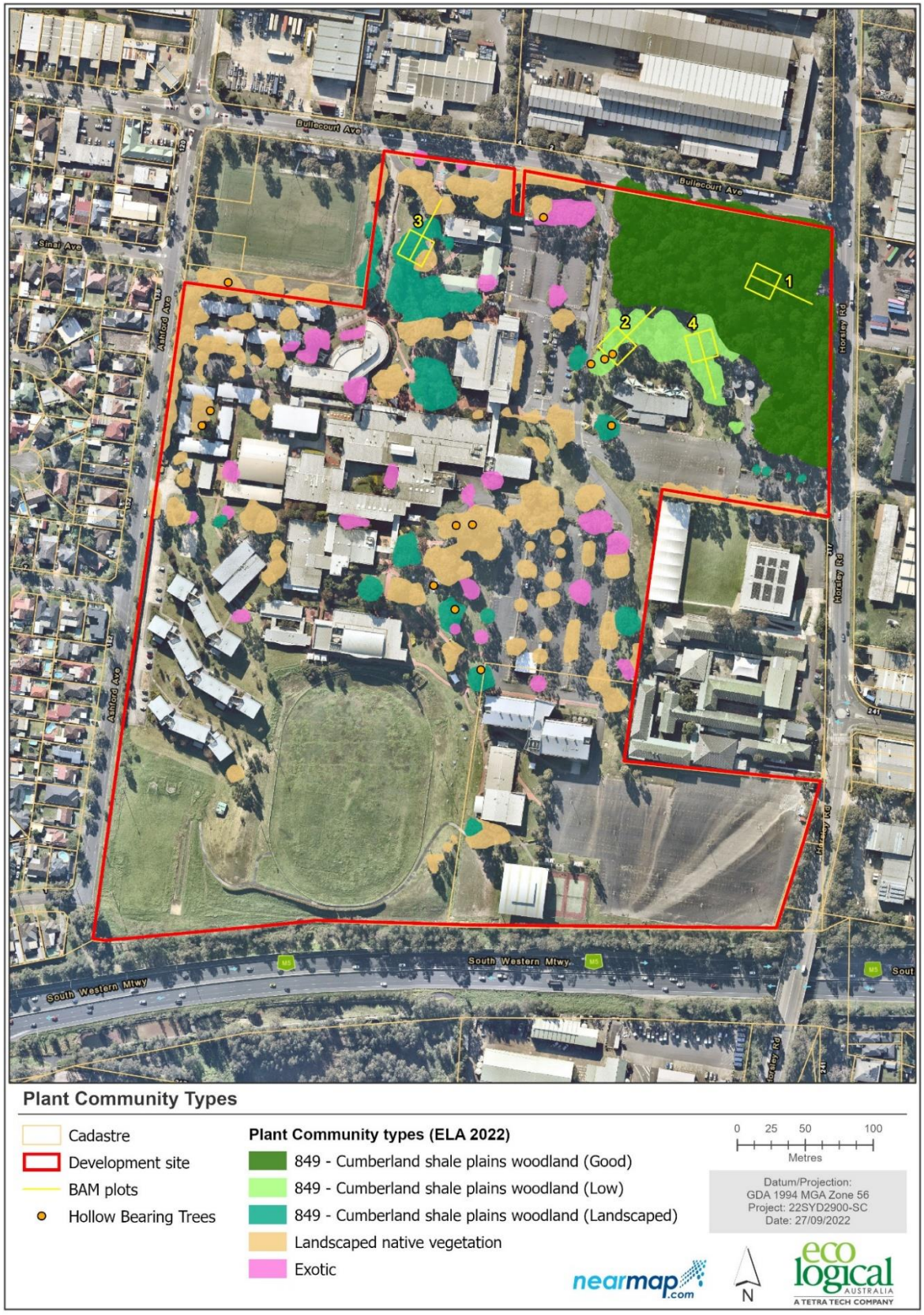

Figure 4: Vegetation zones and plots

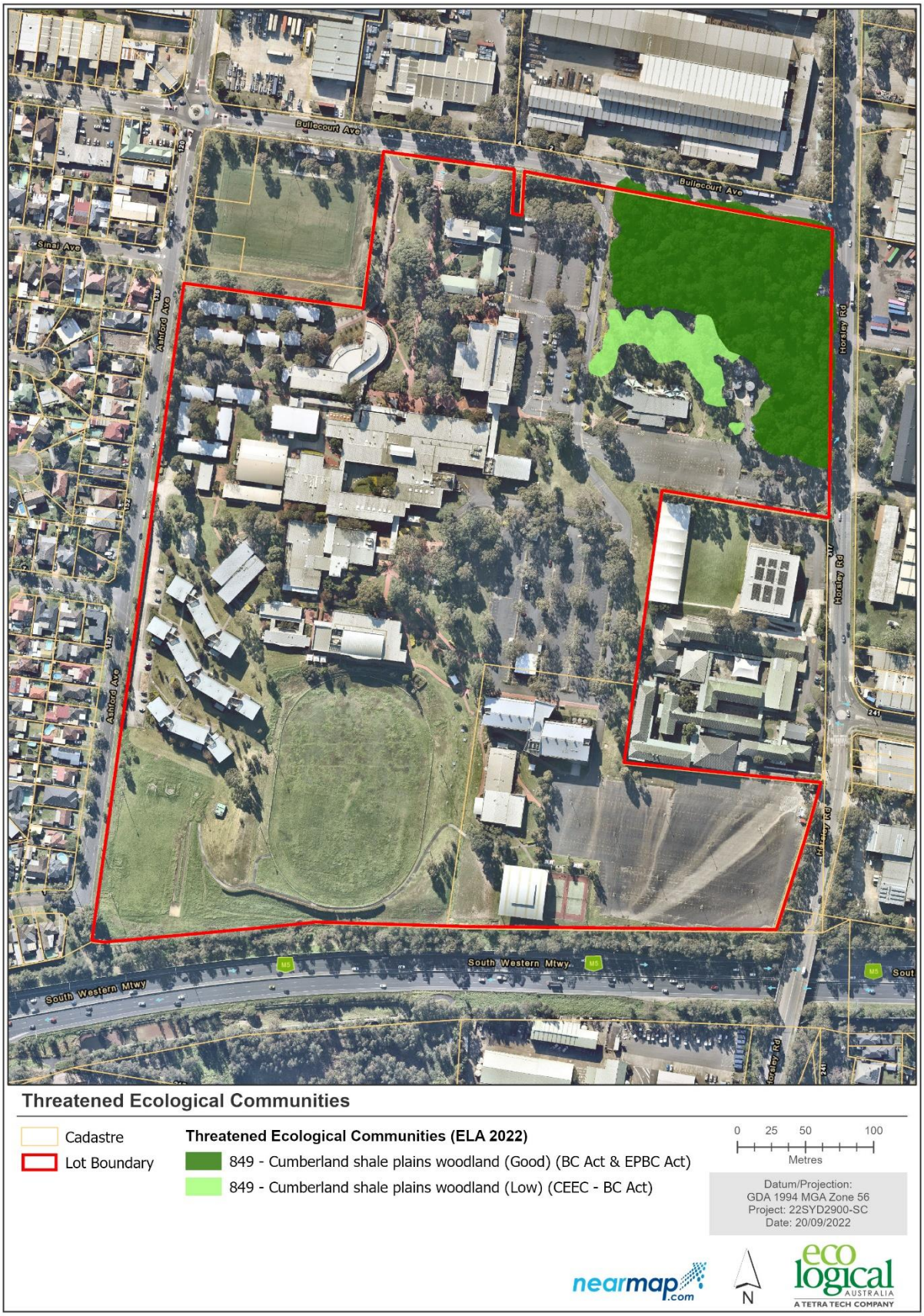

Figure 5: Threatened Ecological Communities

4.4 Use of the streamlined assessment module – Planted native vegetation

Due to the presence of planted native vegetation within the Development site, vegetation identified as 'Landscaped native vegetation' was assessed under the streamlined assessment module for planted native vegetation in accordance with Appendix D of BAM 2020. This appendix contains a decision-making key which provides a framework for the assessment of planted native vegetation. This framework is applied to the relevant area in Table 11.

Table 11: Decision-making key for the assessment of Planted native vegetation in accordance with Appendix D of the BAM 2020

Question	Response and justification
1) Does the planted native vegetation occur within an area that contains a mosaic of planted and remnant native vegetation and which can be reasonably assigned to a PCT known to occur in the same IBRA subregion as the proposal? i Yes – the planted native vegetation must be allocated to the best-fit PCT, and the BAM must be applied. ii **No – Go to 2**.	**No** – canopy species are clearly planted given they're within mulched garden beds, paving and landscaped mounds. No remnant native vegetation is present in the area. Where remnant native vegetation was adjacent to the planted native vegetation, it was mapped to a PCT rather than as part of the Landscaped native vegetation polygon.
1. Is the planted native vegetation: a. Planted for the purpose of environmental rehabilitation or restoration under an existing conservation obligation listed in BAM Section 11.9(2.), and b. The primary objective was to replace or regenerate a plant community type of a threatened plan species or its habitat? i Yes – the planted native vegetation must be assessed in accordance with Chapters 4 and 5 of the BAM ii **No – Go to 3**.	**No** – due to the location of canopy species, the trees were likely planted as landscaping.
1. Is the planted / translocated native vegetation individuals of a threatened species or other native species planted / translocated for the purpose of providing threatened species habitat under one of the following: a. A species recovery project b. *Saving our Species* project c. Other types of government funded restoration project d. Condition of consent for a development approval that required those species to be planted or translocated for the purpose of providing threatened species habitat e. Legal obligation as part of a condition of ruling of court. This includes regulatory directed or ordered remedial plantings (e.g. Remediation Order for clearing without consent issued under the BC Act or the Native Vegetation Act) f. Ecological rehabilitation to re-establish a PCT or TEC that was, or is carried out under a mine operations plan, or g. Approved vegetation management plan (e.g. as required as part of a Controlled Activity Approval for works on waterfront land under the NSW *Water Management Act 2000*)?	**No** – the native species present are not threatened and were not planted for rehabilitation, therefore it is unlikely that they were planted or translocated for one of the listed purposes.

Question	Response and justification
i Yes – the planted native vegetation must be assessed in accordance with Chapters 4 and 5 of the BAM • **No – Go to 4**.	
1. Was the planted native vegetation (including individuals of a threatened flora species) undertaken voluntarily for revegetation, environmental rehabilitation or restoration within a legal obligation to secure or provide for management of the native vegetation? i Yes – Go to D.2 Assessment of planted native vegetation for threatened species habitat (the use of Chapters 4 and 5 of the BAM are not required to be applied) • **No – Go to 5**.	**No** – the planted native vegetation forms part of the landscaping of the current infrastructure.
1. Is the planted native vegetation (including individuals of a threatened flora species) planted for functional, aesthetic, horticultural or plantation forestry purposes? This includes examples such as; windbreaks in agricultural landscapes, roadside plantings (including street trees, median stripes, roadside batters), landscaping in parks, gardens and sport fields/complexes, macadamia plantations or teatree farms? i **Yes – Go to D.2** Assessment of planted native vegetation for threatened species habitat (the use of Chapters 4 and 5 of the BAM are not required to be applied) ii No – Go to 6.	**Yes** – the planted native vegetation appears to be for aesthetic purposes.
1. Is the planted native vegetation a species listed as a widely cultivated native species on a list approved by the Secretary of the Department (or an officer authorised by the Secretary)? i Yes – Go to D.2 Assessment of planted native vegetation for threatened species habitat (the use of Chapters 4 and 5 of the BAM are not required to be applied) ii No – There may be other types of occurrences of planted native vegetation that do not easily fit into the decision-making key above.	N/A

4.4.1 Assessment of planted native vegetation for threatened species habitat

Areas of planted native vegetation were assessed for threatened species habitat using the same methods applied for the rest of the Development site. These methods and results are detailed in Section 4.5.

4.5 Threatened species

4.5.1 Ecosystem credit species

Ecosystem credit species predicted to occur within the Development site are generated by the BAM-C following the input of Vegetation Integrity (VI) data and the PCTs identified within section 4.2. Ecosystem credit species predicted to occur at the Development site, their associated habitat constraints, geographic limitations, sensitivity to gain class and justification for inclusion / exclusion is included in Table 12. In the table below, CE = Critically Endangered, E = Endangered and V = Vulnerable.

Table 12: Predicted ecosystem credit species

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	BC Act listing status	EPBC Act Listing status	Justification for exclusion of species
Anthochaera phrygia	Regent Honeyeater (Foraging)			High	CE	CE	Included
Artamus cyanopterus cyanopterus	Dusky Woodswallow			Moderate	V	Not Listed	Included
Callocephalon fimbriatum	Gang-gang Cockatoo (Foraging)			Moderate	V	Not Listed	Included
Chthonicola sagittata	Speckled Warbler			High	V	Not Listed	Excluded - Large, relatively undisturbed remnants are required for the species to persist in an area (DPIE 2022).
Circus assimilis	Spotted Harrier			Moderate	V	Not Listed	Included
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)			High	V	Not Listed	Included
Daphoenositta chrysoptera	Varied Sittella			Moderate	V	Not Listed	Included
Dasyurus maculatus	Spotted-tailed Quoll			High	V	E	Included
Glossopsitta pusilla	Little Lorikeet			High	V	Not Listed	Included
Grantiella picta	Painted Honeyeater			Moderate	V	V	Included

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	BC Act listing status	EPBC Act Listing status	Justification for exclusion of species
Haliaeetus leucogaster	White-bellied Sea-Eagle (Foraging)			High	V	Not Listed	Included
Hieraaetus morphnoides	Little Eagle (Foraging)			Moderate	V	Not Listed	Included
Hirundapus caudacutus	White-throated Needletail			High	Not Listed	V	Included
Lathamus discolor	Swift Parrot (Foraging)			Moderate	E	CE	Included
Lophoictinia isura	Square-tailed Kite (Foraging)			Moderate	V	Not Listed	Included
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)			Moderate	V	Not Listed	Excluded - Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses (DPIE 2022).
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)			Moderate	V	Not Listed	Included
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat			High	V	Not Listed	Included
Miniopterus australis	Little Bent-winged Bat (Foraging)			High	V	Not Listed	Included
Miniopterus orianae oceanensis	Large Bent-winged Bat (Foraging)			High	V	Not Listed	Included
Neophema pulchella	Turquoise Parrot			High	V	Not Listed	Included
Ninox connivens	Barking Owl (Foraging			High	V	Not Listed	Included
Ninox strenua	Powerful Owl (Foraging)			High	V	Not Listed	Included

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	BC Act listing status	EPBC Act Listing status	Justification for exclusion of species
Petroica boodang	Scarlet Robin			Moderate	V	Not Listed	Included
Petroica phoenicea	Flame Robin			Moderate	V	Not Listed	Included
Pteropus poliocephalus	Grey-headed Flying-fox (Foraging)			High	V	V	Included
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat			High	V	Not Listed	Included
Stagonopleura guttata	Diamond Firetail			Moderate	V	Not Listed	Included
Tyto novaehollandiae	Masked Owl (Foraging)			High	V	Not Listed	Included

4.5.2 Species credit species

4.5.2.1 Identification of species credit species

Species credit species derived from the operation of the BAM-C that require further assessment on the Development site (i.e. candidate species), their associated habitat constraints, geographic limitations, and sensitivity to gain class is included in Table 13.

Table 13: Candidate species credit species

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	BC Act listing status	EPBC Act Listing status
Acacia bynoeana	Bynoe's Wattle			High	E	V
Acacia pubescens	Downy Wattle			High	V	V
Anthochaera phrygia	Regent Honeyeater (Breeding)		As per mapped areas.	High	CE	CE
Burhinus grallarius	Bush Stone-curlew	Fallen/standing dead timber including logs.		High	E	Not Listed
Caladenia tessellata	Thick Lip Spider Orchid			Moderate	E	V
Callocephalon fimbriatum	Gang-gang Cockatoo (Breeding)	Hollow bearing trees. Eucalypt tree species with hollows greater than 9 cm diameter.		High	V	Not Listed
Cercartetus nanus	Eastern Pygmy-possum			High	V	Not Listed

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	BC Act listing status	EPBC Act Listing status
Chalinolobus dwyeri	Large-eared Pied Bat	Cliffs. Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels.		Very High	V	V
Cynanchum elegans	White-flowered Wax Plant			High	E	E
Dillwynia tenuifolia	Dillwynia tenuifolia			Moderate	V	Not Listed
Dillwynia tenuifolia	Dillwynia tenuifolia, Kemps Creek		Bounded by Western Road, Elizabeth Drive, Devonshire Road and Cross Street, Kemps Creek in the Liverpool LGA.	Very High	E population	Not Listed
Eucalyptus benthamii	Camden White Gum			High	V	Not Listed
Grevillea juniperina subsp. juniperina	Juniper-leaved Grevillea			Moderate	V	Not Listed
Haliaeetus leucogaster	White-bellied Sea-eagle (Breeding)	Other. Living or mature dead trees within 1 km of rivers, lakes, large dams or creeks, wetlands and coastlines.		High	V	Not Listed
Hieraaetus morphnoides	Little Eagle (Breeding)	Other. Nest trees - live (occasionally dead) large old trees within vegetation).		Moderate	V	Not Listed
Lathamus discolor	Swift Parrot (Breeding)	Other. As per mapped areas.		Moderate	E	CE
Litoria aurea	Green and Golden Bell Frog	Semi-permanent/ephemeral wet areas. Within 1km of swamps, waterbodies, and wet areas.		High	E	V

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	BC Act listing status	EPBC Act Listing status
Lophoictinia isura	Square-tailed Kite (Breeding)	Other. Nest trees.		Moderate	V	Not Listed
Marsdenia viridiflora subsp. viridiflora - endangered population	Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas.		Blacktown, Camden, Campbelltown, Canterbury-Bankstown, Cumberland, Fairfield, Liverpool and Penrith LGAs (as amended from the Determination)).	Moderate	E population	Not Listed
Meridolum corneovirens	Cumberland Plain Land Snail			High	E	Not Listed
Miniopterus australis	Little Bent-winged Bat (Breeding)	Caves. Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code 'IC – in cave'. Observation type code 'E nest-roost'. With numbers of individuals >500. Or from the scientific literature.		Very High	V	Not Listed
Miniopterus orianae oceanensis	Large Bent-winged Bat (Breeding)	Caves. Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code 'IC – in cave'. Observation type code 'E nest-roost'. With numbers of individuals >500."		Very High	V	Not Listed

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	BC Act listing status	EPBC Act Listing status
Myotis macropus	Southern Myotis	Hollow-bearing trees. Within 200m of a riparian zone. Other. Bridges, caves or artificial structures within 200m of riparian zone| Waterbodies. This includes rivers, creeks, billabongs, lagoons, dams and other waterbodies on or within 200 m of the site.		High	V	Not Listed
Ninox connivens	Barking Owl (Breeding)	HBTs. Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground."		High	V	Not Listed
Ninox strenua	Powerful Owl (Breeding)	HBTs. Living or dead trees with hollow greater than 20 cm diameter.		High	V	Not Listed
Persoonia bargoensis	Bargo Geebung			High	E	V
Petaurus norfolcensis	Squirrel Glider			High	V	Not Listed
Phascolarctos cinereus	Koala (Breeding)	Other. Presence of koala use trees - refer to Survey Comments field in TBDC		High	V	V
Pimelea curviflora var. curviflora				High	V	V
Pimelea spicata	Spiked Rice-flower			High	E	E

4.5.2.2 Assessment of habitat constraints and vagrant species

Species credit species excluded from further assessment, and justification for their exclusion, are presented in Table 14.

Table 14: Species credits excluded from further assessment

Species	Common Name	Justification for exclusion of species
Acacia bynoeana	Bynoe's Wattle	The Development site is substantially degraded and does not contain habitat for the species (i.e., heath or dry sclerophyll forest on sandy soils).
Anthochaera phrygia	Regent Honeyeater (Breeding)	The Development site is not included in the DPIE BAM – Regent Honeyeater Important Areas Map (accessed 15 September 2022).
Burhinus grallarius	Bush Stone-curlew	The Development site is substantially degraded. Vegetation zones within Development site lack fallen timber.
Caladenia tessellata	Thick Lip Spider Orchid	The Development site is substantially degraded and disturbed frequently to the extent that it would not support this species.
Cercartetus nanus	Eastern Pygmy possum	The Development site is substantially degraded and disturbed frequently to the extent that it would not support this species. This species is not associated with PCT 849 within the Threatened Species Database Collection.
Chalinolobus dwyeri	Large-eared Pied Bat	The Development site does not contain cliffs, caves, karsts, sandstone features or disused mines and is not within 2 km of rocky areas containing any of the habitat features required for the species.
Cynanchum elegans	White-flowered Wax Plant	The Development site is substantially degraded to the point where no vines were present.
Dillwynia tenuifolia	Dillwynia tenuifolia	The Development site is substantially degraded.
Eucalyptus benthamii	Camden White Gum	Conspicuous species, was not observed during field survey.
Grevillea juniperina subsp. juniperina	Juniper-leaved Grevillea	The Development site is substantially degraded. This conspicuous species was not observed during field survey.
Haliaeetus leucogaster	White-bellied Sea-eagle (Breeding)	The Development site does not contain large stick nests or suitable nest trees.
Hieraaetus morphnoides	Little Eagle (Breeding)	The Development site does not contain suitable nest trees.

Species	Common Name	Justification for exclusion of species
Lathamus discolor	Swift Parrot (Breeding)	The species is known to breed in Tasmania. The Development site is not included in the DPIE BAM – Important Areas Map (accessed 15 September 2022).
Litoria aurea	Green and Golden Bell Frog	No connectivity for this species occurs for suitable aquatic habitats within 1km of the Development site. There is no suitable habitat present for this species within the Development site.
Lophoictinia isura	Square-tailed Kite (Breeding)	The Development site does not contain suitable nest trees.
Marsdenia viridiflora subsp. viridiflora - endangered population	*Marsdenia viridiflora* R. Br. subsp. *viridiflora* population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	The Development site is substantially degraded. This conspicuous species was not observed during field survey.
Miniopterus australis	Little Bent-winged Bat (Breeding)	Species known only to breed in maternity caves. No breeding habitat present in the Development site or Assessment area.
Miniopterus orianae oceanensis	Large Bent-winged Bat (Breeding)	Species known only to breed in maternity caves. No breeding habitat present in the Development site or Assessment area.
Myotis macropus	Southern Myotis	No water bodies >3 m wide are present within 200m of the Development site.
Ninox connivens	Barking Owl (Breeding)	The Development site is substantially degraded and does not include habitat of sufficient area to provide density of prey habitat..
Persoonia bargoensis	Bargo Geebung	The Development site is substantially degraded and does not contain habitat for the species (i.e., gravely soils).
Petaurus norfolcensis	Squirrel Glider	The Development site is substantially degraded such that it does not contain the density of hollow bearing trees required by the species.
Phascolarctos cinereus	Koala (Breeding)	The Development site is substantially degraded and does not contain connectivity for this species.

Species	Common Name	Justification for exclusion of species
Pimelea curviflora var. curviflora		The Development site is substantially degraded and does not contain habitat for this species.
Pimelea spicata	Spiked Rice-flower	The Development site is substantially degraded and does not contain shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes.
Pommerhelix duralensis	Dural Land Snail	Outside of its occurrence on the northwest fringes of the Cumberland Plain, within the Hills Shire, Blue Mountains City, Penrith City, Hornsby Shire and Parramatta City LGAs, in shale - sandstone transitional landscapes. The Development site is substantially degraded and does not contain habitat for this transition specialist species (i.e., transitional soils).
Pteropus poliocephalus	Grey-headed Flying-fox (Breeding)	The Development site does not contain breeding camps.
Pterostylis saxicola	Sydney Plains Greenhood	The Development site is substantially degraded and disturbed frequently to the extent that it would not support this species.
Pultenaea pedunculata	Matted Bush-pea	The Development site is substantially degraded. This conspicuous species was not observed during field survey.
Thesium austral	Austral Toadflax	The Development site is substantially degraded for this species.

4.5.2.3 Candidate species requiring further assessment

Candidate species identified as requiring further assessment and their justification for inclusion is presented in Table 15.

Table 15: Candidate species credit species

Species	Common Name	Justification for inclusion of species
Acacia pubescens	Downy wattle	Species identified within the Lot boundary. Patches of PCT 849 in good condition represent habitat for the species.
Callocephalon fimbriatum	Gang-Gang Cockatoo	Eucalypt tree species identified within the lot boundary that contain hollows with a diameter of 10 cm or greater at least 9 m above the ground.
Eucalyptus benthamii	Camden White Gum	Patches of PCT 849 represent habitat for the species.
Meridolum corneovirens	Cumberland Plain Land Snail	Patches of PCT 849 represent habitat for the species.

Species	Common Name	Justification for inclusion of species
Ninox strenua	Powerful Owl	Trees with hollows >20cm were identified within the Lot boundary.

4.5.2.4 Targeted surveys

Targeted surveys for species credit species were undertaken at the Development site on the dates outlined in Table 16. The location of targeted surveys is shown on Figure 6, with the results of the surveys shown as individual species polygons on following figures.

Table 16: Targeted surveys

Date	Surveyors	Target species
25/07/22	Diane Campbell	*Acacia pubescens, Eucalyptus benthamii*

Weather conditions during the targeted surveys are outlined in Table 17.

Table 17: Weather conditions

Date	Rainfall (mm)	Minimum temperature °C	Maximum temperature °C
25/07/22	0.2	6.1	20.6

4.5.2.5 Results of targeted surveys

Following completion of targeted surveys, the species credit species that are present on the Development site are outlined in Table 18.

Table 18: Species credit species included in the assessment

Species	Common Name	Species presence	Geographic limitations	Number of individuals / Habitat (ha)	Biodiversity Risk Weighting
Acacia pubescens	Downy wattle	Yes (surveyed)		0.02 ha	high
Callocephalon fimbriatum	Gang-gang Cockatoo	Yes (assumed present)		0.47 ha	high
Eucalyptus benthamii	Camden White Gum	No (surveyed)		0	High
Meridolum corneovirens	Cumberland Plain Land Snail	Yes (assumed present)		0.03 ha	High
Ninox strenua	Powerful Owl	Yes (assumed present)		0.12 ha	High

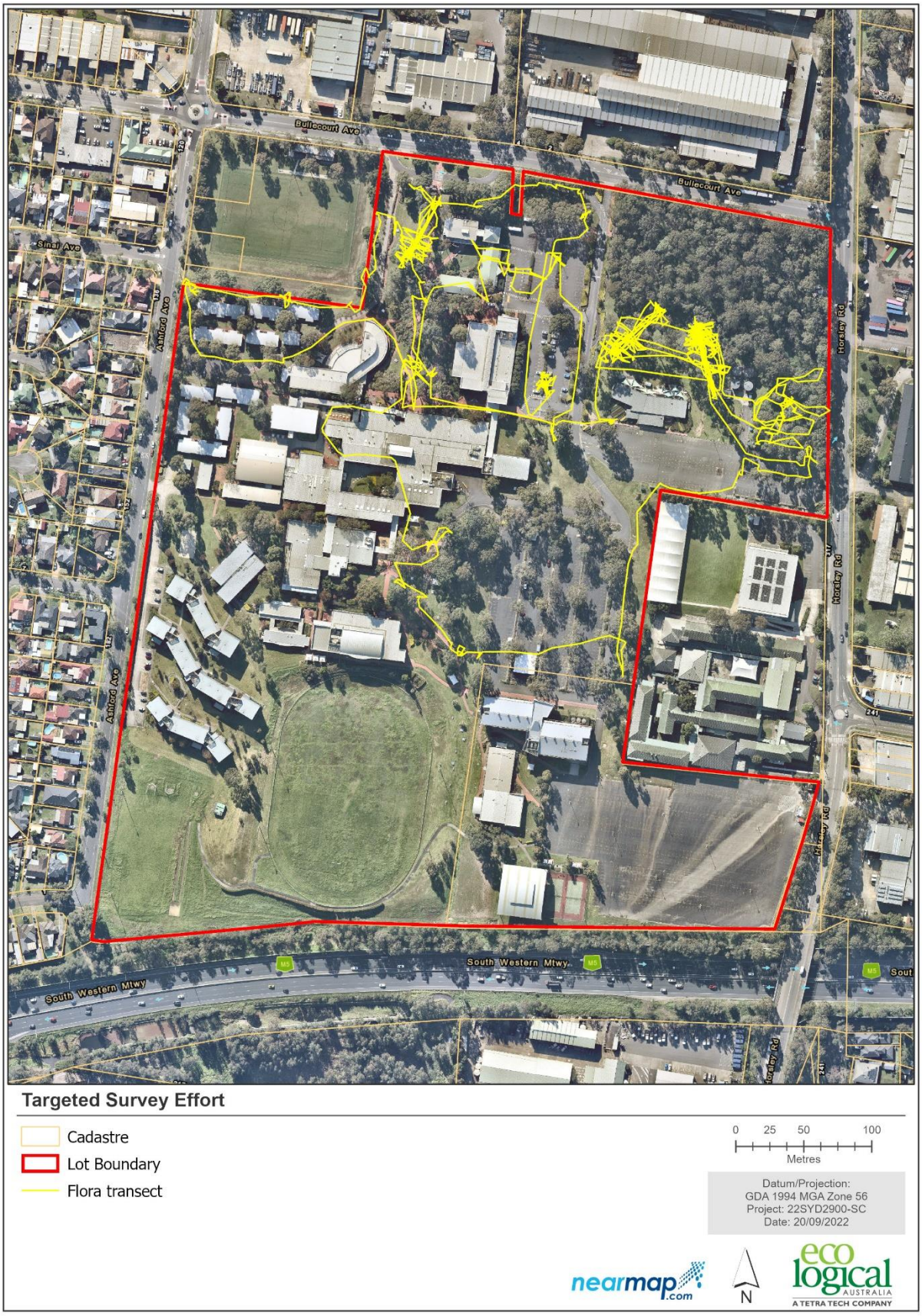

Figure 6: Targeted surveys

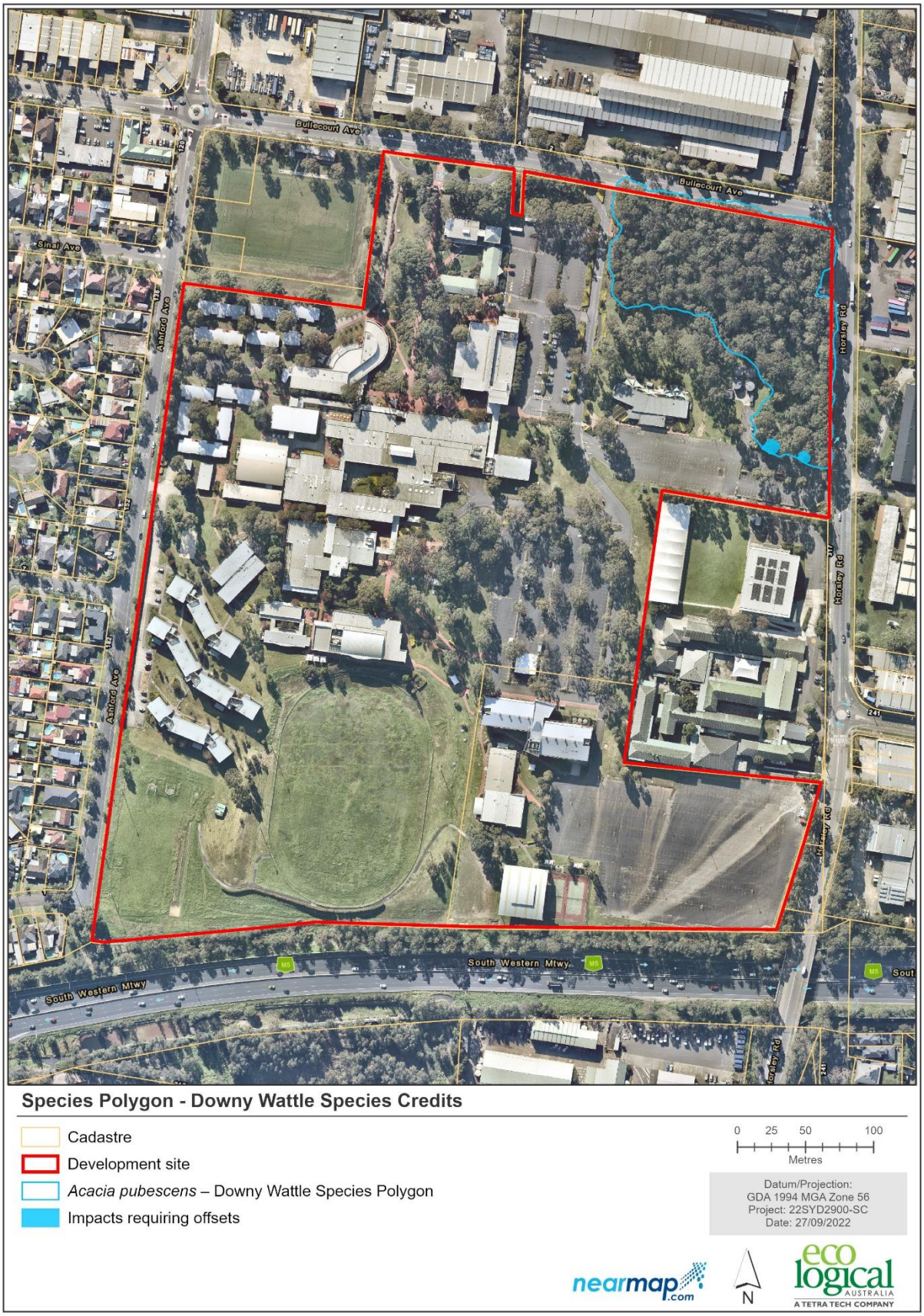

Figure 7: Acacia pubescens polygon

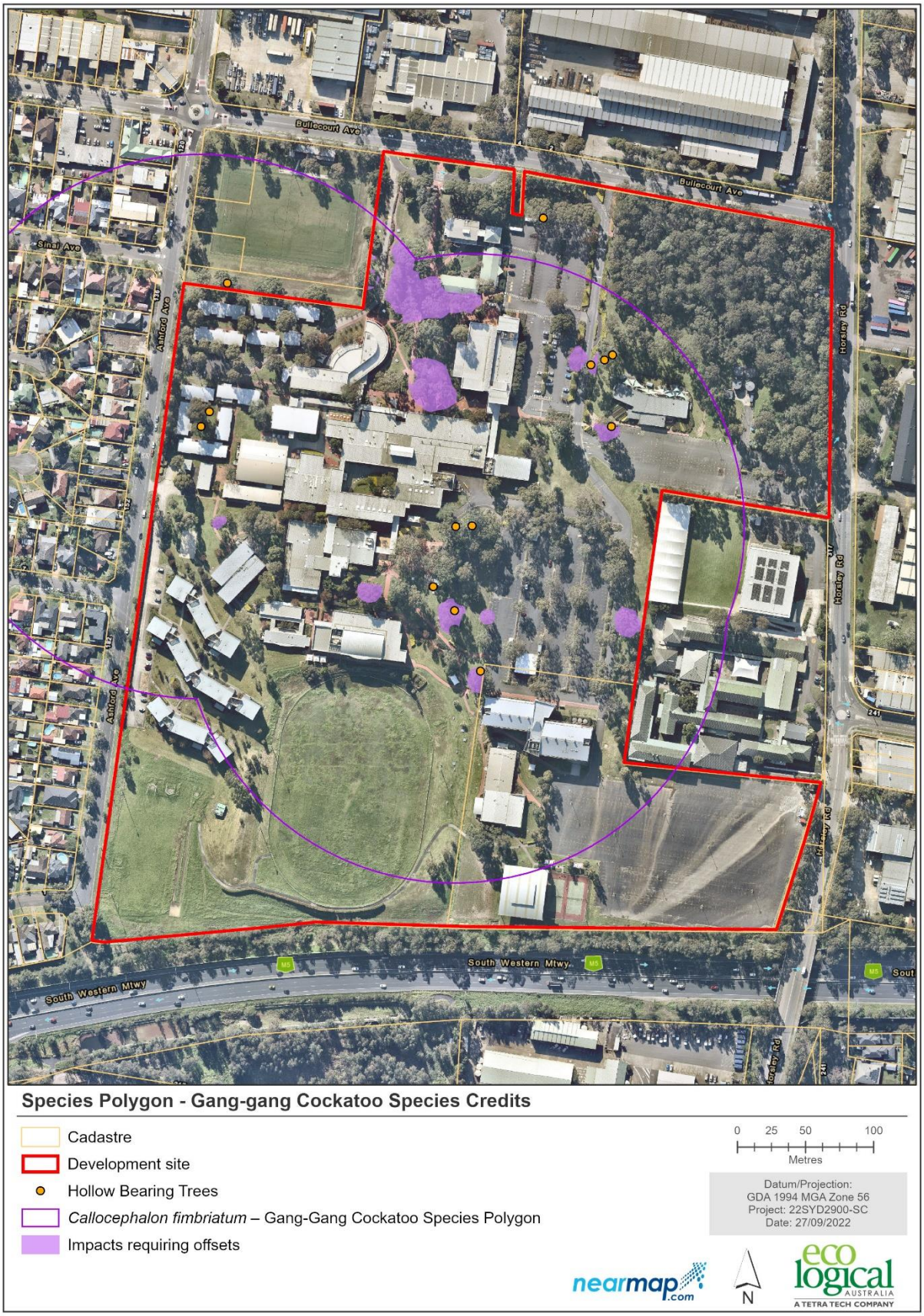

Figure 8: Gang-gang Cockatoo species polygon

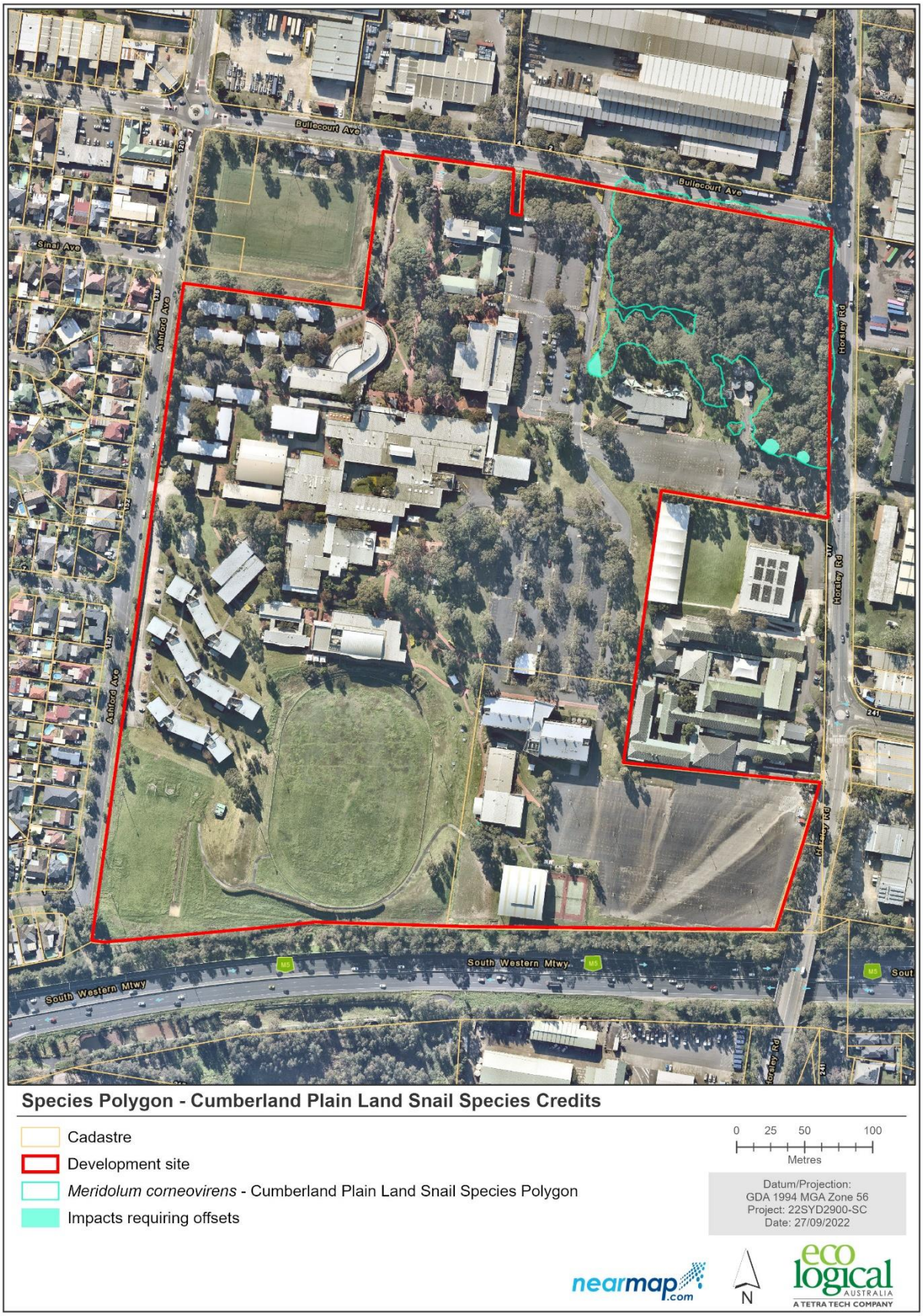

Figure 9: Cumberland Plain Land Snail Species Polygon

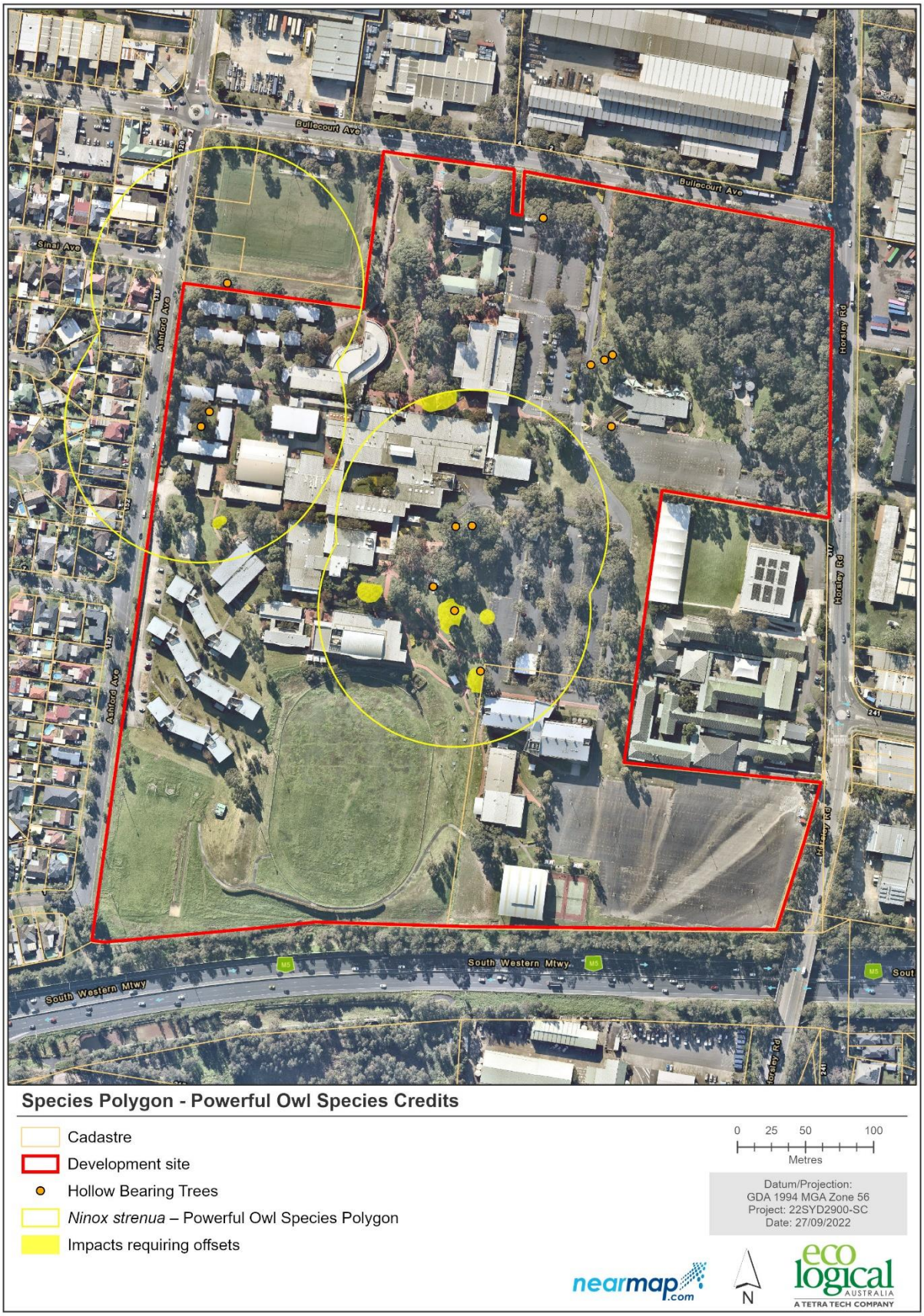

Figure 10: Powerful Owl species polygon

4.6 Identification of prescribed additional biodiversity impact entities

4.6.1 Karst, caves, crevices, cliffs, rocks and other geological features of significance

The Development site does not contain any geological features of significance.

4.6.2 Human-made structures and non-native vegetation

The Development site does contain human-made structures (buildings); however these facilities are modern well maintained and do not contain habitat (gaps, crevices etc) for species generally associated with human-made structures, and are considered unlikely to contain any habitat for roosting or breeding microchiropteran bats.

Non-native vegetation was present throughout the Development site and was not identified as potential habitat for any threatened species.

4.6.3 Habitat connectivity

The Development site is largely cleared, and connectivity is limited. Some connectivity for highly mobile species may be present between the scattered trees within the Development site. Tracts of native vegetation present along the lot boundaries may also provide some connectivity for highly mobile species. These areas of vegetation are separated from the Development site by fencing and adjacent roads. Connective vegetation in all cases will be retained.

An assessment of prescribed impacts to habitat connectivity is presented in Table 19.

Table 19: Prescribed impact – Habitat connectivity assessment

Criteria in accordance with BAM 2020 Section 6.1.3		Response
2. Where corridors or other areas of connectivity link habitat for threatened entities, the assessor must:		
a)	prepare a list of threatened entities that are likely to use or are a part of the connectivity or corridor	Highly mobile, threatened birds and bats that are likely to use native vegetation within the Development site (mostly while foraging) and were included as ecosystem credit species and are listed as 'included' in Table 12.
b)	describe the importance of the connectivity to threatened entities, particularly for maintaining movement that is crucial to the species' life cycle	Connectivity within the Assessment area would be maintained between greater tracts of native vegetation for the higher mobile species that would likely occur within the Development site. The largest most significant area of vegetation is being retained. Therefore, the connecting habitat within the Development site is not considered particularly important or crucial and landscape connectivity would be maintained. In particular the mature *E. crebra* and *E. moluccana* trees present within the subject land provides habitat connectivity for the Grey-headed Flying Fox to other areas of habitat across the Sydney region. The National Recovery Plan Grey-headed Flying Foxes 2021 states 'Grey-headed Flying-foxes forage over extensive areas and have been known to fly as far as 40 km to feed, before returning to their roost the same night'. The closest Grey-headed Flying-fox camp is approximately 5 km to the northwest of the subject land at Chipping Norton. This camp is currently unoccupied, however has previously

Criteria in accordance with BAM 2020 Section 6.1.3	Response
	supported up to 9,900 individuals and is considered a Nationally Important Camp for the species. When occupied the vegetation within the subject land would be considered an important foraging resource for this camp, however as mentioned above Grey headed Flying Foxes may travel as far as 40 kms away from their camp to feed. There is connective vegetation outside of the subject land along the vegetation associated with tributaries of Georges River and surrounding land in Milperra and Panania (Deepwater Park, south of Panania Waste Recovery Centre and other nearby reserves) which fall within the 40 kms of the Chipping Norton camp. Therefore, whilst the patches of *E. moluccana and E. crebra* within the development site are an important foraging resource for this species, it is not considered to be important to maintaining movement that it is critical to the survival of this species as it not located at the edge of the species foraging range. The avoidance of the majority of the good condition habitat on the subject land retains the most important component of its connectivity value for the arboreal species listed in Table 12, as a stepping stone resource linking to native within the Georges River area, especially surrounding land in Milperra and Panania such as Deepwater Park, south of Panania Waste Recovery Centre and other nearby reserves.

4.6.4 Water bodies, water quality and hydrological processes

The Development site does not contain any waterbodies.

4.6.5 Wind farm developments

This prescribed impact is not relevant to the proposed development.

4.6.6 Vehicle strikes

It is considered highly unlikely for fauna other than highly mobile species to be present within the Development site. And the proposed development would not exacerbate species at risk of vehicle strike given the current land use which has large numbers of vehicles entering the property and large car parks. Therefore, the proposed development would be unlikely to result in any additional incidences vehicle strike during construction or during operation as a residential subdivision.

5. BAM – Stage 2

5.1 Avoiding and Minimising Impacts on Biodiversity Values

The BAM requires locating and designing a project to avoid and minimise direct and indirect impacts on biodiversity values and prescribed biodiversity impacts. The development has avoided and minimised the impacts on the Cumberland Plain Woodland in good condition, and therefore has made efforts to avoid and minimise impacts on biodiversity values. This is further outlined in sections below.

5.2 Locating a project to avoid and minimise impacts on biodiversity values

5.2.1 Direct and indirect impacts

The development has been located to avoid and minimise impacts as outlined in Table 20.

Table 20: Locating a project to avoid and minimise impacts on biodiversity values

Approach	How addressed and justification
Locating the proposal in areas lacking biodiversity values	Most of the Development site (84 %) is situated within previously cleared areas containing infrastructure. In areas where vegetation is present (2.63 ha), planted exotic (14.4 %) and native vegetation (63.5 %) zones which lack biodiversity values are prioritised. However, the remaining proposal area will directly affect Cumberland Plain Woodland (PCT 849) (0.58 ha) and habitat for threatened species. Despite this, the highest biodiversity value area (PCT 849 Good) has been mostly avoided, with an additional 1.93 ha to remain within the northeast of the lot boundary, and 2.37 of PCT 849 all conditions retained overall. This patch will complement the proposed planting of 540 trees within the Development site and vegetation retained within the lot boundary.
Locating the proposal in areas that avoid habitat for species with a high biodiversity risk weighting or or native vegetation that is a TEC, a highly cleared PCT or an entity at risk of a serious and irreversible impact (SAII)	The proposed development would remove up to 0.58 ha of habitat for four species credit species with a high biodiversity risk weighting. However, location of the proposed development has avoided direct impacts of up to 2.37 ha of habitat for each of these species. Furthermore, additional species credit species survey may be undertaken during the formal BDAR to confirm if four of these species are absent from the Development site. This is considered likely due to the urban nature of the land. The proposed development would remove 0.03 ha of Cumberland Plain Woodland, a TEC that is highly cleared (93%) and an entity of risk of an SAII. Most patches of the TEC are degraded and isolated. The proposed development has avoided direct impacts of up to 2.37 ha of the TEC.
Locating the proposal in areas outside of the buffer area around breeding habitat features such as nest trees or caves	The Development site does not contain nest trees or caves. No caves were identified within 2 km of the site during a desktop assessment.

5.2.2 Prescribed biodiversity impacts

Table 21: Locating a project to avoid and minimise impacts on prescribed biodiversity values

Approach	How addressed and justification
Locate surface works to avoid direct impacts on the habitat features	The project would retain 1.93 ha of Cumberland Plain Woodland in good condition, and 2.37 ha in all conditions, which may provide connectivity for highly mobile species. Seven HBTs will be removed as part of the proposed works. Additional HBTs will remain within the PCT849 'Good' vegetation zone, which would provide nesting and roosting habitat for a range of threatened species.
Locating the envelope of sub-surface works, both in the horizontal and vertical plane, to avoid and minimise operations beneath the habitat features, e.g. locating long wall panels away from geological features of significance or water dependent plant communities and their supporting aquifers	Geotechnical or groundwater assessments have not been undertaken as part of this assessment. The Development site does not contain geological features of significance.
Locating the project to avoid severing or interfering with corridors connecting different areas of habitat and migratory flight paths to important habitat or preferred local movement pathways	• The Development site is substantially degraded, connectivity is limited and only available for highly mobile species, and about 2.79 ha of native vegetation would be retained within the lot boundary. Additionally a minimum 540 trees will be planted within the Development site following construction. As such, corridors of connectivity will still be available through proposed areas of open space. • The Development site is not known to form part of important or preferred flight paths for migratory birds.

5.3 Designing a project to avoid and minimise impacts on biodiversity values

5.3.1 Direct and indirect impacts

Table 22: Designing a project to avoid and minimise impacts on biodiversity values

Approach	How addressed and justification
Reducing the proposal's clearing footprint by minimising the number and type of facilities	The proposed development has been designed to retain 2.37 ha of Cumberland Plain Woodland (PCT 849) and proposes to plant at least 540 trees within the clearing footprint.
Locating ancillary facilities in areas that have no biodiversity values	Most of the Development site (86.34%) consists of previously cleared areas containing infrastructure and exotic vegetation which lack biodiversity values.
Locating ancillary facilities in areas where the native vegetation or threatened species habitat is in the poorest condition (i.e. areas with the lowest vegetation integrity scores)	The Development site overlaps with PCT 849 in 'landscaped', 'low' and 'good' condition. The vegetation integrity scores for these areas were 31.1, 44.6 and 75.9, respectively. Most impacts (0.55 ha) are proposed for PCT 849 in the 'Landscaped' condition, which has the lowest vegetation integrity score.
Locating ancillary facilities in areas that avoid habitat for species and vegetation that has a high threat status (e.g. an endangered ecological community (EEC) or critically	The proposed development would remove up to 1.75 ha of habitat for four species credit species with a high biodiversity risk weighting. However, location of the proposed development has avoided direct impacts of up to 2.37 ha of habitat for each of these species. Furthermore, additional species

Approach	How addressed and justification
endangered ecological community (CEEC) or is an entity at risk of a serious and irreversible impact (SAII)	credit species survey may be undertaken during the formal BDAR to confirm up to four of these species are absent from the Development site. The proposed development would remove 0.03 ha of Cumberland Plain Woodland, a CEEC that is an entity of risk of an SAII. 0.01 ha of this TEC are considered to be of a 'Low' condition type. The proposed development would avoid direct impacts to 2.37 ha of the TEC.
Actions and activities that provide for rehabilitation, ecological restoration and/or ongoing maintenance of retained areas of native vegetation, threatened species, threatened ecological communities and their habitat on the subject land.	The design would retain 2.37 ha of Cumberland Plain Woodland, including an additional 0.11 ha of a 'Landscaped' area of PCT 849 plus 0.42 ha of landscaped native vegetation. Areas of open space and planted vegetation (minimum 540 trees) will form part of the design which would retain connectivity.

5.3.2 Prescribed biodiversity impacts

Table 23: Designing a project to avoid and minimise impacts on prescribed biodiversity values

Approach	How addressed and justification
Design of project elements to minimise interactions with threatened entities	The proposed development would minimise interactions with threatened entities through retaining 2.37 ha of Cumberland Plain Woodland and an additional 0.42 ha of landscaped native vegetation which may provide connectivity for highly mobile species.
Controlling the quality of water released from the site, to avoid or minimise downstream impacts on threatened entities	Changes to stormwater or other water released from the Development site has not yet been assessed. Mitigation measures should be implemented to ensure stormwater quantity and quality from the future development does not impact the receiving environment.

5.4 Assessment of Impacts

5.4.1 Direct impacts

The direct impacts of the development on:

- native vegetation and threatened ecological communities are outlined in Table 24
- threatened species and threatened species habitat is outlined in Table 25
- prescribed biodiversity impacts is outlined in Section 6.4.

Table 24: Direct impacts to native vegetation

Veg Zone	PCT ID	PCT Name			BC Act listing	EPBC Act listing	Direct impact (ha)
1	849	Cumberland woodland	shale	plains	CE	CE	0.02
2	849	Cumberland woodland	shale	plains	CE	Not listed	0.01
3	849	Cumberland woodland	shale	plains	Not listed	Not listed	0.55

Veg Zone	PCT ID	PCT Name	BC Act listing	EPBC Act listing	Direct impact (ha)
Total					0.58

Table 25: Direct impacts on threatened species and threatened species habitat

Species	Common Name	Direct impact number of individuals / habitat (ha)	BC Act listing status	EPBC Act Listing status
Acacia pubescens	Downy wattle	0.02 ha	V	V
Callocephalon fimbriatum	Gang-gang Cockatoo	0.47 ha	V	-
Meridolum corneovirens	Cumberland Plain Land Snail	0.03 ha	E	-
Ninox strenua	Powerful Owl	0.12 ha	V	-

5.4.1.1 Change in vegetation integrity

The change in vegetation integrity as a result of the development is outlined in Table 26.

Table 26: Change in vegetation integrity

Veg Zone	PCT ID	Condition	Area (ha)	Current vegetation integrity score	Future vegetation integrity score	Change in vegetation integrity
1	849	Good	0.02	75.9	0	-75.9
2	849	Low	0.01	44.6	0	-44.6
3	849	Landscaped	0.55	31.1	0	-31.1

5.4.1.2 Serious and Irreversible Impacts

The development has one candidate Serious and Irreversible Impacts (SAII) values as outlined in Table 31 as listed in the Threatened Biodiversity Data Collection (accessed 12 September 2022). Detailed consideration of whether impacts on this TEC is included in Table 32.

5.4.2 Indirect impacts

The indirect impacts of the development are outlined in Table 27.

Table 27: Indirect impacts

Indirect impact	Description (nature, extent and frequency)	Biodiversity affected	Duration/ Timing	Consequence
Inadvertent impacts on adjacent habitat or vegetation	Accidental damage or removal of vegetation or habitat during construction works. May affect vegetation to be retained within	Native vegetation and TECs.	During construction works	Damage to adjacent habitat or vegetation

Indirect impact	Description (nature, extent and frequency)	Biodiversity affected	Duration/ Timing	Consequence
	the Development site or lot boundary.			
Reduced viability of adjacent habitat due to edge effects	Increased edge effects from adjacent development. Potential as result of construction or operation of the university.	Native vegetation and TECs retained within the lot boundary.	Construction and operation	Increased edge effects for retained vegetation
Reduced viability of adjacent habitat due to noise, dust or light spill	Increased noise, dust or light spill.	Native vegetation and habitats retained within the lot boundary.	Construction	Damage to adjacent habitat
Transport of weeds and pathogens from the site to adjacent vegetation	Spread of weed seed or pathogens. Potential for spread into adjacent habitat and retained vegetation.	Native vegetation and TECs retained within the lot boundary.	Construction	Spread of weed seed or pathogens
Increased risk of starvation or exposure and loss of shade or shelter	N/A - Native vegetation within the Development site would be removed such that fragmentation of any adjacent habitat would not be increased.	N/A	N/A	N/A
Loss of breeding habitat	Negligible. No specialist breeding habitat identified within the Development site	N/A	N/A	N/A
Trampling of threatened flora species	N/A – no additional threatened flora species other than the habitat for *Acacia pubescens* which is being removed are known to occur within the Development site.	N/A	N/A	N/A
Inhibition of nitrogen fixation and increased soil salinity	N/A – the proposal unlikely to exacerbate the inhibition of nitrogen fixation and increased soil salinity given that the Development site is already significantly disturbed.	N/A	N/A	N/A

Indirect impact	Description (nature, extent and frequency)	Biodiversity affected	Duration/ Timing	Consequence
Fertiliser drift	Use of fertiliser during landscaping.	Potential for spread into areas containing retained vegetation.	Construction and operation	Fertiliser drift may favour exotic species growth within the landscape.
Rubbish dumping	Illegal dumping by construction crew and littering by facility users.	Rubbish is unlikely to remain to affect biodiversity.	Construction and operation	Ingestion by local fauna and damage to adjacent habitat
Wood collection	Past, current and future tree senescence may result in woody debris.	Habitat within retained vegetation.	Operation	Removal of terrestrial habitat
Removal and disturbance of rocks including bush rock	N/A – No increase in daily predation is expected.	Habitat within retained vegetation.	Operation	
Increase in predators	N/A – No increase in daily predation is expected.	N/A	N/A	N/A
Increase in pest animal populations	N/A – The Development site is unlikely to result in an increase in pest animal populations.	N/A	N/A	N/A
Changed fire regimes	N/A – The Development site will not change fire regimes.	N/A	N/A	N/A
Disturbance to specialist breeding and foraging habitat, e.g. beach nesting for shorebirds.	N/A - the Development site does not contain specialist breeding and foraging habitat.	N/A	N/A	N/A
Sedimentation and contaminated and/or nutrient rich run-off	Increase in sedimentation and contamination during construction.	Retained vegetation within the boundary lot and downstream aquatic environment.	construction	

5.4.3 Prescribed biodiversity impacts

The Development site has the prescribed biodiversity impacts as outlined in Table 28.

Table 28: Direct impacts on prescribed biodiversity impacts

Prescribed biodiversity impact	Description (Nature, extent and frequency)	Consequences	Justification	Additional information
Karst, caves, crevices, cliffs, rocks and other geological features of significance	N/A	N/A	N/A	N/A

Prescribed biodiversity impact	Description (Nature, extent and frequency)	Consequences	Justification	Additional information
Human made structures or non-native vegetation	N/A	N/A	N/A	N/A
Habitat connectivity	Removal of native vegetation.	The consequence to connective habitat is expected to be minimal for species that would use the Development site (highly mobile species).	Vegetation proposed to be removed would not result in the isolation or fragmentation of areas of habitat. A high percentage of the native vegetation will remain within the Development site and lot boundary to preserve connectivity.	N/A
Water bodies, water quality and hydrological processes	N/A	N/A	N/A	N/A
Wind turbine strikes on protected animals	N/A	N/A	N/A	N/A
Vehicle strikes	N/A	N/A	N/A	N/A

5.4.4 Mitigating and managing direct and indirect impacts

Measures proposed to mitigate and manage impacts at the Development site before, during and after construction are outlined in Table 29. These measures are indicative and will be confirmed when the formal BDAR is prepared at DA stage.

Table 29: Measures proposed to mitigate and manage impacts

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
Making provision for the ecological protection of retained native vegetation habitat on or adjacent to the Development site	Moderate	Nil	Protection of the northeast corner via a C2 zoning and a Terrestrial Biodiversity overlay	Planning restriction to future works being completed within retained vegetation	Prior to construction.	Project Manager
Instigating clearing protocols including pre-	Moderate	Low	Pre-clearance survey of habitat trees to be removed and identification/location	Any fauna utilising habitat within the Development	Prior to and during clearing works.	Project Manager / Ecologist

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
clearing surveys, daily surveys and staged clearing, the presence of a trained ecological or licensed wildlife handler during clearing events			of active nests by a suitably qualified ecologist	site will be identified and managed to ensure clearing works minimise the likelihood of injuring resident fauna		
Revegetation and landscaping of the Development site	Moderate	very low	Planting of 540 trees within the Development site.	Improvement in connectivity and habitat	Following construction	Project Manager

5.4.5 Mitigating prescribed impacts

Measures proposed to mitigate and manage prescribed biodiversity impacts at the Development site before, during and after construction are outlined in Table 30. As this document relates to a Planning Proposal rather than a specific development, the mitigation measures are preliminary only and will be considered in more detail at the Development Application stage.

Table 30: Mitigation measures for prescribed biodiversity impacts

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
Ecological restoration, rehabilitation actions and/or maintenance of retained native vegetation on or adjacent to the subject land	Moderate	Very low	Planting of at least 540 trees within the Development site will preserve and create additional connectivity across the Development site. Protection of vegetation within the northeast corner of the lot boundary via a C2 zoning and a Terrestrial Biodiversity overlay	Retained habitat can continue to provide connectivity for highly mobile species	Prior and during operation.	Project manager

5.4.6 Adaptive management strategy

No adaptive management strategy is proposed.

5.5 Impact summary

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

5.5.1 Serious and Irreversible Impacts

The development has one candidate Serious and Irreversible Impacts (SAII) values as outlined in Table 31 as listed in the Threatened Biodiversity Data Collection (accessed 15 September 2022). The location of the candidate SAII is shown on Figure 11. Detailed consideration of impacts on this TEC is included in Table 32.

Table 31: Serious and Irreversible Impact summary

Community	Common Name	Principle	Direct impact	Threshold
Cumberland Plain Woodland in the Sydney Basin Bioregion	-	1 and 2	0.03	Under development

Table 32: Evaluation of an impact on a TEC consistent with 9.1.1 of the BAM

Impact Assessment Provisions	Assessment
1. the action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII	Refer to section 5.2 and 5.3.
2a. evidence of reduction in geographic distribution (Principle 1, clause 6.7(2)(a) BC Regulation) as the current total geographic extent of the TEC in NSW AND the estimated reduction in geographic extent of the TEC since 1970 (not including impacts of the proposal)	The most recent information about the reduction in geographic distribution of the TEC in NSW is contained in the Final Determination, which includes the following: • The total extent of Cumberland Plain Woodland was estimated to be ~8.8% of the community's pre-European distribution by Tozer in 2003 based on aerial photography from 1998 • This estimate was updated in 2007, showing a decline of ~5.2% in 9 years • There are currently no estimates of the decline in the TEC since 1970.
2b. extent of reduction in ecological function for the TEC using evidence that describes the degree of environmental degradation or disruption to biotic processes (Principle 2, clause 6.7(2)(b) BC Regulation) indicated by: i. change in community structure ii. change in species composition iii. disruption of ecological processes iv. invasion and establishment of exotic species v. degradation of habitat, and vi. fragmentation of habitat	The extent of reduction in ecological function for the TEC is also found in the Final Determination, as follows: • The community structure has changed such that almost all of the remaining Cumberland Plain Woodland is considered to be regrowth forest and woodland from past clearing activities. • Species composition has changed such that remnants are largely degraded by weed invasion and regrowth stands with high densities of saplings or shrubs may supress ground flora. • Ecological processes have been disrupted by the chemical and structural modification associated with agricultural land uses and more recent expansion of urban land uses which the Cumberland Plain has historically been subjected to.

Impact Assessment Provisions	Assessment
	• The TEC has been identified as being severely fragmented.
2c. evidence of restricted geographic distribution (Principle 3, clause 6.7 (2) (c) BC Regulation), based on the TECs geographic range in NSW according to the: i. extent of occurrence ii. area of occupancy, and iii. number of threat-defined locations.	Cumberland Plain woodland is highly restricted to the Sydney Basin Bioregion. According to the Final Determination, it was estimated to occur within an extent of 2,810 km^2 and is known from the Auburn, Bankstown, Baulkham Hills, Blacktown, Camden, Campbelltown, Fairfield, Hawkesbury, Holroyd, Liverpool, Parramatta, Penrith and Wollondilly LGAs. These locations are all subject to threats to the TEC, including weed invasion and clearing of native vegetation
2d. evidence that the TEC is unlikely to respond to management (Principle 4, clause 6.7 (2) (d) BC Regulation).	The Final Determination states that areas where management aims to conserve the TEC suggests that it is capable of some recovery, provided the soil has not been disturbed by earthworks, cultivation, fertiliser application or other means of nutrient or moisture enrichment. The Final Determination also states that opportunities for restoration of the TEC is limited, given that the majority of the former distribution of the community has been subjected to some soil disturbance.
3. Where the TBDC indicated that data is 'unknown' or 'data deficient' for a TEC for a criterion listed in subsection 9.1.1(2), the assessor must record this in the BDAR or BCAR.	N/A – all data is provided in the Final Determination as summarised above
4a. the impact on the geographic extent of the TEC (Principles 1 and 3) by estimating the total area of the TEC to be impacted by the proposal: i. in hectares, and ii. as a percentage of the current geographic extent of the TEC in NSW.	The total area of the TEC to be affected by the proposal is 0.03 ha. Existing information within the VIS estimates 11,200 ha of Cumberland Plain Woodland (identified as PCT 849 or 850 by previous mapping) is present in NSW. Therefore, the area of TEC to be affected represents an estimate of 0.0004% of the current geographic extent of the TEC. It should be noted that this analysis used existing datasets and did not include ground truthing the extent of any mapped Cumberland Plain Woodland.
4b. the extent that the proposed impacts are likely to contribute to further environmental degradation or the disruption of biotic processes (Principle 2) of the TEC by: i. estimating the size of any remaining, but now isolated, areas of the TEC; including areas of the TEC within 500 m of the development footprint or equivalent area for other types of proposals ii. describing the impacts on connectivity and fragmentation of the remaining areas of TEC measured by: - distance between isolated areas of the TEC, presented as the average distance if the remnant is retained AND the average distance if the remnant is removed as proposed, and - estimated maximum dispersal distance for native flora species characteristic of the TEC, and	Using aerial imagery, 107.8 ha of Cumberland Plain Woodland were estimated from within 500 m of the development footprint, excluding the 2.95 ha present within it. Therefore, this proposal would remove 0.54% (0. ha) of the extent (107.8 ha) within 500 m of the Development site. It should be noted that the GIS analysis used existing vegetation mapping datasets and did not include ground truthing the extent of the mapped Cumberland Plain Woodland. The area proposed for removal are along the perimeter of the larger extent of the patch that will be retained. About 1.93 ha of the TEC will be retained in the northeast patch, and 2.37 ha of Cumberland Plain Woodland (all conditions) retained overall. No impacts to connectivity or fragmentation of other patches of the TEC will occur. The TEC was identified as being in Low and Good conditions. The composition, structure and function condition scores for each vegetation zones are as follows:

Impact Assessment Provisions	Assessment
- other information relevant to describing the impact on connectivity and fragmentation, such as the area to perimeter ratio for remaining areas of the TEC as a result of the development iii. describing the condition of the TEC according to the vegetation integrity score for the relevant vegetation zone(s) (Section 4.3). The assessor must also include the relevant composition, structure and function condition scores for each vegetation zone.	• Veg Zone 1: 62.1, 87.5, 80.5 • Veg zone 2: 17.4, 77.5, 39.

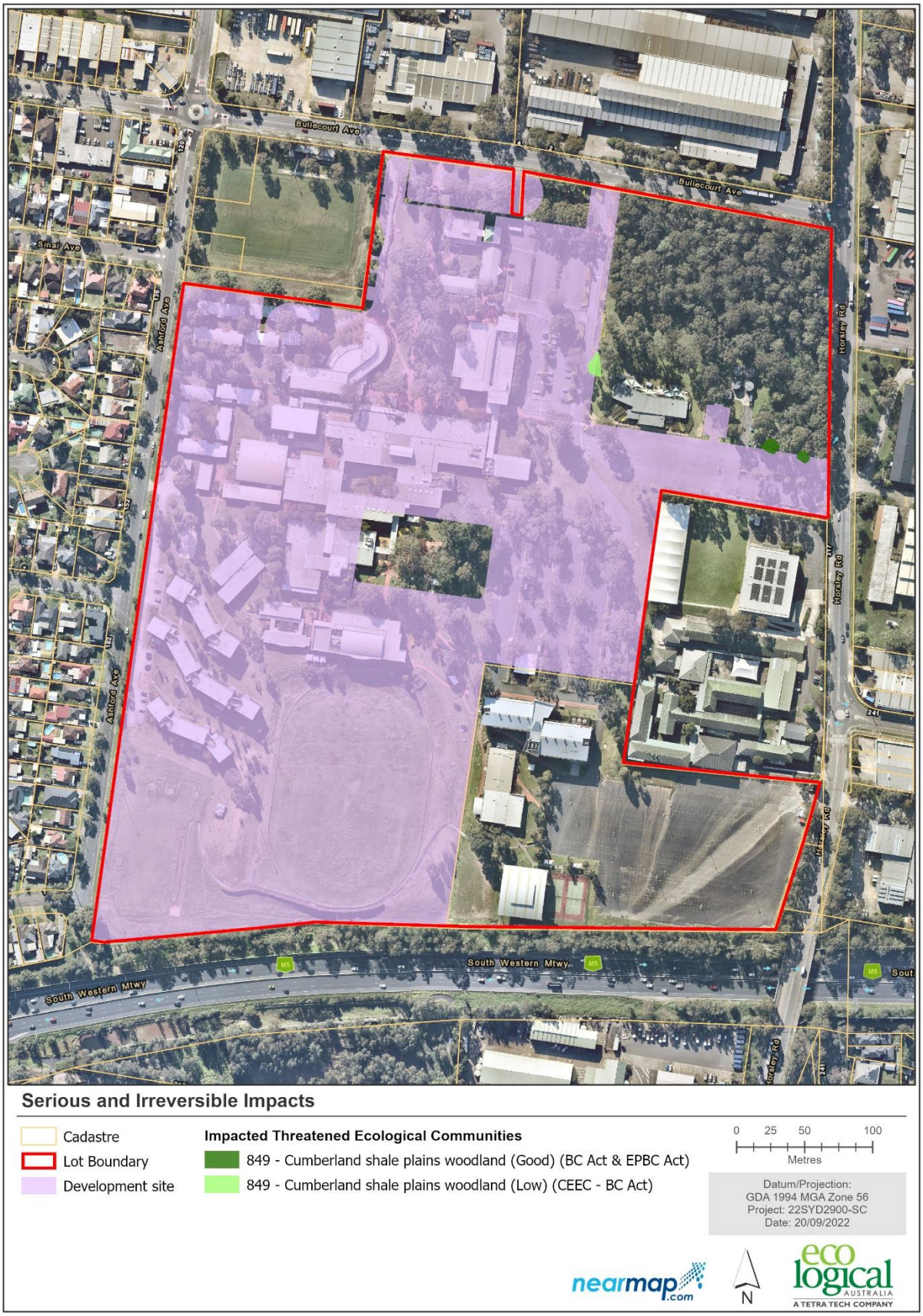

Figure 11: Candidate SAII

5.5.2 Impacts requiring offsets

The impacts of the development requiring offset for native vegetation are outlined in Table 33 and shown on Figure 12. The impacts of the development requiring offset for species credit species and their habitat are outlined in Table 34 and on Figure 16.

Table 33: Impacts to native vegetation requiring offsets

Vegetation zone	PCT ID	PCT Name	Condition	Vegetation Class	Vegetation formation	Direct impact (ha)
1	849	Cumberland shale plains woodland	Good	Coastal Valley Grassy Woodland	Grassy Woodlands	0.02
2	849	Cumberland shale plains woodland	Low	Coastal Valley Grassy Woodland	Grassy Woodlands	0.01
3	849	Cumberland shale plains woodland	Landscaped	Coastal Valley Grassy Woodland	Grassy Woodlands	0.55

Table 34: Impacts on threatened species and threatened species habitat that require offsets

Species	Common Name	Direct impact number of individuals / habitat (ha)	BC Act listing status	EPBC Act Listing status	Comment
Acacia pubescens	Downy wattle	0.02 ha	V	V	Yes (surveyed)
Callocephalon fimbriatum	Gang-Gang Cockatoo	0.47 ha	V	-	Assumed present due to survey period constraints
Meridolum corneovirens	Cumberland Plain Land Snail	0.03 ha	E	-	Assumed present due to survey period constraints
Ninox strenua	Powerful Owl	0.12 ha	V	-	Assumed present due to survey period constraints

5.5.3 Impacts not requiring offsets

Offsets for impacts to planted and native and exotic vegetation are not required, as shown in Figure 13 and described in Section 4.

5.5.4 Areas not requiring assessment

Areas not requiring assessment are those within the Development site which were assessed under the streamlined assessment module for planted native vegetation in accordance with Appendix D of BAM 2020 and that which did not contain vegetation.

5.6 Credit summary

The number of ecosystem credits required for the development are outlined in Table 35. The number of species credits required for the development are outlined in Table 36. A biodiversity credit report is included in Appendix E.

Table 35: Ecosystem credits required

Vegetation Zone	PCT ID	PCT Name	Credit Class	Direct (ha)	Impact	Credits required
1	849	Cumberland shale plains woodland	Ecosystem	0.02		1
2	849	Cumberland shale plains woodland	Ecosystem	0.01		1
3	849	Cumberland shale plains woodland	Ecosystem	0.55		11
			Total	0.58 ha		13

Table 36: Species credit summary

Species	Common Name	Direct Impact (ha)	Credits required
Acacia pubescens	Downy wattle	0.02	1
Callocephalon fimbriatum	Gang-Gang Cockatoo	0.47	8
Meridolum corneovirens	Cumberland Plain Land Snail	0.03	2
Ninox strenua	Powerful Owl	0.12	2

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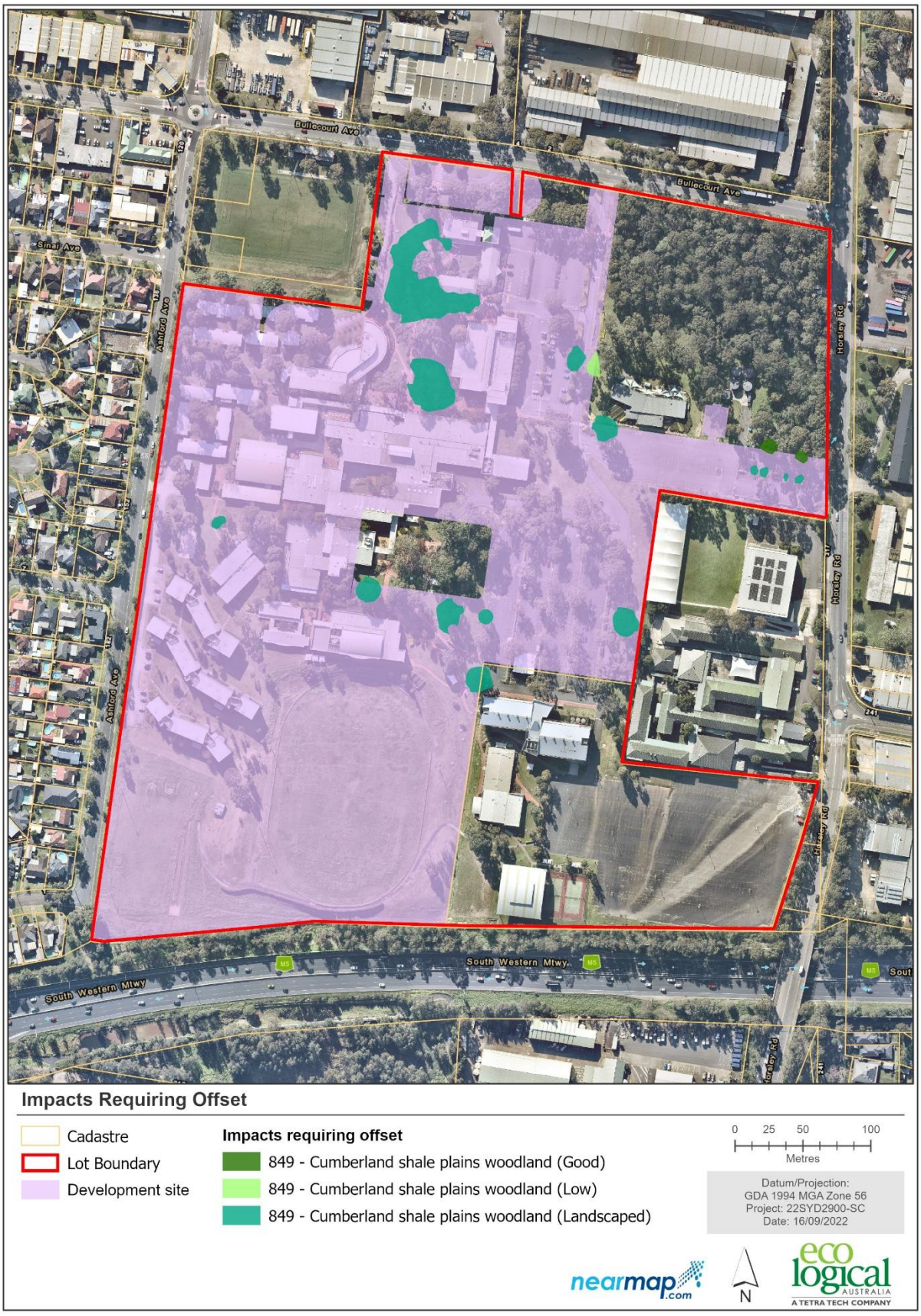

Figure 12: Impacts requiring offsets

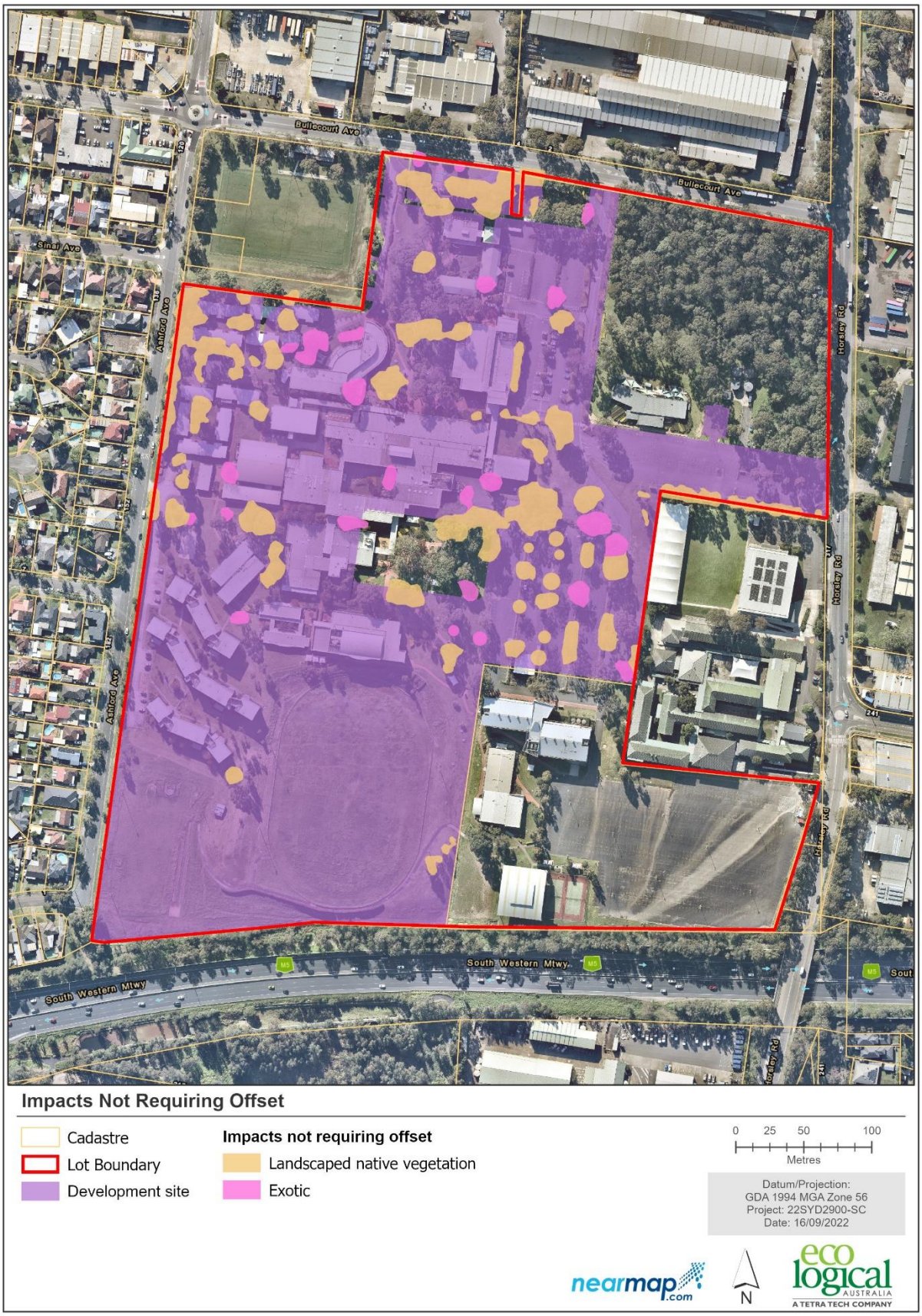

Figure 13: Impacts not requiring offsets

6. Conclusion

Eco Logical Australia was engaged by Mirvac to prepare an ecological assessment that applies Stage 1 and 2 of the BAM to a proposed planning proposal that will rezone the WSU Milperra campus for residential business, recreation and conservation uses.

Native vegetation within the development site was identified as PCT 849 Cumberland shale plains woodland as listed in the table below. PCT 849 is a CEEC under both the BC and EPBC Acts and is considered an SAII. Consideration of this MNES under the EPBC Act will be required during the preparation of the formal BDAR at the DA stage. Section 5.5.1 outlines the SAII. Parts of the Development site was assessed under the streamlined assessment module for planted native vegetation in accordance with Appendix D of BAM 2020.

The proposal will result in the retention of most Cumberland Plain Woodland in good condition, removing only minimal area of 0.01% (0.02 ha of 1.95 ha) and retention of the majority of CPW in low condition removing 2.94% (0.01 ha of 0.34 ha). Overall the proposal will retain 98.69% (2.26 ha of 2.29 ha) CPW in good and low conditions. Most of the vegetation proposed to be removed is 1.67 ha of landscaped native vegetation, 0.55 ha of CPW in landscaped condition, and 0.38 ha of exotic vegetation. In addition, a minimum 540 trees will be planted for landscaping purposes.

Table 37 below outlines the associated ecosystem credit requirements to offset impacts to native vegetation.

Table 37: Ecosystem credit impact summary

Vegetation Zone	PCT ID	PCT Name	Condition	Credit class	Direct impact	Credits Required
1	849	Cumberland shale plains woodland	Good	Ecosystem credits	0.02	1
2	849	Cumberland shale plains woodland	Low	Ecosystem credits	0.01	1
3	849	Cumberland shale plains woodland	Landscaped	Ecosystem credits	0.55	11
				Total	0.58	13

This vegetation also provides habitat for one threatened flora species which was identified within the Lot Boundary and three threatened fauna species which were 'assumed present' within the Development site due to survey period timing, and approval timing constraints (Table 38). These species credits could later be surveyed for prior to the submission of the formal BDAR.

Table 38: Species credit impact summary

Species	Common Name	Species presence	Number of individuals / Habitat (ha)	Credits required
Acacia pubescens	Downy wattle	Yes (surveyed)	0.02 ha	1

Species	Common Name	Species presence	Number of individuals / Habitat (ha)	Credits required
Callocephalon fimbriatum	Gang-gang Cockatoo	Yes (assumed present)	0.47 ha	8
Meridolum corneovirens	Cumberland Plain Land Snail	Yes (assumed present)	0.03 ha	2
Ninox strenua	Powerful Owl	Yes (assumed present)	0.12 ha	2

To ensure protection of Cumberland Plain Woodland in the north-east of the site, it is recommended that the Terrestrial Biodiversity Map in Blacktown LEP be applied to the proposed C2 zoned land. Applying the Terrestrial Biodiversity Map to the remainder of the site is not recommended as the vegetation is not considered high conservation value as it is largely represented by planted and landscaped trees with little to no groundcover or mid-storey.

7. References

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Appendix A Definitions

The following terminology has been used throughout this report for the purposes of describing the impacts of the proposal in the context of a biodiversity assessment in accordance with the NSW Biodiversity Assessment Method 2020. This terminology may or may not align with other technical documents associated with the proposed development.

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.
Extent of occurrence (EOO)	Measures the spatial spread of a taxon to determine the degree to which risks from threatening factors could impact an entire population, and is not intended to be an estimate of the amount of occupied or potential habitat.
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

Terminology	Definition
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).
NSW (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
Operational Manual	The Operational Manual published from time to time by DPIE, 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.
Residual impact	An impact on biodiversity values after all reasonable measures have been taken to avoid, minimise or mitigate the impacts of development. Under the BAM, an offset requirement is determined 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.

Terminology	Definition
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 DPIE 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.
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 Integrity Plot Data

Table 39: Plot location data

Plot no.	Date	PCT	Condition	Easting	Northing	Bearing (Start)
1	31/10/19	849	Good	314573	6242798	115
2	25/07/22	849	Low	314470	6242735	150
3	25/07/22	849	Landscape	314318	6264806x	8

Table 40: Vegetation integrity data (composition) (20 x 20m quadrat)

Composition (number of species)						
Plot	Tree	Shrub	Grass	Forb	Fern	Other
1	4	5	8	6	0	6
2	1	0	3	6	0	0
3	2	0	1	4	0	0

Table 41: Vegetation integrity data (structure) (20 x 20m quadrat)

Structure (Total cover)						
Plot	Tree	Shrub	Grass	Forb	Fern	Other
1	38.0	20.0	65.9	1.2	0.0	2.2
2	40.0	0.0	50.6	5.5	0.0	0.0
3	40.0	0.0	50.0	0.8	0.0	0.0

Table 42: Vegetation integrity data (function) (20 X 50m quadrat)

Function											
Plot	Large Trees	Hollow trees	Litter Cover	Length Fallen Logs	Tree Stem 5-9	Tree Stem 10-1 9	Tree Stem 20-29	Tree Stem 30-49	Tree Stem 50-79	Tree Regen	HTW Cover
1	2	0	44	5	1	1	1	1	1	1	0.7
2	6	0	8	0	0	0	0	1	1	0	10.1
3	3	0	12.4	0	0	0	0	1	1	0	45.0

Table 43: Vegetation integrity score

Plot No.	Plot 1	Plot 2	Plot 3
Composition Score	62.1	17.4	9.9
Structure Score	87.5	77.5	72.8
Function Score	80.5	39	41.9
VI score	**75.9**	**37.5**	**31.1**

Appendix C Biodiversity credit report

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id 00035337/BAAS17069/22/00035338	Proposal Name WSU milperra	BAM data last updated * 16/06/2022
Assessor Name Diane Campbell	Assessor Number BAAS17069	BAM Data version * 54
Proponent Names	Report Created 27/09/2022	BAM Case Status Open
Assessment Revision 0	Assessment Type Part 4 Developments (General)	Date Finalised To be finalised
BOS entry trigger BOS Threshold: Biodiversity Values Map	* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.	

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Cumberland Plain Woodland in the Sydney Basin Bioregion	Critically Endangered Ecological Community	849-Cumberland shale plains woodland

Species
Nil

Additional Information for Approval

BAM Biodiversity Credit Report (Like for like)

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
Melanodryas cucullata cucullata / Hooded Robin (south-eastern form)
Chthonicola sagittata / Speckled Warbler

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

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
849-Cumberland shale plains woodland	Cumberland Plain Woodland in the Sydney Basin Bioregion	0.6	1	12	13

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BAM Biodiversity Credit Report (Like for like)

849-Cumberland shale plains woodland	Like-for-like credit retirement options					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
	Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 849, 850	-	849_Good	No	1	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 849, 850	-	849_Low	Yes	1	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 849, 850	-	849_Landscaped	No	11	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Acacia pubescens / Downy Wattle	**849_Good**	0.0	1.00

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BAM Biodiversity Credit Report (Like for like)

Callocephalon fimbriatum / Gang-gang Cockatoo	**849_Low, 849_Landscaped**	0.5	8.00
Meridolum corneovirens / Cumberland Plain Land Snail	**849_Good, 849_Low**	0.0	2.00
Ninox strenua / Powerful Owl	**849_Landscaped**	0.1	2.00

Credit Retirement Options

Like-for-like credit retirement options

Acacia pubescens / Downy Wattle	Spp	IBRA subregion
	Acacia pubescens / Downy Wattle	Any in NSW
Callocephalon fimbriatum / Gang-gang Cockatoo	Spp	IBRA subregion
	Callocephalon fimbriatum / Gang-gang Cockatoo	Any in NSW
Meridolum corneovirens / Cumberland Plain Land Snail	Spp	IBRA subregion
	Meridolum corneovirens / Cumberland Plain Land Snail	Any in NSW
Ninox strenua / Powerful Owl	Spp	IBRA subregion
	Ninox strenua / Powerful Owl	Any in NSW

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00035337/BAAS17069/22/00035338	WSU milperra	16/06/2022
Assessor Name	Assessor Number	BAM Data version *
Diane Campbell	BAAS17069	54
Proponent Name(s)	Report Created	BAM Case Status
	27/09/2022	Open
Assessment Revision	Assessment Type	Date Finalised
0	Part 4 Developments (General)	To be finalised
BOS entry trigger	* 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.	
BOS Threshold: Biodiversity Values Map		

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Cumberland Plain Woodland in the Sydney Basin Bioregion	Critically Endangered Ecological Community	849-Cumberland shale plains woodland

Species
Nil

Additional Information for Approval

PCT Outside Ibra Added

None added

BAM Biodiversity Credit Report (Variations)

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
Melanodryas cucullata cucullata / Hooded Robin (south-eastern form)
Chthonicola sagittata / Speckled Warbler

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

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
849-Cumberland shale plains woodland	Cumberland Plain Woodland in the Sydney Basin Bioregion	0.6	1	12	13.00

849-Cumberland shale plains woodland

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 849, 850	-	849_Good	No	1	Cumberland,Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

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	Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 849, 850	-	849_Low	Yes	1	Cumberland,Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 849, 850	-	849_Landscaped	No	11	Cumberland,Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Acacia pubescens / Downy Wattle	**849_Good**	0.0	1.00
Callocephalon fimbriatum / Gang-gang Cockatoo	**849_Low, 849_Landscaped**	0.5	8.00
Meridolum corneovirens / Cumberland Plain Land Snail	**849_Good, 849_Low**	0.0	2.00
Ninox strenua / Powerful Owl	**849_Landscaped**	0.1	2.00

Credit Retirement Options

Like-for-like options

Acacia pubescens/ Downy Wattle	Spp	IBRA region	
	Acacia pubescens/Downy Wattle	Any in NSW	
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

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BAM Biodiversity Credit Report (Variations)

		shown below	
	Flora	Vulnerable	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Callocephalon fimbriatum/ Gang-gang Cockatoo	Spp	IBRA region	
	Callocephalon fimbriatum/Gang-gang Cockatoo	Any in NSW	
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Vulnerable	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Meridolum corneovirens/ Cumberland Plain Land Snail	Spp	IBRA region	
	Meridolum corneovirens/Cumberland Plain Land Snail	Any in NSW	
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

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BAM Biodiversity Credit Report (Variations)

		shown below	
	Fauna	Endangered	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Ninox strenua/ Powerful Owl	Spp	IBRA region	
	Ninox strenua/Powerful Owl	Any in NSW	
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Vulnerable	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

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