

A photograph of a koala climbing a tree trunk, positioned on the left side of the cover. The koala is grey with a white chest and is reaching up with its claws. The tree bark is rough and textured.

Travers

bushfire & ecology

Biodiversity Development Assessment Report

Proposed Cemetery
Lot 2 DP 1108408
13 Park Road, Wallacia

December 2019
(REF: 18CMCT02)



Biodiversity Development Assessment Report

**Proposed Cemetery
Lot 2 DP 1108408
13 Park Road, Wallacia**

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File:	18CMCT02BDAR

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The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features are to be confirmed by a registered surveyor.

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Executive Summary

Travers bushfire & ecology has been engaged to prepare a biodiversity development assessment report (BDAR) for a proposed development at Lot 2 DP 1108408, No. 13 Park Road, Wallacia. The entire area bounded by these lots has been subject to detailed survey effort and will hereafter be referred to as the 'study area'. The 'subject site' alternatively refers to the area of proposed direct impacts on existing habitats for roads, buildings or infrastructure.

Development proposal

The proposed Wallacia Golf Course redevelopment essentially involves three (3) parts:

- Redesign of the existing golf course and retention of the existing workshop / maintenance shed. This will involve rehabilitation of the creek line vegetation and threatened ecological communities (TEC) throughout the site.
- Alterations and additions to the existing club including a new pool, gym, deck and terrace with internal refurbishments including a golf pro shop, function rooms, lounge and gaming area; and
- The development of Nepean Memorial Park within the eastern portion of the site, including the construction of a multipurpose chapel and administration office, burial sites as well as the associated road network.

Recorded biodiversity

Ecological survey and assessment has been undertaken in accordance with relevant legislation including the *Environmental Planning and Assessment Act 1979 (EP&A Act)*, the *Biodiversity Conservation Act 2016 (BC Act)*, the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* and the *Fisheries Management Act 1994 (FM Act)*.

In respect of matters required to be considered under the *EP&A Act* and relating to the species / provisions of the *BC Act*, six (6) threatened fauna species including Grey-headed Flying-fox, Large-eared Pied Bat, Eastern Coastal Free-tailed Bat, Large Bent-winged Bat, Greater Broad-nosed Bat and Large-footed Myotis, no threatened flora species, and two (2) threatened ecological communities (TECs), Cumberland Plain Woodland (CPW) and Riverflat Eucalypt Forest (RFEF), were recorded within the subject site.

In respect of matters required to be considered under the *EPBC Act*, two (2) threatened fauna species Grey-headed Flying-fox (*Pteropus poliocephalus*) and Large-eared Pied Bat, no protected migratory bird species, no threatened flora species and one (1) threatened ecological community, Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (CPSW), listed under this Act were recorded within the subject site.

In respect of matters relative to the *FM Act*, no suitable habitat for threatened marine or aquatic species was observed within the subject site.

Impact assessment

The direct, indirect and cumulative ecological impacts of the proposal have been carefully considered in Section 5.2 of this report. Recommendations have been outlined within

Section 5.4 to avoid and minimise these impacts, to address threatening processes and to create a more positive ecological outcome for threatened biodiversity.

The development proposal will see the impact of 3.95 ha of native vegetation, which includes impacts to the following communities (PCT below refers to Plant Community Type):

- PCT 835 Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - equivalent to RFEF (0.53 ha impacted)
- PCT 850 Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion - equivalent to CPW (0.45 ha Moderate_poor and 0.67 ha Poor_no_understorey impacted)
- Planted native vegetation (2.28 ha impacted)

The assessment of serious and irreversible impacts are set out under Section 6.7.2 of the BC Reg 2017 to guide the determining authority on this decision. These principles have been reviewed and assessed in Appendices 2 & 3. It is considered that the proposal may constitute serious and irreversible impacts on CPW.

There will be no significant impact on matters listed under the *FM Act*.

The proposed development was considered to have a potentially significant impact on CPSW, which is a matter of national environmental significance. As such a referral to Australian Government Minister for the Environment is recommended.

Biodiversity Offsets Scheme (BOS) – Threshold Assessment

The proposed development does exceed the nominated threshold triggers of 1) Sensitive Biodiversity Values Land and 2) the Area clearing Threshold as assessed in Section 4.1. Therefore biodiversity offsets are required under the Biodiversity Offsets Scheme (BOS).

BAM Calculator results

The BAM Calculator provides a means of objectively determining the loss of biodiversity as a result of a proposed development. The 'credits' generated (Table A & B) are the amount of credits required to be 'transferred' (purchased) to allow the proposed subdivision to proceed.

The estimated cost of the credits (Table C and D) are estimated by the BAM - Calculator.

Table A – Requirement for ecosystem credits

Zone	Veg. zone name	Veg. integrity loss	Area (ha)	Candidate SAI	Ecosystem credits
1	850_Poor_planted	30.6	2.3	True	44
2	850_Moderate_poor	53.8	0.5	True	15
3	850_Poor_no_understorey	43.8	0.7	True	18
					Subtotal: 77
4	835_Moderate_poor	42.9	0.5	False	11
					Subtotal: 11
					Total: 88

Table B – Requirement for species credits

Veg. zone name	Veg. integrity loss	Area (ha)	Candidate SAI	Ecosystem credits
Large-eared Pied Bat				
835_Moderate_poor	42.9	0.53	True	17
850_Moderate_poor	53.8	0.45	True	18
850_Poor_no_understorey	43.8	0.67	True	22
850_Poor_planted	30.6	2.28	True	52
				Subtotal: 109
Green and Golden Bell Frog				
835_Moderate_poor	42.9	0.50	False	11
850_Moderate_poor	53.8	0.41	False	11
850_Poor_no_understorey	43.8	0.05	False	1
850_Poor_planted	30.6	0.19	False	3
				Subtotal: 26
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> - endangered population				
835_Moderate_poor	42.9	0.53	False	11
850_Moderate_poor	53.8	0.45	False	12
				Subtotal: 23
Southern Myotis (Large-footed Myotis)				
835_Moderate_poor	42.9	0.53	False	11
850_Moderate_poor	53.8	0.44	False	12
850_Poor_no_understorey	43.8	0.61	False	13
850_Poor_planted	30.6	1.33	False	20
				Subtotal: 56
				Total 214

Table C – Ecosystem credit costs

PCT common name	Price per credit	No. of ecosystem credits	Final credits price
835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	\$14,464.79	11	\$159,112.73
850 - Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	\$39,664.42	77	\$3,054,160.28
Subtotal (incl. GST)			\$3,534,600.31

Table D – Species credit costs

Species	Threat status	Price per credit	No. of species credits	Final credits price
<i>Chalinolobus dwyeri</i> (Large-eared Pied Bat)	Vulnerable	\$741.31	109	\$100,187.38
<i>Litoria aurea</i> (Green and Golden Bell Frog)	Endangered	\$6,194.72	26	\$199,701.67
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> - endangered population	Endangered Population	\$1,730.17	23	\$49,340.47

Species	Threat status	Price per credit	No. of species credits	Final credits price
<i>Myotis macropus</i> (Southern Myotis)	Vulnerable	\$741.31	56	\$51,472.42
<i>Chalinolobus dwyeri</i> (Large-eared Pied Bat)	Vulnerable	\$741.31	109	\$100,187.38
Total species credits (incl. GST)				\$440,772.13
Grand Total (ecosystem plus species credits)				\$3,975,372.44

The above prices generated by the BAM calculator should be used as a guide only and confirmation will be required when purchasing potential credits.

The total value of ecosystem credits is **\$3,534,600.31**.

The total value of species credits is **\$440,772.13**.

TBE advises that species credit requirements can be refined further subject to the completion of target survey for Green and Golden Bell Frog (Nov–Mar) and *Marsdenia viridiflora* subsp. *viridiflora* (Nov–Feb).

Reduction of credit requirements

In accordance with Section 7.13 (4) of the *BC Act* the consent authority, being Council, may reduce the credit requirements provided they give reasons for this decision. The planted native vegetation has been assigned to PCT 850, which is treated as CPW in the BAM-C. We recommend that this is an appropriate strategy to accurately account for impacts to the planted native vegetation within the site. Consequently we estimate that the credit requirements for PCT 850 could be reduced to 33 credits (\$1,308,925.83), which would further reduce the total ecosystem credit cost to \$1,614,842.42.

Travers bushfire & ecology consider a reduction in credits is warranted given that the majority of credits generated are due to removal of planted native trees within the golf course. This credit requirement is an unreasonable outcome for the following reasons:

- 2.28 ha of the impacted vegetation is planted
- The proposed golf course and cemetery is revegetated with an equivalent of 1.35 ha of impacted vegetation type
- The proposed golf course and cemetery landscaping will result in planting of 4.3 ha of native trees to replace the impacted trees

List of abbreviations

APZ	asset protection zone
BAM	Biodiversity Assessment Method
BAR	Biodiversity Assessment Report
<i>BC Act</i>	<i>Biodiversity Conservation Act (2016)</i>
<i>BC Reg</i>	<i>Biodiversity Conservation Regulation (2017)</i>
BCAR	Biodiversity Certification Assessment Report
BDAR	Biodiversity Development Assessment Report
BOS	Biodiversity Offset Scheme
BPA	bushfire protection assessment
BSSAR	Biodiversity Stewardship Site Assessment Report
CEEC	Critically endangered ecological community
<i>CM Act</i>	<i>Coastal Management Act 2016</i>
CPSW	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest
CPW	Cumberland Plain Woodland
DCP	development control plan
DEC	NSW Department of Environment and Conservation (superseded by DECC from April 2007)
DECC	NSW Department of Environment and Climate Change (superseded by DECCW from October 2009)
DECCW	NSW Department of Environment, Climate Change and Water (superseded by OEHL from April 2011)
DEWHA	Commonwealth Department of Environment, Water, Heritage & the Arts (superseded by SEWPAC)
DOEE	Commonwealth Department of Environment & Energy
DPIE	NSW Department of Planning, Industry and Environment
EEC	endangered ecological community
EPA	Environment Protection Authority
<i>EP&A Act</i>	<i>Environmental Planning and Assessment Act (1979)</i>
<i>EPBC Act</i>	<i>Environment Protection and Biodiversity Conservation Act (1999)</i>
<i>FM Act</i>	<i>Fisheries Management Act</i>
IBRA	Interim Biogeographic Regionalisation for Australia
LEP	local environmental plan
LGA	local government area
<i>LLS Act</i>	<i>Local Land Services Act (2013)</i>
NES	national environmental significance
<i>NPW Act</i>	<i>National Parks and Wildlife Act (1974)</i>
NRAR	Natural Resources Access Regulator (NSW)
NSW DPI	NSW Department of Industry and Investment
OEHL	Office of Environment and Heritage (superseded by DPIE from August 2019)
PCT	plant community type
PFC	projected foliage cover
RFS	NSW Rural Fire Service
ROTAP	rare or threatened Australian plants
SAII	Serious And Irreversible Impacts
SEPP	State Environmental Planning Policy
SEWPAC	Commonwealth Dept. of Sustainability, Environment, Water, Population & Communities (superseded by DOEE)
SIS	species impact statement
SULE	safe useful life expectancy
TEC	threatened ecological community
TPZ	tree preservation zone
<i>TSC Act</i>	<i>Threatened Species Conservation Act (1995) – Superseded by the Biodiversity Conservation Act (2016)</i>
VMP	vegetation management plan

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Introduction

1

Travers bushfire & ecology has been engaged to prepare a biodiversity development assessment report (BDAR) for a proposed development at Lot 2 DP 1108408 and Lot 512 DP 1079728, No. 13 Park Road, Wallacia. The entire area bounded by these lots has been subject to detailed survey effort and will hereafter be referred to as the 'study area' (refer to Figure 1.1). In accordance with the Threatened Species Assessment Guidelines (DECC 2007) the 'subject site' will hereafter refer to the area of direct impacts by the proposal and will include the development footprint (see Figures 1.2 A-C).

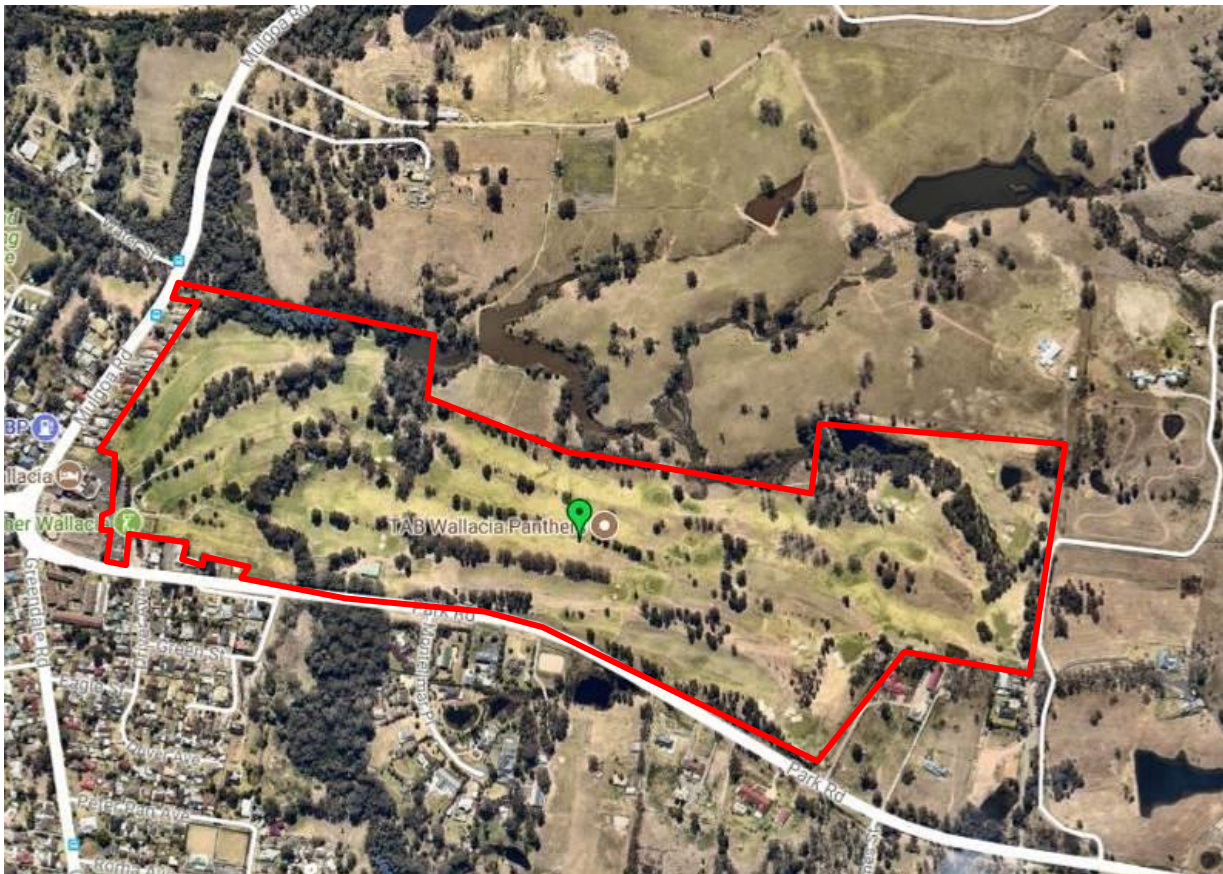


Figure 1.1 – Study area (red)

1.1 Purpose

The purpose of this Biodiversity Development Assessment Report (BDAR) is to:

- Carry out a botanical survey to describe the vegetation communities and their conditions
- Carry out a fauna habitat survey for the detection and assessment of fauna and their potential habitats
- Complete targeted surveys for threatened species, populations and ecological communities
- Prepare a BDAR in accordance with the requirements of the:

- a) *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*,
- b) *Biodiversity Conservation Act 2016 (BC Act)*,
- c) *Biodiversity Conservation Regulation 2017 (BC Reg.)*,
- d) *Fisheries Management Act 1994 (FM Act)*, and
- Prepare a BDAR in accordance with the Biodiversity Assessment Methodology (BAM)

1.1.1 Certification of BAM compliance

Section 6.15 of the *BC Act* regarding the currency of a BDAR requires:

- (1) *A biodiversity assessment report cannot be submitted in connection with a relevant application unless the accredited person certifies in the report that the report has been prepared on the basis of the requirements of (and information provided under) the biodiversity assessment method as at a specified date and that date is within 14 days of the date the report is so submitted.*
- (2) *A relevant application is an application for planning approval, for vegetation clearing approval, for biodiversity certification or in respect of a biodiversity stewardship agreement.*

George Plunkett (BAAS 19010) and Michael Sheather-Reid (BAAS 17085) are accredited persons under the *BC Act*. We certify here that the report has been prepared on the basis of the requirements of (and information provided under) the BAM as at 10 December 2019, and that date is within 14 days of the date the report is so submitted.

1.1.2 Terminology

Throughout this report the terms subject site and study area are used. It is important to have a thorough understanding of these terms as they apply to the assessment. The study area and subject site are shown on Figures 1.1 and 2.

Subject site means the area directly affected by the proposal.

Study area means the subject site and any additional areas which are likely to be affected by the proposal, either directly or indirectly. The study area should extend as far as is necessary to take all potential impacts into account.

Direct impacts are those that directly affect the habitat and individuals. They include, but are not limited to, death through predation, trampling, poisoning of the animal/plant itself and the removal of suitable habitat. When applying each factor, consideration must be given to all of the likely direct impacts of the proposed activity or development.

Indirect impacts occur when project-related activities affect species, populations or ecological communities in a manner other than direct loss. Indirect impacts can include loss of individuals through starvation, exposure, predation by domestic and/or feral animals, loss of breeding opportunities, loss of shade/shelter, deleterious hydrological changes, increased soil salinity, erosion, inhibition of nitrogen fixation, weed invasion, fertiliser drift, or increased human activity within or directly adjacent to sensitive habitat areas. As with direct impacts, consideration must be given, when applying each factor, to all of the likely indirect impacts of the proposed activity or development.

1.2 Site description

1.2.1 Site overview

Table 1.1 provides an overview the planning, cadastral and topographical details of the study area and an overview of the site and surrounds is shown on Figures 1.3 and 1.4. (site and location maps).

Table 1.1 – Site features

Location	13 Park Road, Wallacia
Location description	The site is located directly north east of Wallacia township, between Park Road and Mulgoa Road.
Area	43 ha
Local government area	Penrith
Zoning	E3 – Environmental Management
Grid reference MGA-56	282400E 6250300S
Elevation	Approximately 35–68 m AHD
Topography	The majority of slopes are gentle although there are some moderately steep short rises near to drainage lines.
Catchment and drainage	Jerrys Creek bisects the site in the western portion. A tributary of Jerrys Creek runs close to the northern boundary of the site. Jerrys Creek joins onto the Nepean River approximately 500 m to the west, but it meanders for approximately 1500 m.
Existing land use	Golf course.

1.2.2 Landscape features

Table 1.2 examines the landscape features of the proposed development site in accordance with the BAM.

Table 1.2 – Landscape features

IBRA bioregions and subregions	Sydney Basin bioregion – Cumberland subregion (Figure 1.5 and 1.6)
NSW landscape region	Cumberland Plain
Native vegetation extent in the buffer area (1500 m)	431.24 ha and 33.99%
Cleared areas	>90% of the natural vegetation has been cleared from the site.
Evidence to support differences between mapped vegetation extent and aerial imagery	The mapped vegetation closely matches the aerial imagery.
Rivers and streams classified according to stream order	The site map (Figure 1.3) shows the study area with first, second and third order streams
Wetlands within, adjacent to and downstream of the site	There are several dams across the site, shown on the site map (Figure 1.3)
Connectivity features	There is fragmented connectivity along the main drainage line north and west to the Nepean River, which then connects to the Blue Mountains National Park. The location map (Figure 1.4) shows an overview of the extent of native vegetation in the locality.
Areas of geological	Bringelly Shale Formation covers most of the site except around Jerrys Creek which bisects the site near the western end. This geological unit Quaternary

significance and soil hazard features	Alluvium. The south-western tip around the club house is located on the Blacktown Soil Landscape. Jerrys Creek and immediate surrounds is located on the Richmond Soil Landscape. The remainder of the site is located on the Luddenham Soil Landscape.
Identification of method applied (i.e. linear or site-based)	Site based assessment

1.3 Proposed development

The proposed redevelopment essentially involves three (3) parts:

- Redesign of the existing golf course and retention of the existing workshop / maintenance shed (refer Figure 1.2 A-B). This will involve rehabilitation of the creek line vegetation and endangered ecological communities (EEC) throughout the site.
- Alterations and additions to the existing club. As depicted in Figures 1.2 A-B the proposed extension will include a new pool, gym, deck and terrace with internal refurbishments including a golf pro shop, function rooms, lounge and gaming area; and
- The development of Nepean Gardens within the eastern portion of the site. This will include the construction of a multipurpose chapel and administration office, burial sites as well as the associated road network (refer Figure 2 C).

The western portion of the site will be retained and existing fairways partial reconfigured.

The eastern portion will be utilised for a cemetery. The proposed development involves the construction of the following built facilities on site:

- A multipurpose chapel ;
- A administration office;
- Alterations and additions to the existing clubhouse; and
- Reuse of existing workshop building.

A road network has been designed to allow access to each of the cemetery facilities and access to the various proposed burial and memorial sites throughout. Please refer to Figures 2A and 2B for the golf course modifications in the western portion of the site, and Figure 2C for an illustration of the proposed road network and built facilities in the eastern portion.

There are APZ requirements surrounding the proposed new buildings, as shown in Figure 3.

1.4 Statutory assessment requirements

1.4.1 Environmental Planning and Assessment Act 1979 (EP&A Act)

Prior to any development taking place in New South Wales a formal assessment needs to be made of the proposed work to ensure it complies with relevant planning controls and, according to its nature and scale, confirm that it is environmentally and socially sustainable. State, regional and local planning legislation indicates the level of assessment required, and outlines who is responsible for assessing the development. The development assessment and consent system is outlined in Part 4 and the infrastructure and environmental impact assessment system is outlined in Part 5 of the *EP&A Act*.

1.4.2 Biodiversity Conservation Act 2016 (BC Act)

The *BC Act* repeals the *Threatened Species Conservation Act 1995*, the *Nature Conservation Trust Act 2001* and the animal and plant provisions of the *National Parks and Wildlife Act 1974*.

The *BC Act* and the *BC Reg* establishes a regulatory framework for assessing and offsetting impacts on biodiversity values due to proposed developments and clearing. It establishes a framework to avoid, minimise and offset impacts on biodiversity from development through the Biodiversity Offsets Scheme. Where development consent is granted, the authority may impose as a condition of consent an obligation to retire a number and type of biodiversity credits determined under the new Biodiversity Assessment Method (BAM).

For local development, the BOS includes two (2) elements to the threshold test – an area trigger and a Sensitive Biodiversity Values Land Map trigger. If clearing exceeds either trigger, the Biodiversity Offset Scheme applies to the proposed clearing.

Development consent cannot be granted for non-State significant development under Part 4 of the *EP&A Act* if the consent authority is of the opinion it is likely to have serious and irreversible impacts (SAIL) on biodiversity values. The determination of SAIL is to be made in accordance with principles prescribed section 6.7 of the *BC Regulation 2017*. The principles have been designed to capture those impacts which are likely to contribute significantly to the risk of extinction of a threatened species or ecological community in New South Wales.

The threatened species test of significance is used to determine if a development or activity is likely to significantly affect threatened species or ecological communities, or their habitats. It is applied as part of the Biodiversity Offsets Scheme entry requirements and for Part 5 activities under the Environmental Planning and Assessment Act 1979.

The test of significance is set out in s.7.3 of the *BC Act*. If the activity is likely to have a significant impact, or will be carried out in a declared area of outstanding biodiversity value, the proponent must either apply the Biodiversity Offsets Scheme or prepare a species impact statement (SIS).

The environmental impact of activities that will not have a significant impact on threatened species will continue to be assessed under s.111 of the Environmental Planning and Assessment Act 1979.

1.4.3 Fisheries Management Act 1994 (FM Act)

The *FM Act* provides a list of threatened aquatic species that require consideration when addressing the potential impacts of a proposed development. Where a proposed activity is located in an area identified as critical habitat, or such that it is likely to significantly affect threatened species, populations, ecological communities, or their habitats, an SIS is required to be prepared.

1.4.4 Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The *EPBC Act* requires that Commonwealth approval be obtained for certain actions. It provides an assessment and approvals system for actions that have a significant impact on matters of *national environmental significance* (NES). These may include:

- World Heritage Properties and National Heritage Places
- Wetlands of International Importance protected by international treaty
- Nationally listed threatened species and ecological communities
- Nationally listed migratory species
- Commonwealth marine environment

Actions are projects, developments, undertakings, activities, and series of activities or alteration of any of these. An action that needs Commonwealth approval is known as a controlled action. A controlled action needs approval where the Commonwealth decides the action would have a significant effect on an NES matter.

Where a proposed activity is located in an area identified to be of NES, or such that it is likely to significantly affect threatened species, ecological communities, migratory species or their habitats, then the matter needs to be referred to the Commonwealth Department of Environment and Energy (DOEE) for assessment. In the case where no listed federal species are located on site then no referral is required. The onus is on the proponent to make the application and not the Council to make any referral.

A threshold criterion apply to specific NES matters which may determine whether a referral is or is not required, such as for the *EPBC*-listed ecological communities Cumberland Plain Woodland and Shale-Gravel transition Forest. Consultation with DOEE may be required to determine whether a referral is or is not required. If there is any doubt as to the significance of impact or whether a referral is required, a referral is generally recommended to provide a definite decision under the *EPBC Act* thereby removing any further obligations in the case of 'not controlled' actions.

A significant impact is regarded as being:

important, notable, or of consequence, having regard to its context or intensity and depends upon the sensitivity, value, and quality of the environment which is impacted and upon the duration, magnitude, and geographical extent of the impacts. A significant impact is likely when it is a real or not a remote chance or possibility.

Source: EPBC Policy Statement

Guidelines on the correct interpretation of the actions and assessment of significance are located on the department's web site <http://www.environment.gov.au/epbc/publications>.

1.4.5 Coastal Management Act 2016 (CM Act)

The *Coastal Management Act* (CM Act, 2016) establishes the framework and overarching objects for coastal management in New South Wales. The Act commenced on 29 June 2018 and replaces the previous *Coastal Protection Act* (1979).

The purpose of the *CM Act* is to manage the use and development of the coastal environment in an ecologically sustainable way, for the social, cultural and economic well-being of the people of New South Wales.

The *CM Act* also supports the aims of the *Marine Estate Management Act 2014*, as the coastal zone forms part of the marine estate.

The *CM Act* defines the coastal zone, comprising four (4) coastal management areas:

1. coastal wetlands and littoral rainforests area; areas which display the characteristics of coastal wetlands or littoral rainforests that were previously protected by SEPP 14 and SEPP 26
2. coastal vulnerability area; areas subject to coastal hazards such as coastal erosion and tidal inundation
3. coastal environment area; areas that are characterised by natural coastal features such as beaches, rock platforms, coastal lakes and lagoons and undeveloped headlands. Marine and estuarine waters are also included
4. coastal use area; land adjacent to coastal waters, estuaries and coastal lakes and lagoons.

The *CM Act* establishes management objectives specific to each of these management areas, reflecting their different values to coastal communities.

1.4.6 Licences

Individual staff members of *Travers bushfire & ecology* are licensed under Clause 20 of the *National Parks and Wildlife (Land Management) Regulation 1995* and Sections 120 & 131 of the *National Parks and Wildlife Act 1974* to conduct flora and fauna surveys within service and non-service areas. NPWS Scientific Licence Numbers: SL100848.

Travers bushfire & ecology staff are licensed under an Animal Research Authority issued by the NSW Department of Primary Industries. This authority allows *Travers bushfire & ecology* staff to conduct various fauna surveys of native and introduced fauna for the purposes of environmental consulting throughout New South Wales.

1.4.7 Local government planning instruments (LEP's & DCP's)

The land is currently zoned E3 - Environmental Management in the Penrith Local Environmental Plan 2010.

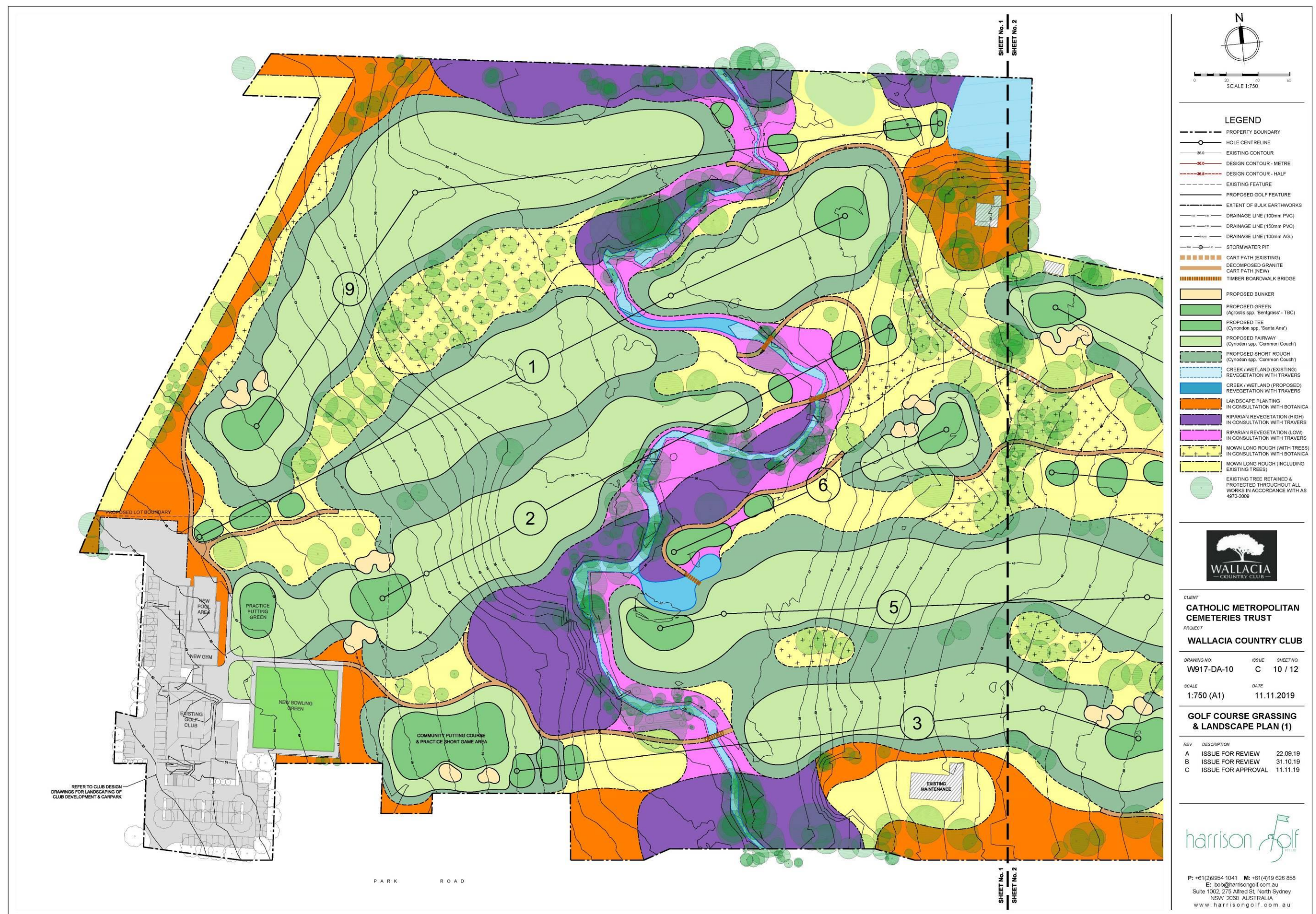


Figure 1.2a – Proposed golf course plan (western portion)



Figure 1.2b – Proposed golf course plan (eastern portion)



Figure 1.2c – Proposed cemetery layout

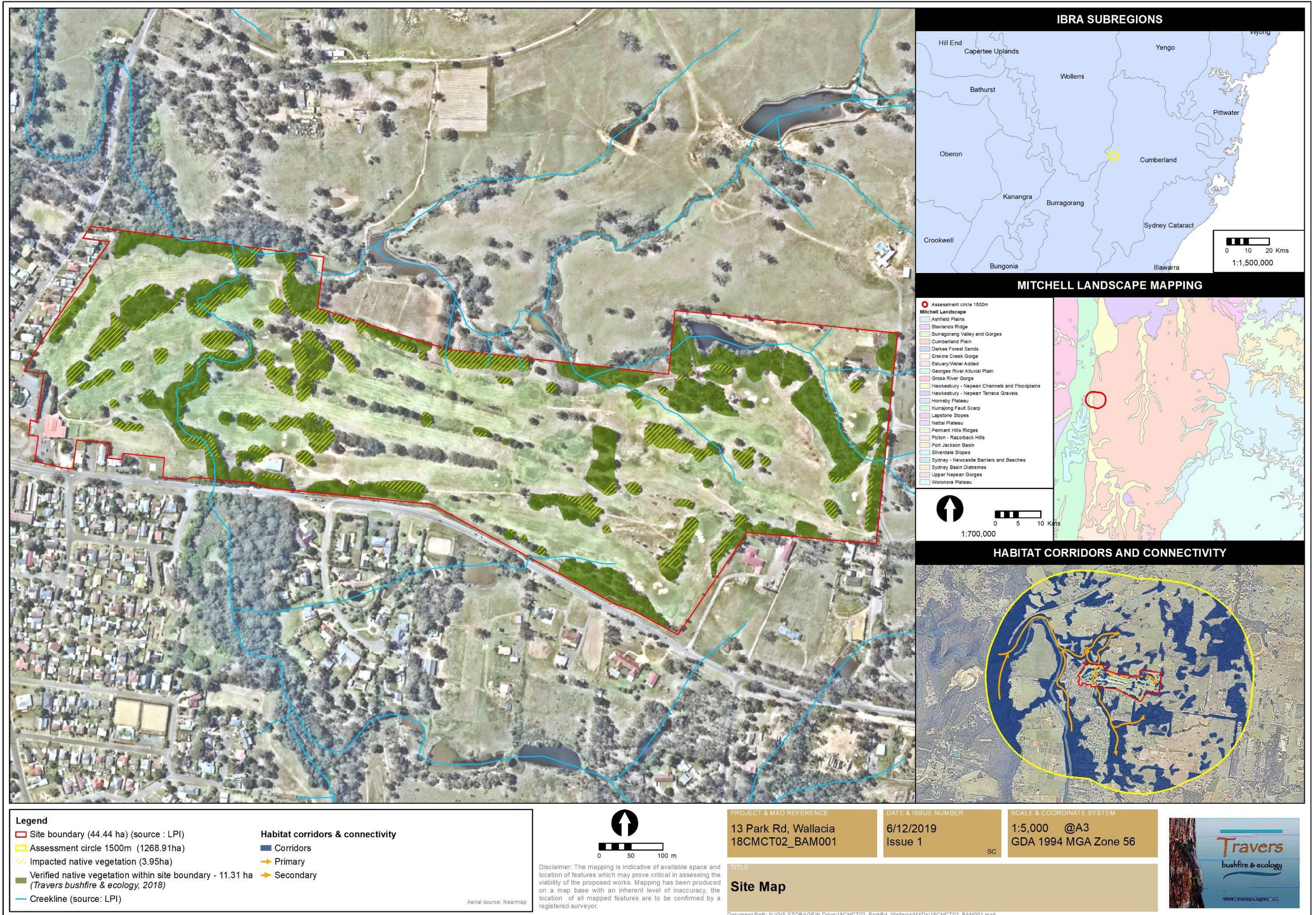


Figure 1.3 – Site map

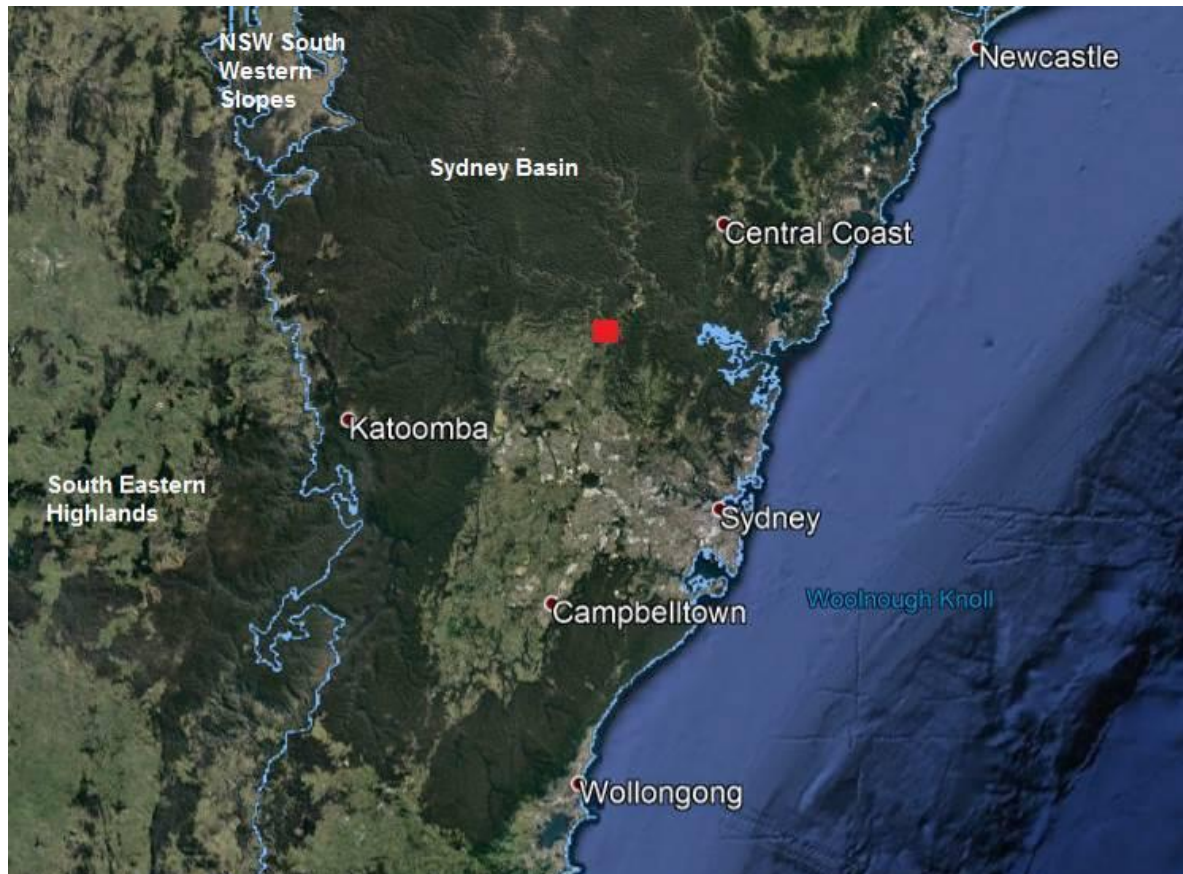


Figure 1.5 – IBRA bioregions

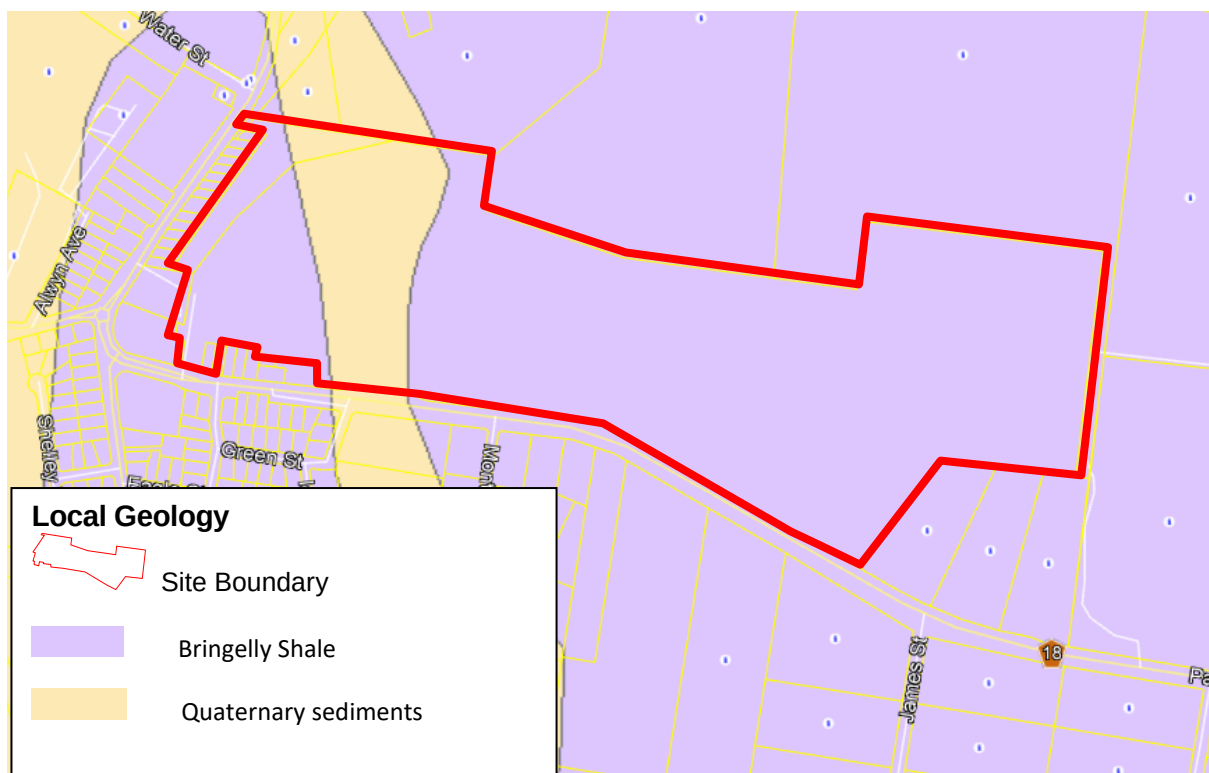


Figure 1.6 – Local geology
(Source: Google Earth Pro – Geology 100K - Penrith)

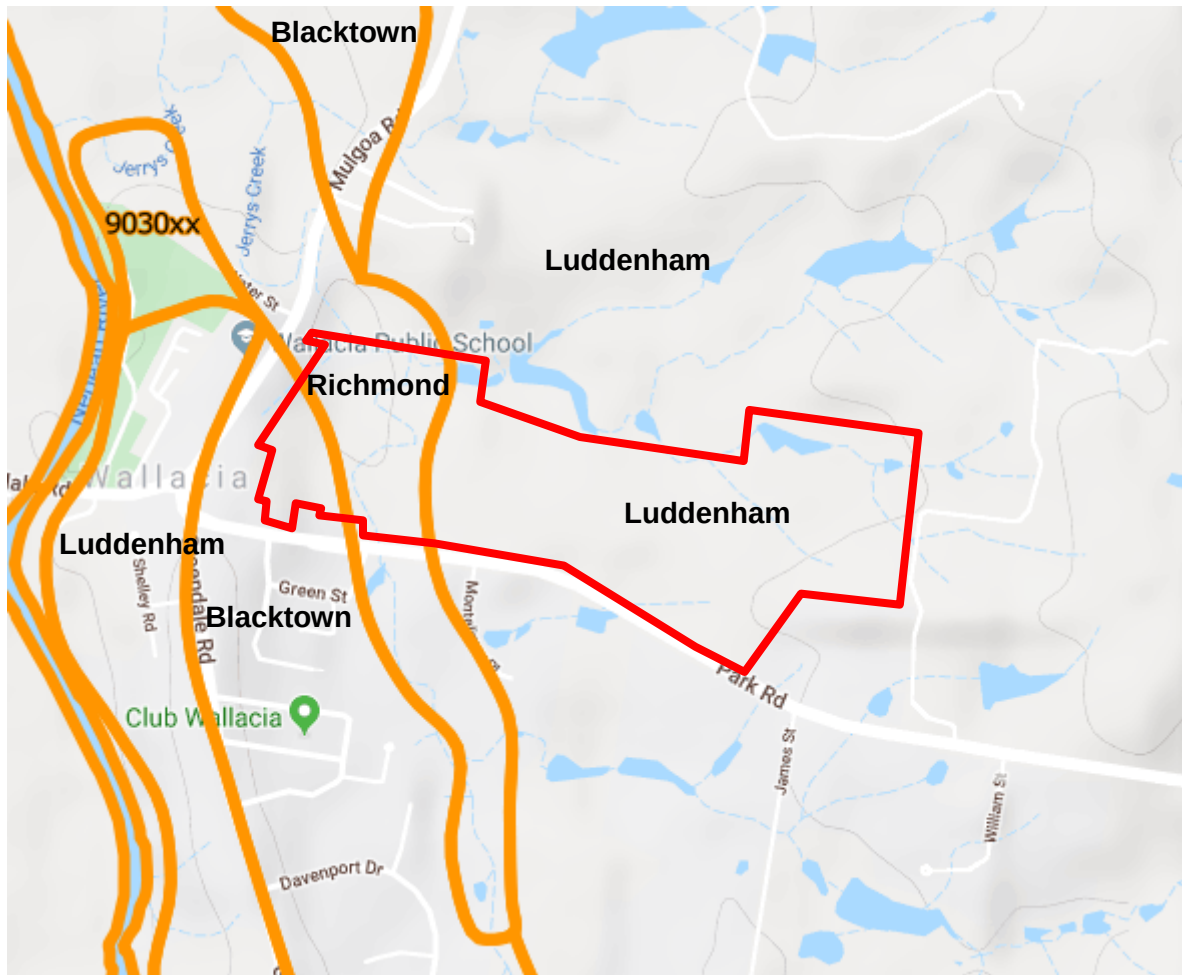


Figure 1.7 – Local soil landscapes
(Source: eSPA NSW Office of Environment and Heritage)

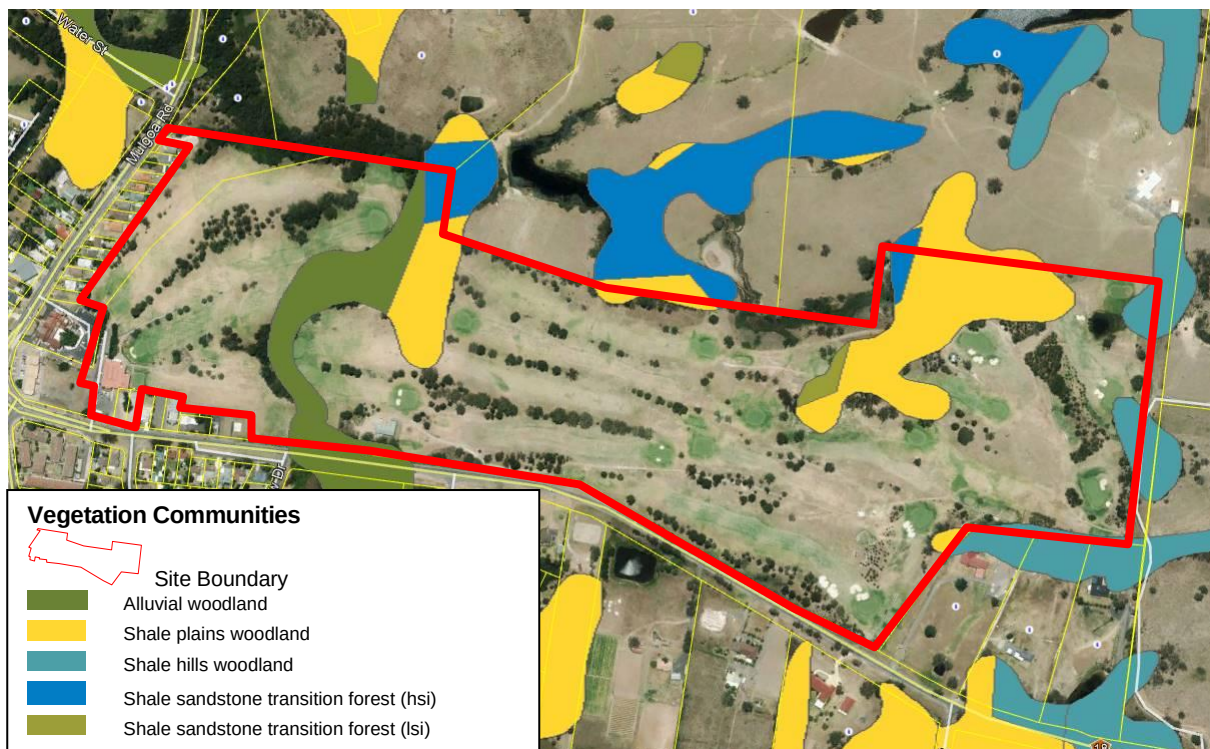


Figure 1.8 –Vegetation mapping of the Cumberland Plain (NPWS 2002)

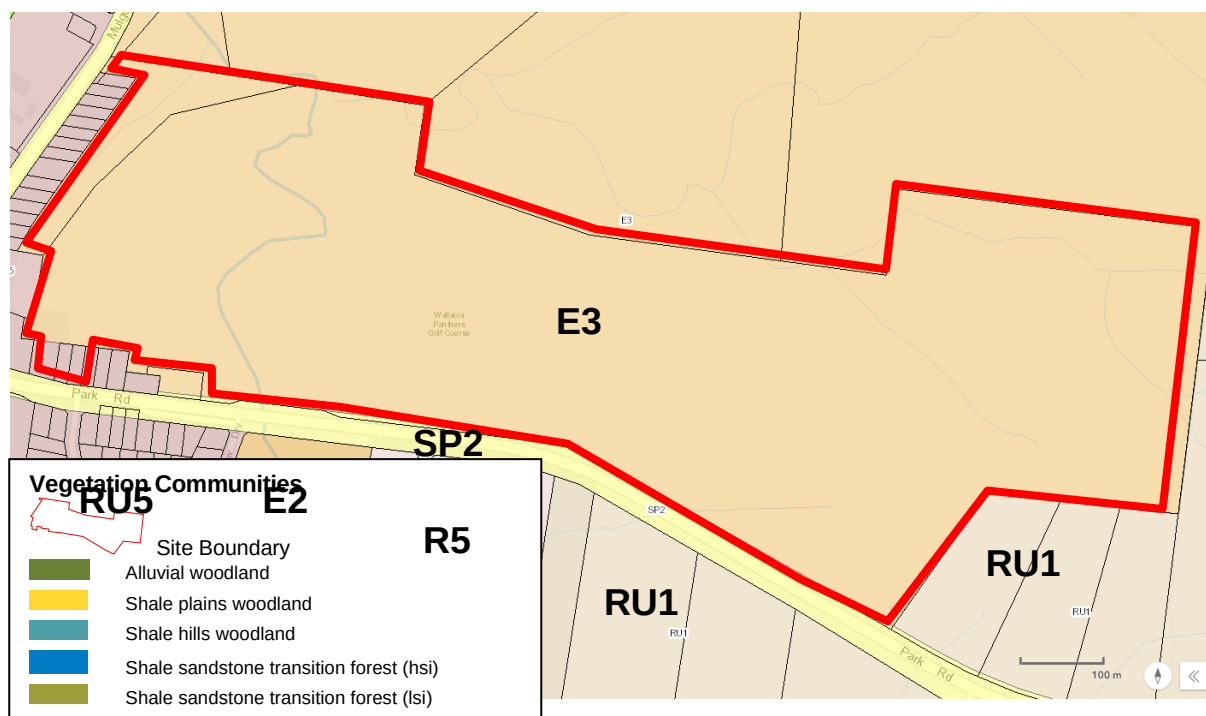


Figure 1.9 – Zoning
(Source: Planning Portal, 2019)



Survey Methodology

2

2.1 Presurvey information collation & resources

A review of the relevant information pertinent to the subject site was undertaken.

Documents reviewed include:

- Landscape Plan and Planting Plans prepared by Narelle Sonter of *Botanica Landscape and Horticultural Specialists* (dated 04/12/2019)
- Tree Assessment Report prepared by *Travers bushfire & ecology* (2019)
- Vegetation Management Plan prepared by *Travers bushfire & ecology* (2019)
- Flora and Fauna Assessment prepared by *Travers bushfire & ecology* (2018)

Standard technical resources utilised:

Legislation

- *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*
- *Biodiversity Conservation Act 2016 (BC Act)*
- *Biodiversity Conservation Regulation 2017 (BC Reg.)*
- *Fisheries Management Act 1994 (FM Act)*

Survey Guidelines

- *Matters of National Environmental Significance* (Commonwealth of Australia 2013)
- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities 2004* (working draft), Department of Environment and Conservation (DEC)
- *Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna – Amphibians* (DECC – April 2009a)
- *Hygiene Protocol for the Control of Diseases in Frogs* (DECC 2008)
- *Species credit threatened bats and their habitats* (DPIE 2018)

Mapping Resources

- Aerial photographs (Google Earth Pro / Spatial Information Exchange / NearMap)
- Topographical maps (scale 1:25,000)
- LiDAR data for contours (Land and Property Information, est. 2015 estimated)
- ESade – OEH tool for checking soil types

Threatened species records

- NSW Office of Environment and Heritage's BioNet - Atlas of NSW Wildlife, which holds data from a number of custodians. Data obtained 2 Dec 2019
- EPBC Protected Matters Search Tool - *DOEE* (2019)

Vegetation mapping/resources

- Bionet Vegetation Classification System
- Native vegetation of the Cumberland Plain (NPWS 2002)
- NSW Guide to Surveying Threatened Plants (DPIE 2016)

Desktop assessment:

To determine the likely and actual occurrence of flora species, fauna species and plant communities on the subject site, desktop assessments were undertaken including:

- **A literature review** – A review of readily available literature for the area was undertaken to obtain reference material and background information for this survey.
- **A data search** – A search of the *Atlas of NSW Wildlife* (DPIE 2019) was undertaken to identify records of threatened flora and fauna species located within a 10 km radius of the site. Searches were also undertaken on the DOEE – ‘protected matters search tool’ website to generate a report that will help determine whether matters of national environmental significance or other matters protected by the *EPBC Act* are likely to occur in the area of interest. The search was broadened to a 10 km radius like the Atlas search. These two searches combined, enabled the preparation of a list of threatened flora and fauna species that could potentially occur within the habitats found on the site (Tables A2.1, A2.2 and A2.3).

Vegetation Mapping:

Vegetation mapping of the Cumberland Plain (NPWS 2002) identifies the following communities within the study area:

- Alluvial woodland
- Shale plains woodland
- Shale hills woodland
- Shale sandstone transition forest (high sandstone influence)
- Shale sandstone transition forest (low sandstone influence)

2.2 Flora survey methodology

A review of the Atlas of NSW Wildlife (OEH 2017) was undertaken prior to the site visit to determine threatened species previously recorded within 10 km of the subject site. Searches of the database were repeated in October 2019 (DPIE).

2017 - Initial botanical survey was undertaken over 5hrs on the 5th October 2017. Previous to that, some inspections have been made upon both natural and ornamental vegetation in the western portion of the golf course.

Botanical survey included a random meander in accordance with *Cropper* (1993) to gain a full species list of the plants within the site. Tree assessments in particular areas have also been undertaken which have assisted in the preparation of a flora species list. Nine (9) 20 m x 20 m or 40 m x 10 m quadrats were undertaken within remnant bushland areas with one conducted in a plantation area. Flora species recorded during the survey are listed in Table 3.1. Figure 2 shows the mapped vegetation communities.

Threatened species searches (as relevant) were conducted as near linear transects within areas of potential habitat.

2019 - Updated botanical survey was undertaken on the 3rd December 2019 in accordance with the BAM over a period of 7hrs. Seven (7) 20 m x 50 m BAM plots were undertaken within vegetation directly impacted by the proposal. Vegetation communities were also reviewed during this survey.

2.3 Fauna survey methodology

Fauna survey including diurnal and nocturnal survey and threatened species habitat assessment was undertaken within the study area on 27th – 29th September, 5th – 6th October and 9th–12th October 2017. This was predominantly opportunistic diurnal surveys undertaken during tree health surveys but also included afternoon and nocturnal fauna survey on the 5th October 2017. Additional ultrasonic microbat survey was undertaken on 29 October 2019 as well as some incidental sightings whilst undertaking further arborist assessment across areas of impacts.

Diurnal fauna survey included Cumberland Plain Land Snail habitat searches within CPW remnants and nearby, bird activity and call survey, activity searches (scats, scratches, diggings, burrows, etc.) and habitat tree survey.

Nocturnal fauna survey included spotlighting, frog call identification, Green and Golden Bell Frog call-playback, microbat ultrasonic recording (x4 passive stations) and threatened owl, bitterns, glider and Koala call-playback. An additional x2 passive microbat ultrasonic recording stations were undertaken for a single night in October 2019.

The full survey effort table showing timing and weather conditions is provided in Table 2.1. Specific survey effort locations and results are shown on Figure 2. All fauna species recorded during survey within the subject site and nearby surrounds are listed in Table 3.6.

A review of the Atlas of NSW Wildlife (OEH 2017) was undertaken prior to the site visit to determine threatened species previously recorded within 10 km of the subject site. Searches were repeated through the database in October 2019 (DPIE).

2.4 Field survey effort

Tables 2.1 and 2.2 below detail the flora and fauna survey effort undertaken for the subject site.

Table 2.1 – Fauna survey effort

Fauna group	Date	Weather conditions	Survey technique(s)	Survey effort / time (24hr)
Diurnal birds	27/9/17	2/8 cloud, gentle NNE wind, no rain, 26°C	Diurnal opportunistic	4hrs 1230 - 1630
	28/9/17	3/8 cloud, gentle NW wind, no rain, 26°C	Diurnal opportunistic	9hrs 0800 - 1700
	29/9/17	0/8 cloud, calm NNE wind, no rain, 18°C	Diurnal opportunistic	6hrs 30min 0830 - 1500
	5/10/17	4/8 cloud, gentle NNE wind, no rain, 23°C	Diurnal opportunistic	7hrs 30min 1100 - 1830
	6/10/17	8/8 cloud, light SW wind, no rain, 19°C	Diurnal opportunistic	8hrs 0800 - 1600
	9/10/17	3/8 cloud, moderate WSW wind, no rain, 32°C	Diurnal opportunistic	2hrs 30min 1430 - 1700
	10/10/17	8/8 cloud, calm S wind, no rain, 15-22°C	Diurnal opportunistic	7hrs 30min 0700 - 1630
	11/10/17	8/8 cloud, calm NE wind, showers, 18°C	Diurnal opportunistic	7hrs 0730 - 1430
	29/10/19	1/8 cloud, 3-15km/h NE wind, no rain, 13-31°C	Diurnal opportunistic	5hrs 30min 1100 - 1630
	30/10/19	1/8 cloud, 2-10km/h NE wind, no rain, 13-33°C	Diurnal opportunistic	8hrs 0730 - 1530
Nocturnal birds	5/10/17	5/8 cloud, gentle E wind, no rain, 26-24°C	Spotlighting & call identification	2hrs 30min 1900 - 2130
			Call playback (threatened owls/bitterns)	Commenced @ 1930
Arboreal mammals	5/10/17	5/8 cloud, gentle E wind, no rain, 26-24°C	Spotlighting	2hrs 30min 1900 - 2130
Terrestrial mammals	5/10/17	5/8 cloud, gentle E wind, no rain, 26-24°C	Spotlighting	2hrs 30min 1900 - 2130
Bats	5/10/17	5/8 cloud, gentle E wind, no rain, 26-24°C	Spotlighting	2hrs 30min 1900 - 2130
			Ultrasonic recorders (passive monitoring x4)	Overnight from 1800
	29/10/19	1/8 cloud, 3-15km/h NE wind, no rain, 15-13°C	Ultrasonic recorders (passive monitoring x2)	Overnight from 1920
Reptiles	5/10/17	4/8 cloud, gentle NNE wind, no rain, 23°C	Opportunistic habitat searches	7hrs 30min 1100 - 1830
	6/10/17	8/8 cloud, light SW wind, no rain, 19°C	Opportunistic habitat searches	8hrs 0800 - 1600
	9/10/17	3/8 cloud, moderate WSW wind, no rain, 32°C	Opportunistic habitat searches	2hrs 30min 1430 - 1700
Amphibians	5/10/17	5/8 cloud, gentle E wind, no rain, 26-24°C	Spotlighting & call identification	2hrs 30min 1900 - 2130
			Call playback (Green & Golden Bell Frog)	Commenced @ 2000

Table 2.2 – Flora survey effort

Flora survey	Survey technique(s)	Dates
Vegetation communities	- Survey of the boundaries of all communities – field verification, plotting vegetation boundaries on aerial photographs	5 Oct 2017 3 Dec 2019
Stratified sampling	- Five (5) 20m x 20m quadrats spaced throughout the study area in areas of bushland - Four (4) 10 m x 40 m quadrats spaced throughout the study area in areas of bushland - Opportunistic observations of flora species during all on-foot traverses of the subject site - Seven (7) 20m x 20m / 50m x 20m floristic transect plots within native vegetation using BAM	5 Oct 2017 3 Dec 2019
Targeted searches	- Targeted searches in known or potential habitats. - Opportunistic searches during all on-foot traverses across the site.	5 Oct 2017 5 Oct 2017, 3 Dec 2019

Table 2.3 – Plot and transect survey effort – subject site

Veg zone no.	PCT	Condition	Area (Ha)	Minimum plot transect sites required	Plot transect sites sampled
1	850	Poor_planted	2.28	2	3
2	850	Moderate_poor	0.45	1	2
3	850	Poor_no_understorey	0.67	1	1
4	835	Moderate_poor	0.53	1	1

2.5 Survey limitations

It is important to note that field survey data collected during the survey period is representative of species occurring within the subject site for that occasion. Due to effects of fire, breeding cycles, migratory patterns, camouflage, weather conditions, time of day, visibility, predatory and / or feeding patterns, increased species frequency or richness may be observed within the subject site outside the nominated survey period. Habitat assessments based on the identification of micro-habitat features for various species of interest, including regionally significant and threatened species, have been used to minimise the implications of this survey limitation.

Given the limited potential for threatened species to occur on site because of the heavily disturbed (and removed understorey), together with long-term and ongoing management of the surrounding managed lands, it is unlikely that there are any significant limitations of this study.

Flora survey limitations

The species list does not include all household or exotic garden / landscaping species and those species which could not be identified at the time of the survey past genus level. Cryptic species not flowering at the time of the survey may not be observed during survey outside of peak flowering periods. Likewise cryptic orchid species are generally only recognisable when flowering.

Targeted survey was not conducted during the appropriate period for *Marsdenia viridiflora* subsp. *viridiflora*. Further survey during the recommended period could potentially reduce credit requirements.

Fauna survey limitations

Target survey for Green and Golden Bell Frog was not undertaken within the recognised period. Therefore this species has been included as a candidate species (refer to Section 4.4.4(e)).

No hollows identified to be removed have been stag-watched to determine any use by fauna. This will be required during pre-clearance surveys particularly given the presence of recorded hollow-dependent threatened microbats Eastern Coastal Free-tailed Bat, Large-footed Myotis and Greater broad-nosed Bat.

Only a single night of nocturnal survey inclusive of nocturnal species call-playback and spotlighting has been undertaken.

2.6 Accuracy of identification

Structural descriptions of the vegetation were made according to Specht *et al* (1995).



Survey Results

3

3.1 Flora results

3.1.1 Native vegetation extent

The native vegetation extent within the study area has been ground-truthed. The amount of native vegetation is 10.87 ha which included planted native vegetation.

The native vegetation to be impacted measures 3.95 ha. This is a combination of impacts from roads, trails, building envelopes, APZs, and associated infrastructure.

3.1.2 Flora species

The plants observed within the vegetation communities of the study area are listed in the Table 4.1 below.

Table 3.1 – Flora observations within the study area

Family	Scientific name	Common name
Trees		
Fabaceae	<i>Acacia decurrens</i>	Black Wattle
Fabaceae	<i>Acacia parramattensis</i>	Parramatta Wattle
Aceraceae	<i>Acer negundo</i> *	Box Elder
Myrtaceae	<i>Angophora bakeri</i>	Narrow-leaved Apple
Myrtaceae	<i>Angophora floribunda</i>	Rough-barked Apple
Myrtaceae	<i>Angophora subvelutina</i>	-
Araucariaceae	<i>Araucaria cunninghamii</i> *	Hoop Pine
Betulaceae	<i>Betula pendula</i> *	Silver Birch
Casuarinaceae	<i>Casuarina cunninghamiana</i>	River Oak
Casuarinaceae	<i>Casuarina glauca</i>	Swamp Oak
Ulmaceae	<i>Celtis sinensis</i> *	Chinese Hackberry
Lauraceae	<i>Cinnamomum camphora</i> *	Camphor Laurel
Myrtaceae	<i>Corymbia citriodora</i> *	Lemon-scented Gum
Myrtaceae	<i>Corymbia eximia</i>	Yellow Bloodwood
Myrtaceae	<i>Corymbia maculata</i>	Spotted Gum
Cupressaceae	<i>Cupressus macrocarpa</i> *	Monterey Cypress
Myrtaceae	<i>Eucalyptus acmenoides</i>	White Mahogany
Myrtaceae	<i>Eucalyptus amplifolia</i>	Cabbage Gum
Myrtaceae	<i>Eucalyptus beyeriana</i>	Beyer's Ironbark
Myrtaceae	<i>Eucalyptus botryoides</i>	Bangalay / Southern Mahogany
Myrtaceae	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark
Myrtaceae	<i>Eucalyptus elata</i>	River Peppermint
Myrtaceae	<i>Eucalyptus eugenioides</i>	Thin-leaved Stringybark

Family	Scientific name	Common name
Myrtaceae	<i>Eucalyptus fibrosa</i>	Broad Leaved Ironbark
Myrtaceae	<i>Eucalyptus microcorys</i>	Tallowwood
Myrtaceae	<i>Eucalyptus moluccana</i>	Grey Box
Myrtaceae	<i>Eucalyptus paniculata</i>	Grey Ironbark
Myrtaceae	<i>Eucalyptus populneus</i>	Poplar Box
Myrtaceae	<i>Eucalyptus punctata</i>	Grey Gum
Myrtaceae	<i>Eucalyptus robusta</i>	Swamp Mahogany
Myrtaceae	<i>Eucalyptus saligna</i>	Sydney Blue Gum
Myrtaceae	<i>Eucalyptus sclerophylla</i>	Scribbly Gum
Myrtaceae	<i>Eucalyptus tereticornis</i>	Forest Red Gum
Santalaceae	<i>Exocarpos cupressiformis</i>	Native Cherry
Phyllanthaceae	<i>Glochidion ferdinandi</i>	Cheese Tree
Proteaceae	<i>Grevillea robusta</i>	Silky Oak
Bignoniaceae	<i>Jacaranda mimosifolia</i> *	Jacaranda
Malvaceae	<i>Lagunaria patersonii</i>	Norfolk Island Hibiscus
Hamamelidaceae	<i>Liquidambar styraciflua</i> *	Sweet Gum
Arecaceae	<i>Livistona australis</i>	Cabbage Tree Palm
Myrtaceae	<i>Lophostemon confertus</i>	Brush Box
Myrtaceae	<i>Melaleuca linariifolia</i>	Snow in Summer
Myrtaceae	<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark
Myrtaceae	<i>Melaleuca styphelioides</i>	Prickly-leaved Tea Tree
Meliaceae	<i>Melia azedarach</i> var. <i>australasica</i>	White Cedar
Arecaceae	<i>Phoenix canariensis</i> *	Canary Island Date Palm
Rosaceae	<i>Photinia robusta</i> *	Red Leaf Photinia
Pinaceae	<i>Pinus elliotti</i> *	Slash Pine
Pinaceae	<i>Pinus patula</i> *	Mexican Weeping Pine
Pinaceae	<i>Pinus radiata</i> *	Radiata or Monterey Pine
Salicaceae	<i>Populus alba</i> *	White Poplar
Salicaceae	<i>Salix babylonica</i> *	Weeping Willow
Anacardiaceae	<i>Schinus areira</i> *	Pepper Tree
Myrtaceae	<i>Syzygium australe</i>	Brush Cherry
Ulmaceae	<i>Ulmus parvifolia</i> *	Chinese Elm
Shrubs		
Fabaceae	<i>Acacia binervia</i>	Coast Myall
Fabaceae	<i>Acacia falcata</i>	Sickle Wattle
Fabaceae	<i>Acacia falciformis</i>	Broad-Leaved Hickory
Fabaceae	<i>Acacia floribunda</i>	Sally Wattle
Fabaceae	<i>Acacia implexa</i>	Hickory
Proteaceae	<i>Banksia spinulosa</i>	Hairpin Banksia
Pittosporaceae	<i>Bursaria spinosa</i> var. <i>spinosa</i>	Native Blackthorn
Buxaceae	<i>Buxus</i> sp.*	-
Myrtaceae	<i>Callistemon citrinus</i>	Crimson Bottlebrush
Myrtaceae	<i>Callistemon linearis</i>	Narrow-leaved Bottlebrush
Myrtaceae	<i>Callistemon salignus</i>	Willow Bottlebrush
Myrtaceae	<i>Callistemon viminalis</i>	Weeping Bottlebrush
Fabaceae	<i>Dillwynia sieberi</i>	Prickly Parrot-pea
Sapindaceae	<i>Dodonaea triquetra</i>	Hop Bush
Rubiaceae	<i>Gardenia</i> sp. (cultivar)*	Gardenia

Family	Scientific name	Common name
Proteaceae	<i>Hakea salicifolia</i>	Willow Hakea
Fabaceae	<i>Jacksonia scoparia</i>	Dogwood
Verbenaceae	<i>Lantana camara</i> *	Lantana
Oleaceae	<i>Ligustrum lucidum</i> *	Large-leaved Privet
Oleaceae	<i>Ligustrum sinense</i> *	Small-leaved Privet
Myrtaceae	<i>Melaleuca armillaris</i>	Bracelet Honey Myrtle
Berberidaceae	<i>Nandina domestica</i> *	Sacred Bamboo
Ochnaceae	<i>Ochna serrulata</i> *	Mickey Mouse Plant
Oleaceae	<i>Olea europaea</i> subsp. <i>cuspidata</i> *	African Olive
Poaceae	<i>Phyllostachys aurea</i> *	Bamboo
Phytolaccaceae	<i>Phytolacca octandra</i> *	Inkweed
Malaceae	<i>Rhaphiolepis indica</i> *	Indian Hawthorn
Rosaceae	<i>Rubus fruticosus</i> sp. agg.*	Blackberry Complex
Solanaceae	<i>Solanum sisymbriifolium</i>	-
Euphorbiaceae	<i>Triadica sebifera</i>	Chinese Tallow
Groundcovers		
Poaceae	<i>Aristida vagans</i>	Three-awn Speargrass
Anthericaceae	<i>Arthropodium milleflorum</i>	Pale Vanilla Lily
Poaceae	<i>Arundo donax</i> *	Giant Reed
Asparagaceae	<i>Asparagus aethiopicus</i> *	Asparagus Fern
Poaceae	<i>Avena fatua</i> *	Wild Oats
Poaceae	<i>Axonopus fissifolius</i> *	Narrow-leafed Carpet Grass
Asteraceae	<i>Bidens pilosa</i> *	Cobbler's Pegs
Brassicaceae	<i>Brassica juncea</i> *	Indian Mustard
Poaceae	<i>Briza maxima</i> *	Quaking Grass
Poaceae	<i>Briza minor</i> *	Shivery Grass
Poaceae	<i>Briza subaristata</i> *	Chilean Quaking Grass
Poaceae	<i>Bromus cartharticus</i> *	Prairie Grass
Acanthaceae	<i>Brunoniella australis</i>	Blue Trumpet
Poaceae	<i>Cenchrus clandestinus</i> *	Kikuyu
Gentianaceae	<i>Centaurium tenuiflorus</i> *	Pink Stars
Carophyllaceae	<i>Cerastium glomeratum</i> *	Mouse-ear Chickweed
Poaceae	<i>Chloris gayana</i> *	Rhodes Grass
Poaceae	<i>Chloris truncata</i>	Windmill Grass
Poaceae	<i>Chloris ventricosa</i>	Tall Chloris
Liliaceae	<i>Chlorophytum comosum</i> *	Spider Plant
Asteraceae	<i>Cirsium vulgare</i> *	Spear Thistle
Asteraceae	<i>Conyza bonariensis</i> *	Flaxleaf Fleabane
Asteraceae	<i>Conyza sumatrensis</i> *	Fleabane
Crassulaceae	<i>Crassula sarmentosa</i> *	Jade Plant
Apiaceae	<i>Cyclospermum leptophyllum</i> *	Slender Celery
Poaceae	<i>Cynodon dactylon</i> *	Common Couch
Cyperaceae	<i>Cyperus eragrostis</i> *	Umbrella Sedge
Cyperaceae	<i>Cyperus gracilis</i>	-
Phormiaceae	<i>Dianella caerulea</i> var. <i>caerulea</i>	Flax Lily
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed
Iridaceae	<i>Dietes grandiflora</i> *	Wild Iris
Chenopodiaceae	<i>Dysphania carinata</i>	Keeled Goosefoot

Family	Scientific name	Common name
Poaceae	<i>Echinochloa crus-gali</i> *	Cockspur
Poaceae	<i>Echinopogon caespitosus</i> var. <i>caespitosus</i>	Tufted Hedgehog Grass
Boraginaceae	<i>Echium plantagineum</i> *	Patterson's Curse
Poaceae	<i>Ehrharta erecta</i> *	Panic Veldtgrass
Chenopodiaceae	<i>Einadia hastata</i>	Berry Saltbush
Chenopodiaceae	<i>Einadia trigonos</i> subsp. <i>trigonos</i>	Fishweed
Chenopodiaceae	<i>Einadia polygonoides</i>	-
Poaceae	<i>Entolasia marginata</i>	Bordered Panic
Poaceae	<i>Eragrostis brownii</i>	Brown's Lovegrass
Poaceae	<i>Eragrostis curvula</i> *	African Lovegrass
Asteraceae	<i>Euchiton sphaericus</i>	Cudweed
Euphorbiaceae	<i>Euphorbia peplus</i> *	Spurge
Fumariaceae	<i>Fumaria muralis</i> *	Wall Fumitory
Rubiaceae	<i>Galium aparine</i> *	Cleavers
Asteraceae	<i>Gamochaeta</i> sp.	Cudweed
Goodeniaceae	<i>Goodenia hederacea</i> subsp. <i>hederacea</i>	Ivy-leaved Goodenia
Dilleniaceae	<i>Hibbertia diffusa</i>	-
Poaceae	<i>Hyparrhenia rufa</i> *	Thatch grass
Asteraceae	<i>Hypochaeris radicata</i> *	Flatweed
Dennstaedtiaceae	<i>Hypolepis muelleri</i>	Harsh Ground Fern
Poaceae	<i>Imperata cylindrica</i> var. <i>major</i>	Blady Grass
Juncaceae	<i>Juncus acutus</i> *	-
Juncaceae	<i>Juncus usitatus</i>	Common Rush
Lomandraceae	<i>Lomandra hyrstix</i>	Creek Mat-rush
Lomandraceae	<i>Lomandra longifolia</i>	Spiky-headed Mat-rush
Lomandraceae	<i>Lomandra multiflora</i> var. <i>multiflora</i>	Many-flowered Mat-rush
Fabaceae	<i>Lotus suaveolans</i> *	Hairy Bird's Foot Trefoil
Onagraceae	<i>Ludwigia peploides</i> subsp. <i>montevidensis</i>	Water Primrose
Primulaceae	<i>Lysimachia arvensis</i> *	Scarlet Pimpernel
Malvaceae	<i>Malva sylvestris</i> *	Tall Mallow
Poaceae	<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass
Malvaceae	<i>Modiola caroliniana</i> *	Red-flowered Mallow
Poaceae	<i>Oplismenus aemulus</i>	Basket Grass
Cactaceae	<i>Opuntia stricta</i> *	Prickly Pear
Oxalidaceae	<i>Oxalis corniculata</i> *	Yellow Wood Sorrel
Poaceae	<i>Paspalum distichum</i>	Water Couch
Poaceae	<i>Paspalum urvillei</i> *	Vasey Grass
Poaceae	<i>Paspalum dilatatum</i> *	Paspalum
Geraniaceae	<i>Pelargonium</i> sp. (cultivar)*	-
Polygonaceae	<i>Persicaria decipiens</i>	Slender Knotweed
Polygonaceae	<i>Persicaria strigosa</i>	-
Plantaginaceae	<i>Plantago lanceolata</i> *	Ribwort
Poaceae	<i>Poa annua</i> *	Winter Grass
Poaceae	<i>Poa sieberiana</i>	Tussock Grass
Caryophyllaceae	<i>Polycarpon tetraphyllum</i> *	Allseed
Acanthaceae	<i>Pseuderanthemum variabile</i>	Pastel Flower
Ranunculaceae	<i>Ranunculus repens</i> *	Creeping Buttercup
Rubiaceae	<i>Richardia stellaris</i> *	-

Family	Scientific name	Common name
Iridaceae	<i>Romulea rosea</i> var. <i>australis</i> *	Onion Grass
Polygonaceae	<i>Rumex crispus</i> *	Curled Dock
Asteraceae	<i>Senecio madagascariensis</i> *	Fireweed
Poaceae	<i>Setaria parviflora</i> *	-
Malvaceae	<i>Sida rhombifolia</i> *	Paddy's Lucerne
Solanaceae	<i>Solanum nigrum</i> *	Black Nightshade
Solanaceae	<i>Solanum prinophyllum</i>	Forest Nightshade
Solanaceae	<i>Solanum pseudocapsicum</i> *	-
Asteraceae	<i>Soliva sessilis</i> *	Jojo
Asteraceae	<i>Sonchus asper</i> subsp. <i>asper</i> *	Prickly Sowthistle
Asteraceae	<i>Sonchus oleraceus</i> *	Common Sow-thistle
Poaceae	<i>Sporobolus africanus</i> *	Parramatta Grass
Asteraceae	<i>Taraxacum officinale</i> *	Dandelion
Poaceae	<i>Themeda triandra</i>	Kangaroo Grass
Commelinaceae	<i>Tradescantia fluminensis</i> *	Wandering Jew
Fabaceae	<i>Trifolium repens</i> *	White Clover
Juncaginaceae	<i>Triglochin microtuberosa</i>	Water Ribbons
Anthericaceae	<i>Tricoryne elatior</i>	Yellow Rush-lilly
Typhaceae	<i>Typha orientalis</i>	Cumbungi
Verbenaceae	<i>Verbena bonariensis</i> *	Purpletop
Asteraceae	<i>Vernonia cinerea</i>	Iron Weed
Poaceae	<i>Vulpia muralis</i> *	Rat's Tail Fescue
Campanulaceae	<i>Wahlenbergia gracilis</i>	Australian Bluebell
Vines		
Basellaceae	<i>Anredera cordifolia</i> *	Madeira Vine
Apocnyaceae	<i>Araujia sericifera</i> *	Mothvine
Ranunculaceae	<i>Clematis aristata</i>	Old Man's Beard
Convolvulaceae	<i>Convolvulus erubescens</i>	Australian Bindweed
Fabaceae	<i>Desmodium varians</i>	Slender Tick-trefoil
Fabaceae	<i>Glycine clandestina</i>	Twining Glycine
Fabaceae	<i>Glycine tabacina</i>	-
Fabaceae	<i>Hardenbergia violacea</i>	False Sarsparilla
Fabaceae	<i>Kennedia rubicunda</i>	Dusky coral pea
Caprifoliaceae	<i>Lonicera japonica</i> *	Japanese Honeysuckle
Fabaceae	<i>Vicia sativa</i> subsp. <i>sativa</i> *	Common Vetch

* denotes exotic species

3.1.3 Plant community types (PCTs)

Evidence used to identify a PCT

Evidence used to identify the PCTs within the site: the entire list of PTCs was exported from the online BioNet Vegetation Classification Tool. Dominant canopy species, mid-stratum species, ground cover species, and Interim Biogeographic Regionalisation for Australia (IBRA) region and sub-region (Cumberland) information were utilised to produce a short list of potential PCTs (Table 3.2). Final PCTs were then chosen based on species composition and presence, and similarity to descriptive attributes and distributional information provided

in the BioNet Vegetation Classification Tool. Justification for inclusion or exclusion of each shortlisted PCT is provided in Table 3.2.

Table 3.3 provides a summary of the PCT occurring within the development site, including vegetation formation, percent cleared within and extent within the development site.

All plot sheets utilised for the BAM calculator are in Appendix 4.

Table 3.2 – PCT shortlist and justification

Zone	Shortlisted PCTs	PCT name	Match	Justification
1,2 & 3	849	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	x	Potential but 850 is a closer match.
	850	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	✓	Presence of <i>Acacia implexa</i> , which is diagnostic for this PCT. Correct landscape position (hills and rises).
4	835	Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	✓	Diagnostic species <i>Eucalyptus tereticornis</i> and <i>E. amplifolia</i> . Correct landscape position.

Zones 1,2 & 3:

The identification of the most suitable PCT was based upon filtering for PCTs within the Cumberland IBRA sub-region with *E. moluccana* and *E. tereticornis* in the upper strata, and *Microlaena stipoides* and *Themeda triandra* in the mid strata. This produced two PCTs: PCT 849 and PCT 850. Both PCTs are potentially representative, however, PCT 850 is a closer match, due to the presence of *Acacia implexa*, which is diagnostic for this PCT, and the landscape position - hills and rises - which best matches these zones.

Zone 3 contains planted native vegetation. Most of this planted vegetation occurs above the flood-prone areas and contains several species commensurate with PCT 850 (*E. tereticornis*, *E. crebra*, *E. moluccana*, *E. fibrosa*). Even though the diversity of planted vegetation is low, we are required to assign this vegetation to PCT 850.

Zone 4:

The identification of the most suitable PCT was based upon filtering for PCTs with *Eucalyptus tereticornis* and *E. amplifolia* as upper strata species within the Cumberland IBRA sub-region. This produced one PCT: PCT 835. This PCT is a close match due to the presence of *E. amplifolia*, *Acacia parramattensis* and *Bursaria spinosa*. The provided landscape position for PCT 835, alluvial flats, and alongside streams and creeks, correctly describes the landscape of Zone 1.

Table 3.3 – PCTs

PCT code	PCT name	Species relied upon	Vegetation formation	Vegetation class	% Cleared	Area within development site (ha)	TEC status
850	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	<i>E. moluccana</i> <i>E. tereticornis</i> <i>Acacia implexa</i> <i>Themeda triandra</i> <i>Microlaena stipoides</i>	Grassy Woodlands	Coastal Valley Grassy Woodlands	88	Remnant: 2.46 on site, 1.12 to be impacted; Planted: 5.76 on site, 2.28 to be impacted	CPW
835	Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	<i>E. tereticornis</i> <i>E. amplifolia</i> <i>Angophora subvelutina</i> <i>Acacia parramattensis</i> <i>Bursaria spinosa</i>	Forested Wetlands	Coastal Floodplain Wetlands;	93	3.07 on site, 0.53 to be impacted	RFEF

3.1.4 Vegetation descriptions of observed communities

The following vegetation communities were recorded on site:

- PCT 835 Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
- PCT 850 Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion
- Planted native vegetation (equivalent to PCT 850)
- Occasional fringing macrophytes surrounding waterbodies
- Exotic and non-native managed vegetation

PCT 835 Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion

This vegetation community occurs on the lower slopes along and adjacent to drainage lines and waterbodies that may be occasionally flooded. There is a combination of gum trees with Swamp Oak trees. This mix of canopy vegetation is typical of the endangered ecological community, River-flat Eucalypt Forest on Coastal Floodplains (RFEF).

Canopy – Commonly made up of *Eucalyptus tereticornis* with *Casuarina glauca* or *Casuarina cunninghamiana*, with *Eucalyptus subvelutina* more so in Jerrys Creek and less so in the tributaries. Projected foliage cover in mature stands is 40–70%, but less in impacted regrowth / immature remnants.

Mid-storey – The mid-storey is heavily impacted in almost every remnant patch, particularly from Privets. There are also some planted species in many of the remnants. Mid-storey specimens are not too common, however, some recorded species include *Melaleuca styphelioides*, *Acacia parramattensis*, *Acacia decurrens*, *Bursaria spinosa* and *Melia azedarach*.

Ground layer – The ground layer is heavily disturbed from Privet seedlings and lack of light in the mature stands of vegetation. Regrowth or immature stands tend to be dominated by juvenile Swamp Oak / River Oak trees. Common native grass species include *Microlaena stipoides* and *Oplismenus aemulus*. Common small shrubs under 1 m include *Solanum prinophyllum* and *Persicaria strigosa*, and other common native species include *Dichondra repens*, *Juncus usitatus* and *Clematis aristata*.

Disturbances – Most patches are heavily disturbed with Privets, occasional Camphor Laurel and a combination of assisted revegetation species (in the southern portion of Jerrys Creek) and occasional ornamental trees. Common weed species include *Ligustrum sinense*, *Ligustrum lucidum*, *Cinnamomum camphora* and *Araujia sericifera*.



Photo 1 – PCT 835 Forest Red Gum - Rough-barked Apple grassy woodland within plot G1



Photo 2 – PCT 835 Forest Red Gum - Rough-barked Apple grassy woodland around the edge of a dam in the north-east of the site



Photo 3 – PCT 835 Forest Red Gum - Rough-barked Apple grassy woodland along Jerrys Creek

PCT 850 Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion

This natural vegetation community occupies some small patches across the site, largely along or near the northern boundary east of Jerrys Creek with smaller remnants along the southern boundary also.

Canopy – Typically derived of *Eucalyptus moluccana* and *Eucalyptus tereticornis*, 10–25% projected foliage cover and height of 15–25 m.

Mid-storey – In areas where mid-storey is present, common species regularly included *Bursaria spinosa*, *Acacia decurrens*, *Acacia parramattensis* and *Acacia implexa*. These shrubs or small trees are typically between 1–10 m tall.

Ground layer – Common grasses include *Themeda triandra*, *Microlaena stipoides* and *Aristida vagans*. Common shrubby species under 1 m tall include *Dillwynia sieberi*, *Einadia hastata* and *Einadia polygonoides*. Other common groundcover species include *Dichondra repens*, *Glycine clandestinum*, *Centella asiatica*, *Pseuderanthemum variabile*, *Goodenia hederacea* and *Arthropodium milleflorum*.

Disturbances – not all patches of remnant vegetation have a mid-storey layer. Those without a mid-storey are indicated on Figure 3. Weed occurrences are common in all patches, some worse than others. Common weeds may include *Lantana camara*, *Ligustrum sinense*, *Ligustrum lucidum*, *Olea europaea* subsp. *africana*, *Senecio madagascariensis*, *Rubus fruticosus* ssp. *agg.*, *Plantago lanceolata*, *Araujia sericifera*, *Verbena bonariensis*, *Bidens pilosa*, *Euphorbia peplus* and, *Eragrostis curvula*. Some ornamental plants have been planted within the community but typically only occur in low numbers.

Classification – This vegetation is commensurate with Cumberland Plain Woodland in the Sydney Basin Bioregion (CPW) which is listed as Critically Endangered under the *BC Act*. Some patches are also commensurate with Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (CPSWSGTF), which is listed under the *EPBC Act*. One (1) patch contained a few species that are more common in Shale-Sandstone Transition Forest, however the quadrat that was located within this area was tested against the tool produced by Greg Steenbeeke (DPIE) that uses documentation by *Tozer*. The lack of any sandstone geology within 1 km of the study area further supports the classification of this vegetation as CPW.



Photo 4 – PCT 850 Grey Box - Forest Red Gum grassy woodland within plot G4



Photo 5 – PCT 850 Grey Box - Forest Red Gum grassy woodland poor / no midstorey vegetation that has likely been impacted by overuse of herbicide on understorey weeds



Photo 6 – PCT 850 Grey Box - Forest Red Gum grassy woodland poor / no midstorey vegetation within plot G3.



Photo 7 – PCT 850 Grey Box - Forest Red Gum grassy woodland within plot G7

Planted native vegetation

Native trees that are most likely planted occur throughout the study site. These include locally-occurring species, such as *E. tereticornis*, *E. moluccana*, *E. crebra*, *E. punctata* and *E. fibrosa*, along with species that would not naturally occur within the site, such as *Lophostemon confertus*, *Grevillea robusta*, *Melaleuca* spp., *Callistemon viminalis* and *Araucaria cunninghamiana*.

The mid-storey is absent and the ground layer is highly disturbed and comprised of native and exotic grasses and forbs.

Although this vegetation is planted, it meets the definition of native vegetation in accordance within the *BC Act* and *LLS Act 2013* and must be classified as such. In accordance with the BAM, a PCT must be assigned to this vegetation for credit calculation. In this case, the mixture of indigenous and non-indigenous species makes it difficult to assign a PCT that correctly describes the vegetation floristically. Most of this planted vegetation occurs above the flood-prone areas and contains several species commensurate with PCT 850 (*E. tereticornis*, *E. crebra*, *E. moluccana*, *E. fibrosa*). It is reasonable to assume that the previous natural vegetation within the planted areas would have been equivalent to PCT 850, which occurs in similar positions within the study area. As such, we have assigned this vegetation to PCT 850.



Photo 8 – Planted native vegetation within plot G2 in the far west of the site



Photo 9 – Planted native vegetation within plot G5



Photo 10 – Planted Swamp Oak trees within plot G6 in the far east of the site

Occasional fringing macrophytes surrounding waterbodies

There are three (3) main waterbodies on the site, and one (1) tiny one in the western portion of the site. The edges of the waterbodies contain macrophytes such as *Typha orientalis*, *Persicaria decipiens* or *Persicaria strigosa*, *Ludwigia peploides*, *Maundia triglochinoides* and *Elaeocarpus sphacelata*.

The waterbodies have been constructed therefore do not form a natural wetland community nor a native or threatened wetland ecological community.

The proposal will not impact on any macrophyte vegetation.



Photo 11 – Largest waterbody near tee no. 5

Exotic and non-native managed vegetation

This description covers the remainder of the site to include the fairways and greens, planted non-native vegetation between the fairways and general landscaping. Many of the trees utilised are exotic ornamental species and non-natives such as *Corymbia citriodora*.

There are common occurrences of the following species: *Sapium sebiferum*, *Photinia robusta*, *Acer negundo*, *Betula pendula*, *Ulmus parvifolius*, *Liquidambar styraciflua*, *Pinus* species, *Cupressus* species, *Populus alba*, *Corymbia citriodora* and *Celtis sinensis*.



Photo 12 – Planted Eucalypts and Pines along the southern boundary



Photo 12 – Planted exotic pines along the fairways near the middle of the site

3.1.5 Vegetation integrity assessment

A vegetation integrity assessment is an assessment on the site's condition. Vegetation patches are broken into zones of roughly equal quality and then surveyed by transect plots. The number of required transect plots is dependent upon the size of the zone.

Vegetation zone area (ha)	Minimum number of plots/transects
<2	1 plot/transect
>2–5	2 plots/transects
>5–20	3 plots /transects
>20–50	4 plots/transects
>50–100	5 plots/transects
>100–250	6 plots/transects
>250–1000	7 plots/transects; more plots may be needed if the condition of the vegetation is variable across the zone
>1000	8 plots/transects; more plots may be needed if the condition of the vegetation is variable across the zone

Once data from the transect plot has been collected, the composition of native plant species per growth form is assessed, along with numbers of stems, percentages of exotic or high threat exotic species present, number and sizes of Eucalypt and non-Eucalypt tree stems, litter cover, rock cover, cryptogram cover, hollows and fallen logs. Therefore the vegetation integrity assessment is a measure of composition, structure and function.

The breakdown of PCTs and zones is shown on Figure 11. Impacted areas (the subject site) are shown cross-hatched. Figure 12 shows the location of the plots in relation to the impacted areas.

The vegetation integrity score is obtained using equations and weightings based upon a number of entities to calculate scores for composition, structure and function, for an overall current vegetation integrity score. Table 3.4 shows the current vegetation integrity score.

Table 3.4 – Current vegetation integrity score

Vegetation zone name	Area (ha)	Composition condition score	Structure condition score	Function condition score	Current vegetation integrity score
850_Poor_planted	2.28	19.9	38.6	37.3	30.6
850_Moderate_poor	0.45	35.7	58.3	74.7	53.8
850_Poor_no_understorey	0.67	24.2	54.6	63.8	43.8
835_Moderate_poor	0.53	44.8	17.6	100	42.9

The future vegetation integrity score is measured assuming there will be complete vegetation removal within the impact areas.

Given the above clarification, the future vegetation integrity score will be 0 as indicated in Table 3.5.

Table 3.5 – Future vegetation integrity score

Vegetation zone name	Area (ha)	Composition condition score	Structure condition score	Function condition score	Future vegetation integrity score
850_Poor_planted	2.28	0	0	0	0
850_Moderate_poor	0.45	0	0	0	0
850_Poor_no_understorey	0.67	0	0	0	0
835_Moderate_poor	0.53	0	0	0	0

3.2 Fauna results

Fauna species observed throughout the duration of fauna surveys are listed below.

Table 3.6 – Fauna observations within the study area

Common name	Scientific name	Method observed	
Birds		Oct 2017	Oct 2019
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>	OW	O
Australian King Parrot	<i>Alisterus scapularis</i>	OW	O
Australian Magpie	<i>Cracticus tibicen</i>	OW	OW
Australian Raven	<i>Corvus coronoides</i>	OW	OW
Australian White Ibis	<i>Threskiornis molucca</i>	O	
Australian Wood Duck	<i>Chenonetta jubata</i>	OW	OW
Bell Miner	<i>Manorina melanophrys</i>	W	OW
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	OW	
Channel-billed Cuckoo	<i>Scythrops novaehollandiae</i>	OW	
Chestnut Teal	<i>Anas castanea</i>	O	
Common Blackbird *	<i>Turdus merula</i>	OW	OW
Common Koel	<i>Eudynamys scolopacea</i>	W	
Common Myna *	<i>Sturnus tristis</i>	OW	OW
Crested Pigeon	<i>Ocyphaps lophotes</i>	OW	OW
Dollarbird	<i>Eurystomus orientalis</i>	OW	W
Dusky Moorhen	<i>Gallinula tenebrosa</i>	OW	O
Eastern Rosella	<i>Platycercus eximius</i>	OW	OW
Eastern Spinebill	<i>Acanthorhynchus tenuirostris</i>	W	
Eastern Whipbird	<i>Psophodes olivaceus</i>	W	W
Eurasian Coot	<i>Fulica atra</i>	OW	OW
Eastern Yellow Robin	<i>Eopsaltria australis</i>	OW	
Galah	<i>Eolophus roseicapillus</i>	OW	OW
Grey Butcherbird	<i>Cracticus torquatus</i>	OW	OW
Grey Fantail	<i>Rhipidura albiscapa</i>	OW	OW
Grey Teal	<i>Anas gracilis</i>	OW	
Intermediate Egret	<i>Ardea intermedia</i>	O	O
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	OW	OW
Lewin's Honeyeater	<i>Meliphaga lewinii</i>	W	
Little Corella	<i>Cacatua sanguinea</i>	OW	OW
Little Pied Cormorant	<i>Microcarbo melanoleucos</i>	O	O
Magpie-lark	<i>Grallina cyanoleuca</i>	OW	O
Masked Lapwing	<i>Vanellus miles</i>	OW	
Noisy Friarbird	<i>Philemon corniculatus</i>	OW	O
Noisy Miner	<i>Manorina melanocephala</i>	OW	O
Olive-backed Oriole	<i>Oriolus sagittatus</i>	OW	
Pacific Black Duck	<i>Anas superciliosa</i>	OW	O
Pallid Cuckoo	<i>Cacomantis pallidus</i>	W	
Pied Butcherbird	<i>Cracticus nigrogularis</i>	OW	OW
Pied Currawong	<i>Strepera graculina</i>	OW	W
Purple Swamphen	<i>Porphyrio porphyrio</i>	OW	OW
Rainbow Lorikeet	<i>Trichoglossus haematodus</i>	OW	OW

Common name	Scientific name	Method observed	
Red Wattlebird	<i>Anthochaera carunculata</i>	O	
Red-rumped Parrot	<i>Psephotus haematonotus</i>	OW	
Red-whiskered Bulbul *	<i>Pycnonotus jocosus</i>	W	
Rufous Whistler	<i>Pachycephala rufiventris</i>	W	
Sacred Kingfisher	<i>Todiramphus sanctus</i>	W	
Satin Bowerbird	<i>Ptilonorhynchus violaceus</i>	OW	O
Scarlet Honeyeater	<i>Myzomela sanguinolenta</i>	OW	
Spotted Pardalote	<i>Pardalotus punctatus</i>	W	
Spotted Turtle-Dove *	<i>Streptopelia chinensis</i>	O	O
Sulphur Crested Cockatoo	<i>Cacatua galerita</i>	OW	OW
Tawny Frogmouth	<i>Podargus strigoides</i>	O	
Variegated Fairy-wren	<i>Malurus lamberti</i>	OW	OW
Welcome Swallow	<i>Hirundo neoxena</i>	OW	O
White-faced Heron	<i>Egretta novaehollandiae</i>	OW	O
White-necked Heron	<i>Ardea pacifica</i>	OW	O
Willie Wagtail	<i>Rhipidura leucophrys</i>	OW	
Yellow-faced Honeyeater	<i>Caligavis chrysops</i>	W	
Yellow-tailed Black-Cockatoo	<i>Calyptorhynchus funereus</i>	OW	
Mammals			
Common Brushtail Possum	<i>Trichosurus vulpecula</i>	O	
Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>	O	
European Hare *	<i>Lepus europaeus</i>		O
Sheep	<i>Ovis aries</i>	O	O
Grey-headed Flying-fox ^{TS}	<i>Pteropus poliocephalus</i>	O	
Horse *	<i>Equus caballus</i>	O	O
Rabbit *	<i>Oryctolagus cuniculus</i>	O	O
Chocolate Wattled Bat	<i>Chalinolobus morio</i>	U	
Eastern Horseshoe-bat	<i>Rhinolophus megaphyllus</i>		U
Greater Broad-nosed Bat ^{TS}	<i>Scotorepens rueppellii</i>	U	U ^{PO}
Eastern Coastal Free-tailed Bat ^{TS}	<i>Micronomus norfolkensis</i>	U ^{PR}	U
Large Bent-wing Bat ^{TS}	<i>Miniopterus orianae oceanensis</i>	U	
Eastern Freetail-bat	<i>Mormopterus ridei</i>	U ^{PO}	U
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>	U	
Long-eared Bat	<i>Nyctophilus sp</i>	U ^{PR}	U ^{PR}
Large-eared Pied Bat ^{TS}	<i>Chalinolobus dwyeri</i>	U	
Large Forest Bat	<i>Vespadelus darlingtoni</i>	U	U
Large-footed Myotis ^{TS}	<i>Myotis macropus</i>	U	U
Little Forest Bat	<i>Vespadelus vulturnus</i>	U	U
Southern Forest Bat	<i>Vespadelus regulus</i>		U
White-striped Mastiff-bat	<i>Austronomus australis</i>	U	U
Reptiles			
Delicate Skink	<i>Lamprophis delicate</i>		O
Eastern Long-necked Turtle	<i>Chelodina longicollis</i>		O
Eastern Water Dragon	<i>Intellagama lesueurii</i>	O	O
Eastern Water Skink	<i>Eulamprus quoyii</i>	O	O
Lace Monitor	<i>Varanus varius</i>	O	
Red-bellied Black Snake	<i>Pseudechis porphyriacus</i>	O	
Amphibians			

Common name	Scientific name	Method observed	
Common Eastern Froglet	<i>Crinia signifera</i>	W	
Dwarf Tree Frog	<i>Litoria fallax</i>	W	W
Laughing Tree Frog	<i>Litoria tyleri</i>	W	
Peron's Tree Frog	<i>Litoria peronii</i>	W	
Striped Marsh Frog	<i>Limnodynastes peronii</i>	W	
Note: * indicates introduced species TS indicates threatened species All species listed are identified to a high level of certainty unless otherwise noted as: PR indicates species identified to a 'probable' level of certainty – more likely than not PO indicates species identified to a 'possible' level of certainty – recorded to a moderate to high level of uncertainty usually applied to a threatened species of note.			
E - Nest/roost F - Tracks/scratchings FB - Burrow G - Crushed cones	H - Hair/feathers/skin K - Dead O - Observed OW - Obs & heard call	P - Scat Q - Camera T - Trapped/netted U - Anabat/ultrasound	W - Heard call X - In scat Y - Bone/teeth/shell Z - In raptor/owl pellet

3.3 Habitat results

3.3.1 Fauna habitat observations

The fauna habitats present within the site are identified within the following table.

Table 3.7 – Observed fauna habitat

Topography				
Flat	Gentle ✓	Moderate ✓	Steep	Drop-offs
Vegetation structure				
Closed Forest	Open Forest ✓	Woodland ✓	Heath	Grassland ✓
Disturbance history				
Fire	Under-scrubbing ✓	Cut and fill works	✓	
Tree clearing ✓	Grazing ✓			
Soil landscape				
DEPTH:	Deep	Moderate ✓	Shallow ✓	Skeletal
TYPE:	Clay ✓	Loam ✓	Sand	Organic
VALUE:	Surface foraging ✓	Sub-surface foraging ✓	Denning/burrowing	
WATER RETENTION:	Well Drained ✓	Damp / Moist	Water logged	Swamp / Soak
Rock habitat				
CAVES:	No caves were present on site			
CREVICES:	No crevices were present on site			
ESCARPMENTS:	No escarpments were present on site			
OUTCROPS:	No outcrops were present on site			
SCATTERED / ISOLATED:	High Surface Area Hides	Med. Surface Area Hides ✓	Low Surface Area Hides ✓	
Feed resources				
FLOWERING TREES:	Eucalypts ✓	Corymbias	Melaleucas ✓	
	Banksias	Acacias ✓		
SEEDING TREES:	Allocasuarinas	Conifers		

WINTER FLOWERING EUCALYPTS:	C. maculata ✓	E. crebra ✓	E. globoidea	E. sideroxylon
	E. squamosa	E. grandis	E. multicaulis	E. scias
	E. robusta ✓	E. tereticornis ✓	E. agglomerata	E. siderophloia
FLOWERING PERIODS:	Autumn ✓	Winter ✓	Spring ✓	Summer ✓
OTHER:	Mistletoe	Figs / Fruit	Sap / Manna ✓	Termites ✓
Foliage protection				
UPPER STRATA:	Dense	Moderate ✓	Sparse ✓	
MID STRATA:	Dense	Moderate	Sparse ✓	
PLANT / SHRUB LAYER:	Dense	Moderate	Sparse ✓	
GROUNDCOVERS:	Dense	Moderate ✓	Sparse ✓	
Hollows / logs				
TREE HOLLOW:	Large	Medium ✓	Small ✓	
TREE HOLLOW TYPES	Spouts / branch ✓	Trunk ✓	Broken Trunk	Basal Cavities
GROUND HOLLOW:	Large	Medium	Small	Stags ✓
Vegetation debris				
FALLEN TREES:	Large	Medium	Small ✓	
FALLEN BRANCHES:	Large	Medium ✓	Small ✓	
LITTER:	Deep	Moderate	Shallow ✓	
HUMUS:	Deep	Moderate	Shallow ✓	
Drainage catchment				
WATER BODIES	Wetland(s)	Soak(s)	Dam(s) ✓	Drainage line(s) ✓
RATE OF FLOW:	Still ✓	Slow ✓	Rapid	
CONSISTENCY:	Permanent ✓	Perennial ✓	Ephemeral	
RUNOFF SOURCE:	Urban / Industrial ✓	Parkland ✓	Grazing ✓	Natural
RIPARIAN HABITAT:	High quality	Moderate quality	Low quality ✓	Poor quality ✓
Artificial habitat				
STRUCTURES:	Sheds ✓	Infrastructure ✓	Equipment ✓	
SUB-SURFACE	Pipe / culvert(s) ✓	Tunnel(s)	Shaft(s)	
FOREIGN MATERIALS:	Sheet	Pile / refuse		

3.3.2 Habitat tree data

Hollow-bearing trees were surveyed during the tree health assessment and fauna survey. The trees selected for assessment were along and adjacent to proposed roads and infrastructure. This was revised as part of the 2019 amended proposal. A tree study area was generally applied to within 20 m of the proposed roads and detention areas, 50 m around buildings and 10 m on either side of footpaths. Therefore, not all trees within the overall site study area have been surveyed for health and hollows.

A total of twenty-two (22) trees containing fifty-six (56) hollows were recorded within the tree study area. Tree species, dimension and hollow data for these is provided in Table 3.8. Overall the hollows present within the entire study area were found to be generally only within the small (0–10 cm) and medium (10–30 cm) entry size categories and were in very low density. The low number of hollows is attributed to the planted and managed areas adjacent to the fairways where many trees are planted, and older limbs of remnant trees have been noticeably cut in large numbers. Many of these dead limbs likely provided the representation of small branch spout hollows. Other trees were identified for their habitat value based on the presence of a bird nest (x2) or Common Ringtail Possum drey (x1).

Habitat tree data is provided in Table 3.8 and locations are shown on Figure 2.

Table 3.8 – Habitat tree data

HT No.	Tag No.	Tree species	DBH (cm)	Height (m)	Spread (m)	Vigour (%)	Hollows / habitat recorded	Remove / retain
HT1	T133	<i>Eucalyptus tereticornis</i>	180	32	25	90	3x 0-5cm branch spout hollows, 1x 5-10cm trunk hollow, 2x 10-15cm branch spout hollows, 2x 15-20cm branch hollow, 1x 15-20cm trunk hollow, 1x 20-30cm branch	retain
HT2	T476	<i>Eucalyptus tereticornis</i>	56,50	16	10	90	ringtail possum in drey	retain
HT3	T628	<i>Eucalyptus tereticornis</i>	53	22	9	40	bird nest	remove
HT4	T703	<i>Eucalyptus tereticornis</i>	98	24	14	70	1x 5-10cm trunk hollow	retain
HT5	T707	<i>Eucalyptus moluccana</i>	110,30	25	16	65	1x 5-10cm branch spout	retain
HT6	T732	<i>Eucalyptus tereticornis</i>	25	14	6	75	1x 5-10cm trunk hollow, potential microchiropteran bat roost	retain
HT7	T764	<i>Eucalyptus tereticornis</i>	58	20	8	65	1x 0-5cm trunk hollow	retain
HT8	T766	<i>Eucalyptus tereticornis</i>	20	8	4	45	1x 0-5cm trunk hollow, 1x 5-10cm trunk hollow	retain
HT9	T778	dead stag	36	24	5	0	1x 5-10cm branch	remove
HT10	T784	<i>Eucalyptus tereticornis</i>	30	21	3	20	1x 0-5cm trunk hollow, microbat flew out	retain
HT11	T916	<i>Eucalyptus moluccana</i>	99	24	15	80	1x 0-5cm branch hollow	remove
HT12	T917	<i>Eucalyptus eugenioides</i>	86	22	11	75	2x 5-10cm trunk hollows	remove
HT13	T918	<i>Eucalyptus tereticornis</i>	170	29	20	85	2x 0-5cm branch spouts 1x 5-10cm branch hollow	retain
HT14	T923	<i>Eucalyptus tereticornis</i>	116	24	15	85	1x 5-10cm trunk hollow (good)	retain
HT15	T925	<i>Eucalyptus eugenioides</i>	159	23	12	60	2x 5-10cm trunk hollows (good), 1x 5-10cm branch spout, 1x 10-15cm trunk hollow	remove
HT16	T929	<i>Eucalyptus tereticornis</i>	100	24	11	85	1x 5-10cm trunk hollow	retain
HT17	T930	<i>Eucalyptus eugenioides</i>	75	9	4	30	1x 15-20 broken trunk hollow	remove
HT18	T938	<i>Eucalyptus tereticornis</i>	150,180	25	16	75	1x 0-5cm trunk hollow, 1x 5-10cm trunk hollow, 1x 10-15cm broken trunk hollow	remove
HT19	T942	<i>Eucalyptus punctata</i>	25	11	3	75	bird nest	remove
HT20	T948	<i>Angophora floribunda</i>	160	26	15	70	1x 10-15cm trunk hollow (good for microbats) 6x 5-10 branch spouts	retain
HT21	T975	<i>Eucalyptus tereticornis</i>	158,110	25	22	80	2x 0-5cm branch spouts, rainbow lorikeet nesting pair	retain
HT22	T1008	<i>Eucalyptus tereticornis</i>	140	28	24	80	1x 5-10cm trunk hollow, 1x 10-15cm trunk hollow	remove

3.4 BAM calculator species

- The BAM calculator predicts the following ecosystem species:

Australian Bittern	Large Bent-wing-bat (foraging)
Brown Treecreeper	Little Bentwing-bat (foraging)
Diamond Firetail	Little Lorikeet
Dusky Woodswallow	Regent Honeyeater (foraging)
Eastern Coastal Free-tailed Bat	Scarlet Robin
Eastern Osprey (foraging)	Speckled Warbler
Flame Robin	Spotted-tailed Quoll
Grey-headed Flying-fox (foraging)	Swift Parrot (foraging)
Hooded Robin	White-bellied Sea-Eagle (foraging)
Koala (foraging)	

- The BAM calculator predicts the following candidate species credit species:

<i>Acacia pubescens</i>	<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> - end. pop.
<i>Caladenia tessellata</i>	<i>Persicaria elatior</i>
<i>Callistemon linearifolius</i>	<i>Persoonia hirsuta</i>
Cumberland Plain Land Snail	<i>Pilularia novae-hollandiae</i>
<i>Cynanchum elegans</i>	<i>Pimelea spicata</i>
Dural Land Snail	<i>Pomaderris brunnea</i>
Eastern Osprey (breeding)	<i>Pultenaea pedunculata</i>
<i>Eucalyptus benthamii</i>	Regent Honeyeater (breeding)
Green and Golden Bell Frog	<i>Thesium australe</i>
<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	Southern Myotis
Grey-headed Flying-fox (breeding)	Squirrel Glider
<i>Hibbertia</i> sp. <i>Bankstown</i>	Swift Parrot (breeding)
Koala (breeding)	<i>Wahlenbergia multicaulis</i> – end. pop.
Large Bent-wing-bat (breeding)	White-bellied Sea-Eagle (breeding)
Little Bent-winged Bat (breeding)	

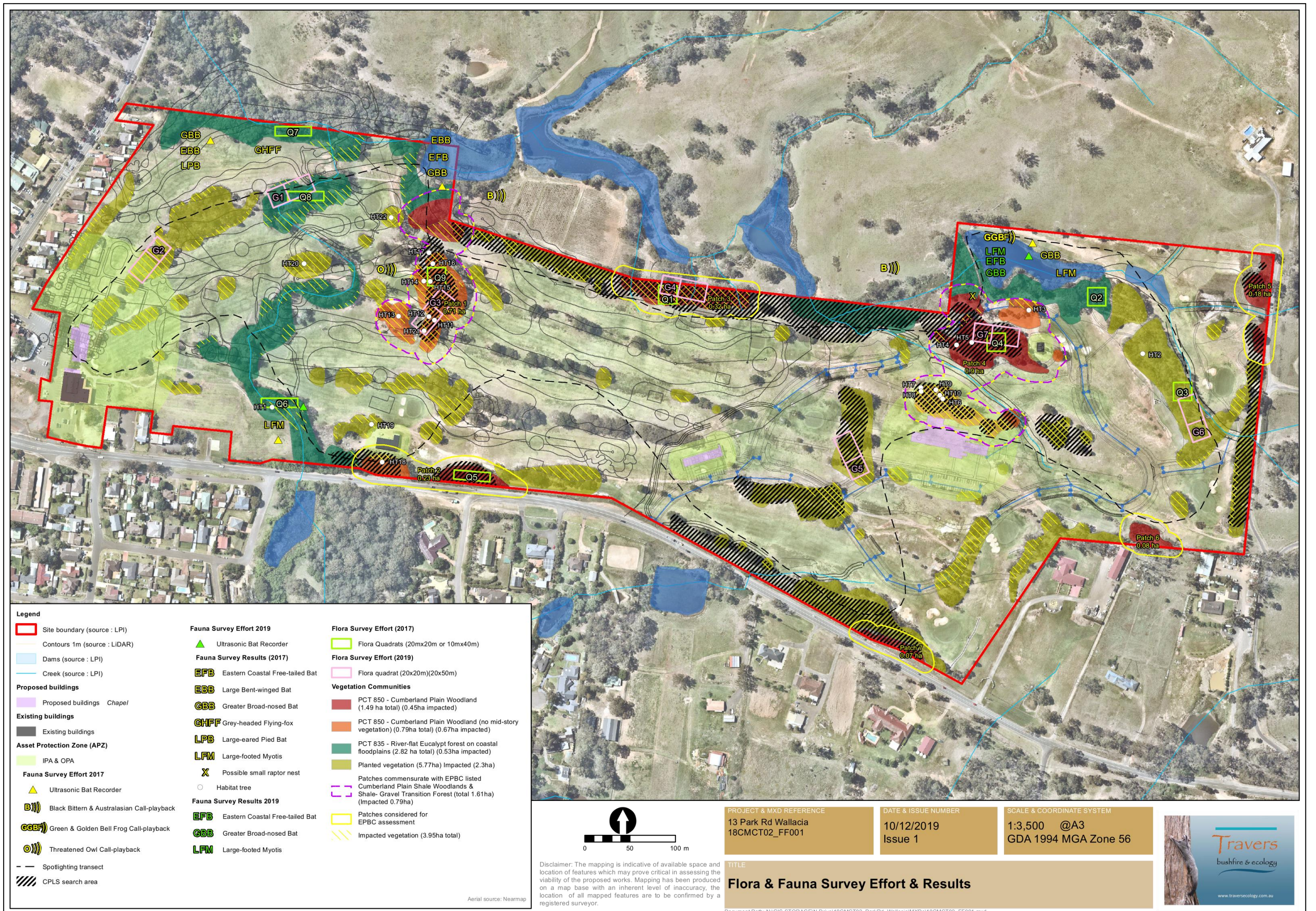


Figure 2 – Flora and fauna survey effort and results (PCTs and vegetation zones)



Biodiversity Assessment

4

4.1 BOS thresholds

The BOS includes two (2) elements to the threshold test – an area trigger and a Sensitive Biodiversity Values Land Map trigger. If clearing exceeds either trigger, the Biodiversity Offset Scheme applies to the proposed clearing.

4.1.1 Sensitive Biodiversity Values Land

Sensitive Biodiversity Values Land is mapped within the study area (refer to Figure 3) – therefore offsets are required as an outcome of this threshold test.

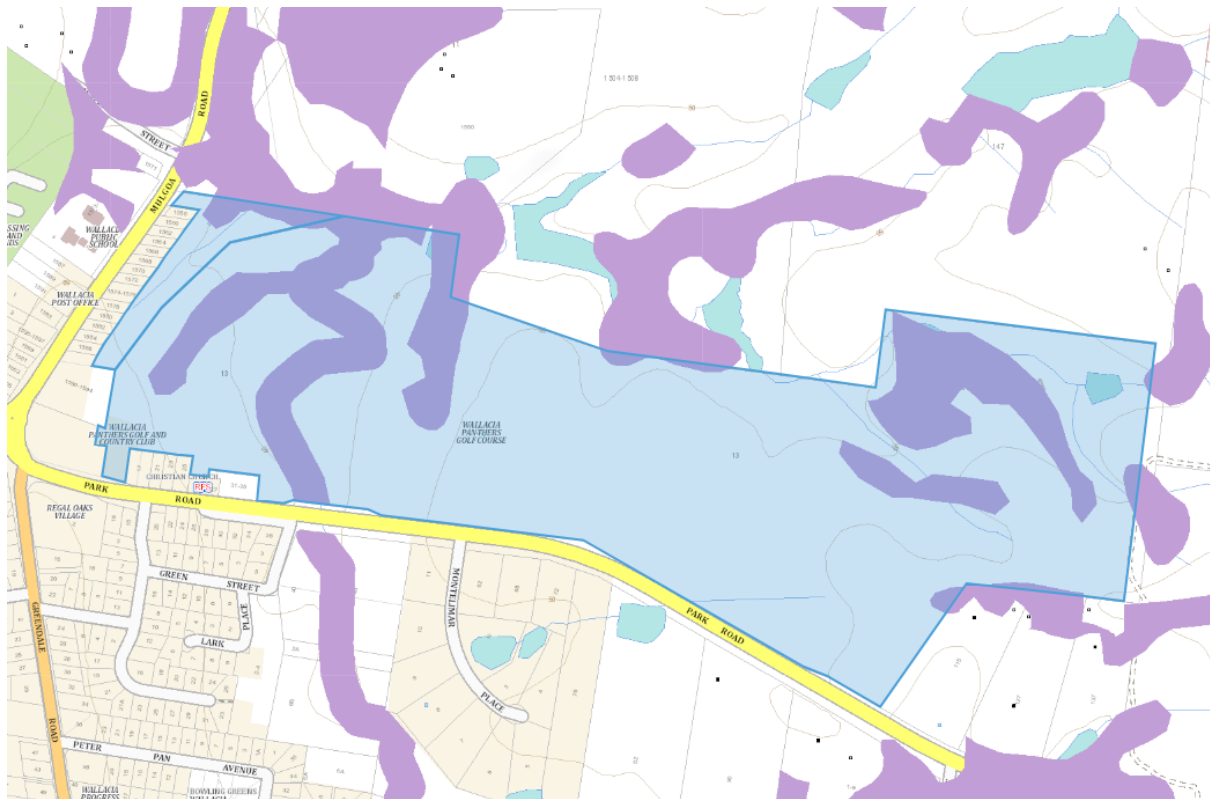


Figure 3 – Sensitive biodiversity values land (purple) relative to the study area (blue)
(source: <https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BosetMap>)

4.1.2 Area clearing threshold

The area threshold varies depending on the minimum lot size (shown in the Lot Size Maps made under the relevant Local Environmental Plan (LEP)), or actual lot size (where there is no minimum lot size provided for the relevant land under the LEP).

The area threshold applies to all proposed native vegetation clearing associated with a development proposal – for example in the case of a subdivision; all future clearing across the lots subject to the subdivision, must be considered. Thresholds outlined under the BOS are outlined in the table below.

Table 5.1 identifies that the site has a minimum lot size of 20 ha, and the clearing area threshold for which the BOS applies is 0.5 ha. Based on the preliminary concept plans (Figure 1.2), TBE concludes that the proposed development will remove greater than 0.25 ha of native vegetation therefore offsetting under BOS applies.

Table 4.1 – BOS entry threshold report

Date of Calculation	02/12/2019 1:14 PM	BDAR Required*
Total Digitised Area	2.64 ha	
Minimum Lot Size Method	LEP	
Minimum Lot Size	20 ha	
Area Clearing Threshold	0.5 ha	
Area clearing trigger Area of native vegetation cleared	Unknown #	Unknown #
Biodiversity values map trigger Impact on biodiversity values map(not including values added within the last 90 days)?	yes	yes
Date of the 90 day Expiry	N/A	

The Development proposal does exceed the nominated clearing thresholds therefore offsetting is required as an outcome of this test. A biodiversity offset credit assessment has been undertaken as part of this BDAR and the credit requirements are presented in Section 6.

4.1.3 Serious and Irreversible Impacts

An impact is to be regarded as serious and irreversible if it is likely to contribute significantly to the risk of a threatened species or ecological community most at risk of extinction. Threatened species and communities that are potential for serious and irreversible impacts are outlined in Appendix 2 of *Guidance to assist a decision-maker to determine a serious and irreversible impact* (OEH 2017). The principles for determining serious and irreversible impacts are set out under Section 6.7.2 of the BC Reg.

Candidate entities recorded or with potential to occur within the study area include:

Table 4.2 – Candidate SAIL entities

Species / EEC (Scientific Name)	Species (Common Name)	BC Act	Potential to occur
CPW		CE	recorded on site
<i>Anthochaera phrygia</i>	Regent honeyeater	E	low
<i>Lathamus discolor</i>	Swift parrot	E	✓
<i>Miniopterus schreibersii</i> subsp. <i>oceanensis</i>	Large Bent-wing Bat	E	recorded
<i>Chalinolobus dwyeri</i>	Large-eared pied-bat	V	recorded
<i>Miniopterus australis</i>	Little bent-wing Bat	E	✓

- The additional impact assessment provisions for threatened species are outlined under Section 10.2.3 of the BAM (2017) and have been applied to the recorded Large Bent-wing Bat and Large-eared Pied Bat within Appendix 2. An assessment has also been undertaken for Large-eared Pied Bat and Eastern Cave Bat as prompted by the BAM calculator. As a result of this assessment it is considered that the proposal will not likely cause a serious or irreversible impact on these microbat species or other candidate fauna species considered.
- The additional impact assessment provisions for TECs are outlined under Section 10.2.2 of the BAM (2017) and have been applied to the recorded CPW within Appendix 3. As a result of this assessment it is considered that the impact on CPW of 1.12 ha may constitute an SAIL.

The site also does not likely support any breeding habitat or likely important roosting/foraging for other candidate species with potential to occur including Little Bent-wing Bat, Swift Parrot or Regent Honeyeater. The proposal is therefore not likely to cause serious and irreversible impacts on threatened biodiversity most at risk of extinction.

4.2 Previous surveys reviewed

The following regional vegetation mapping and previous reports were examined to identify the potential vegetation communities and other threatened biodiversity with potential to occur for assessment.

Vegetation mapping of the Cumberland Plain (NPWS 2002)

Vegetation mapping of the Cumberland Plain (NPWS 2002) identifies the following communities within the study area:

- Alluvial woodland
- Shale plains woodland
- Shale hills woodland
- Shale sandstone transition forest (high sandstone influence)
- Shale sandstone transition forest (low sandstone influence)

Flora and Fauna Assessment - Proposed Cemetery, Lot 2 DP 1108408 13 Park Road, Wallacia - Travers bushfire & ecology October 2017

This report assessed the impact of the construction of the following built facilities:

- A multipurpose chapel (with crematorium below);
- A administration office;
- Reuse of existing building as function room; and
- Reuse of existing workshop building.
- A network of roads and pathways to allow access to each of these facilities and access to the various burial and memorial sites throughout the development.

Flora survey recorded. Six (6) state listed threatened fauna species including Grey-headed Flying-fox, Large-eared Pied Bat, Eastern Coastal Free-tailed Bat, Large Bent-wing Bat, Greater Broad-nosed Bat and Large-footed Myotis, no threatened flora species, and two (2) TECs, CPW and RFEF, were recorded present during survey. The Eastern Coastal Free-tailed Bat was recorded to a 'probable' level of certainty.

The report included a 7 part test of significance which concluded a not significant impact on threatened species and TECs.

4.3 Flora

A number of landscaping species were observed within the eastern portion of the subject site. These were generally not taken into consideration in preparing the species list.

No threatened flora species were observed.

All species are listed in Table 3.1.

4.3.1 State legislative flora matters

(a) Threatened flora species (NSW)

BC Act – A search of the *Atlas of NSW Wildlife* (DPIE 2019) indicated a list of species that have been recorded within a 10 km radius of the study area. Those species are considered for suitable habitat and potential to occur in Table A2.1 (Appendix 1).

Based on the habitat assessment within Appendix 1, it is considered that the subject site provides varying levels of potential habitat for the following state listed threatened flora species:

Table 4.3 – State listed threatened flora species with suitable habitat present

Scientific name	BC Act	Potential to occur
<i>Dillwynia tenuifolia</i>	V	Low. Marginal habitat present, mostly along northern boundary in CPW
<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	V	Low. Marginal habitat present outside of floodplain areas
<i>Pimelea spicata</i>	E1	Low. Marginal habitat present, mostly along northern boundary in CPW
<i>Pultenaea parviflora</i>	E1	Low. Marginal habitat present, mostly along northern boundary in CPW

Note: Full habitat descriptions for these species are provided in Appendix 1.

All species above can be detected at any time of year and are not cryptic. The likelihood of threatened species presence was considered to be low given the lack of quality and suitable habitat, the fragmentation of the habitat, and lack of connectivity to other remnants, particularly CPW.

Targeted searches for threatened species were conducted during the botanical survey on 5 October 2017, with incidental searches conducted whilst tree surveys were being undertaken within a 1 week range of that date. *Dillwynia*, *Pimelea* and *Pultenaea* could potentially occur in CPW vegetation. The patches containing some native understorey were searched in a stratified manner by transects with approximately 8–12 m separation. *Grevillea juniperina* subsp. *juniperina* may be more sporadic as it can more readily adapt to soil impacts. It was searched across the site adjacent to fairways where there was limited mowing.

During the botanical survey, no threatened flora species were detected.

(b) Endangered flora populations (NSW)

There is only one (1) endangered flora population noted within 10 km of the site. This is:

- *Marsdenia viridiflora* subsp. *viridiflora* endangered population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith LGAs

It has a preference for:

Dry sclerophyll forests (shrub/grass sub-formation) Cumberland Dry Sclerophyll Forests

- Broad-leaved Ironbark - *Melaleuca decora* shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion
- Derived shrubland on Tertiary Gravels of the Cumberland Plain
- Narrow-leaved Ironbark - Broad-leaved Ironbark-Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion

Dry sclerophyll forests (shrubby sub-formation) Sydney Sand Flats Dry Sclerophyll Forests

- Coast Banksia scrub on sand in the Elderslie area, Sydney Basin Bioregion Grassy woodlands

Coastal Valley Grassy Woodlands

- Derived grasslands on shale hills of the Cumberland Plain (50–300 m ASL)
- Derived grasslands on shale plains of the Cumberland Plain (<100 m ASL)
- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
- Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion

The vegetation present within the study area is most similar to those described under Coastal Valley Grassy Woodlands which is listed as a series of vegetation types that would support a population of the species, therefore potential habitat would be considered present.

The overall depauperate nature of CPW, nearest record being 4 km away, fragmentation and no connectivity of CPW, it is considered unlikely to occur. No specimens of the endangered population were noted during the botanical survey.

(c) Threatened ecological communities (NSW)

Two (2) threatened ecological communities (TECs) – *River-flat Eucalypt Forest on Coastal Floodplains* (RFEF) and *Cumberland Plain Woodland in the Sydney Basin Bioregion* (CPW) – were observed within the subject site.

Impacts on these communities have been assessed in detail within Appendix 3.

Impacts upon CPW are listed as a potential SAIL (*Reference - Guidance to assist a decision-maker to determine a serious and irreversible impact Office of Environment & Heritage 2017*).

River-flat Eucalypt Forest on Coastal Floodplains

RFEF is listed as endangered under the *BC Act*.

The proposed impacts on the community include creek crossings by pathways in the west, and construction of the edge of a basin. There will be an impact along one edge by a proposed road near the north-east site corner. The estimation of impacts is 0.53 ha which represents 18.79% of all RFEF within the site.

In a local context, RFEF extends beyond the site and follows Jerrys Creek and its tributaries, right to the Nepean River.

Cumberland Plain Woodland in the Sydney Basin Bioregion

Cumberland Plain Woodland in the Sydney Basin Bioregion (CPW) is listed as critically endangered under the *BC Act*. It occurs as a number of fragmented remnants across the site, generally at higher elevation away from watercourses. The estimated extent on site is 2.28 ha. Impacts on the vegetation include the installation of roads and tracks, and application of asset protection zones for new dwellings / structures. Whilst many remnants are currently managed or canopy only vegetation, the roads, tracks or APZs will continue to impact on the regenerative capacity of the trees, or they will impact partially on ground layer species. The impact area is estimated at 1.12 ha or 49.12% of all CPW within the study area.

There is no connectivity from the CPW vegetation on site, to vegetation off site. As such, the remnants on site are highly fragmented.

Very little tree removal is required in the CPW remnants, and all APZs occur in areas where the understorey is completely managed. Thus impacts on CPW within APZs will be negligible as these areas are already APZ compliant.

(d) Ecosystem credit species

The BAM calculator did not predict any threatened flora species as ecosystem credit species.

(e) Species credit species

Based upon the BAM calculator and field surveys to date, the following predicted threatened species were considered as confirmed candidate species:

Table 4.4 – Species credit species (flora)

Scientific name	BC Act	Associated PCTs	Potential to occur (presence status)	Confirmed candidate species	Survey Adequacy			Presence		Presence
					Preferred Survey period (DPIE)	Actual Survey period	Survey Compliant (Yes/ No)	Assumed	Expert report	
<i>Acacia pubescens</i>	V	-	x	x	-	-	-	-		n/a
<i>Caladenia tessellata</i>	E1	-	x	x	-	-	-	-		n/a
<i>Callistemon linearifolius</i>	V	-	not likely	x	-	-	-	-		n/a
<i>Cynanchum elegans</i>	E1	-	x	x	-	-	-	-		n/a
<i>Eucalyptus benthamii</i>	V	-	x	x	-	-	-	-		n/a
<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	V	850, 835	low	✓	All months	Sept	yes	no	no	no (survey)
<i>Hibbertia</i> sp. Bankstown		-	x	x	-	-	-	-		n/a
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> - endangered population	E2	850_Moderate_poor 835_Moderate_poor	unlikely	✓	Nov–Feb	Sept	no	yes	no	yes (assumed)
<i>Persicaria elatior</i>	V	-	x	x	-	-	-	-		n/a
<i>Persoonia hirsuta</i>	E1	-	x	x	-	-	-	-		n/a
<i>Pilularia novae-hollandiae</i>	E1	-	x	x	-	-	-	-		n/a
<i>Pimelea spicata</i>	E1	850_moderate_poor	low	✓	All months	Sept	yes	no	no	no (survey)
<i>Pomaderris brunea</i>	V	-	not likely	x	-	-	-	-		n/a
<i>Pultenaea pedunculata</i>	E1	-	x	x	-	-	-	-		n/a
<i>Wahlenbergia multicaulis</i> - endangered population	E2	-	x	x	-	-	-	-		n/a
<i>Thesium australe</i>	V	-	x	x	-	-	-	-		n/a

Exclusions based on habitat features / survey

Habitat assessments for all species recorded within 10 km of the study area are provided in detail and based on local records within Appendix 1. Some additional species for consideration have been generated by the BAM calculator and their potential to occur is considered here only. Species recorded present or considered with any potential to occur are then assessed for habitat presence. If these species have not been recorded some may be ruled out based on adequacy of survey (survey techniques and methodology have been described in section 3).

General exclusions from assessment have been based on a number of features. Although the BAM calculator may suggest particular species have potential habitat based upon the vegetation type, they may be excluded due to geographic distribution, last known local record being decades old, lack of suitable geological features, isolation of particular habitats or degradation of habitats. These factors were considered in detail to advise which candidate species could potentially be impacted.

Excluded species are mentioned below:

Caladenia tessellata

This species is known from the Sydney area (old records), Wyong, Ulladulla and Braidwood in NSW. There is marginal habitat within the subject site but the lack of any nearby or recent records within 10 km suggests that there is no potential for this species to occur within the subject site.

Callistemon linearifolius

Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW where it grows in dry sclerophyll forest. There is marginal habitat within the subject site but the lack of any nearby or recent records within 10 km suggests that there is no potential for this species to occur within the subject site.

Wahlenbergia multicaulis - endangered population

This population is restricted to the Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield LGAs. As such, it does not occur within the Penrith LGA, where the subject site is located.

Persicaria elatior

This species grows in damp places especially beside streams and lakes, and occasionally in swamp forest. The subject site provides low potential habitat, but the lack of any nearby or recent records within 10 km suggests that there is no potential for this species to occur within the subject site.

Pilularia novae-hollandiae

Austral Pillwort grows in shallow swamps and waterways, often among grasses and sedges. It is most often recorded in drying mud as this is when it is most conspicuous. The watercourses and waterbodies within the subject site provides very marginal habitat for this species. The lack of any nearby or recent records within 10 km suggests that there is no potential for this species to occur within the subject site.

Pultenaea pedunculata

A disjunct population of this species occurs on the Cumberland Plain, in woodland on clay or sandy-clay, shale-derived soils. There is potential habitat within CPW within the subject site but the lack of any nearby or recent records within 10 km suggests that there is no potential for this species to occur within the subject site.

Hibbertia sp. Bankstown

This species is known only from Bankstown Airport in Sydney's southern suburbs, within the Bankstown LGA and has no potential to occur within the subject site.

(f) Local data

Local data has not been used in this case.

(g) Expert reports

Expert reports have not been utilised for flora on this project.

(h) Endangered wetland communities

A number of wetland communities have been listed as TECs under the NSW *BC Act*. We note that 'wetlands' are included in the definition of 'waterfront lands' in accordance with the *Water Management Act 2000 (WM Act)* due to their inclusion in the definition of a 'lake' under the same Act. TECs that are considered to be an endangered protected wetland are as follows:-

- Artesian springs ecological community
- Castlereagh Swamp Woodland Community
- Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions
- Coastal Upland Swamp in the Sydney Basin bioregion
- Coolibah–Black Box woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain and Mulga Lands bioregions
- Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions
- Kurri sand swamp woodland in the Sydney Basin Bioregion
- Lagunaria swamp forest on Lord Howe Island
- Maroota Sands swamp forest
- Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion
- Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions
- Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions
- The shorebird community occurring on the relict tidal delta sands at Taren Point
- Upland wetlands of the drainage divide of the New England Tableland Bioregion
- Wingecarribee Swamp

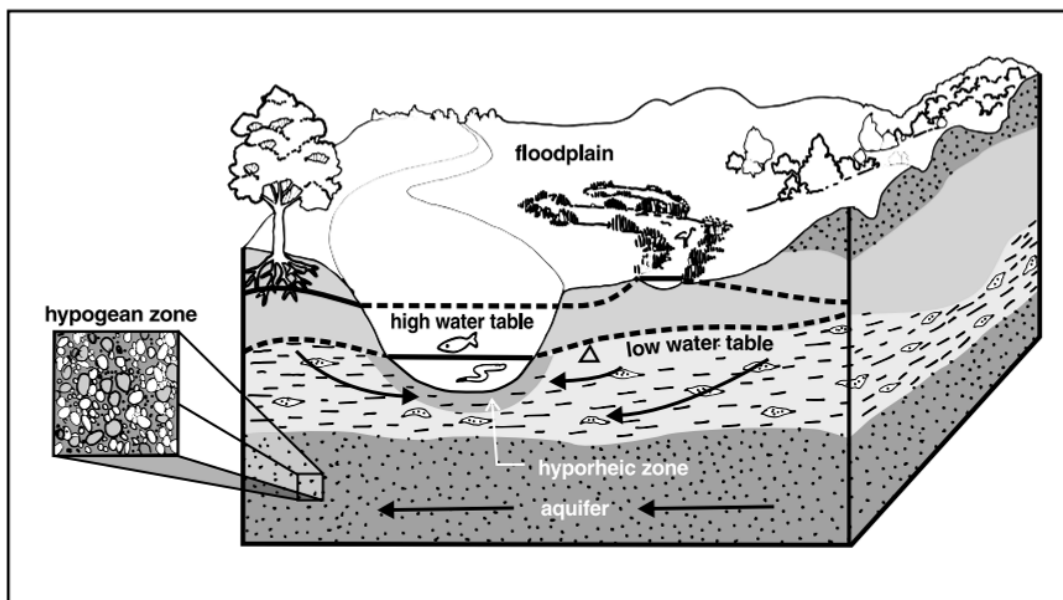
In accordance with the *WM Act*, endangered wetland communities are through the definition of 'lakes' potentially classed as waterfront land. Referral to NSW Natural Resources Access Regulator (NRAR) may be required for determination under the *WM Act* as a controlled activity. As well as protection, a buffer may be applied to these communities as specified by the NRAR.

No endangered wetland communities were present within the subject site and therefore a referral to NRAR is not required.

(i) Groundwater dependent ecosystems

Groundwater dependent ecosystems (GDEs) are communities of plants, animals and other organisms whose extent and life processes are dependent on groundwater. Some examples of ecosystems which depend on groundwater are:

- wetlands;
- red gum forests, vegetation on coastal sand dunes and other terrestrial vegetation;
- ecosystems in streams fed by groundwater;
- limestone cave systems;
- springs; and
- hanging valleys and swamps.



Alluvial groundwater system discharging into a river

GDEs are therefore ecosystems which have their species composition and their natural ecological processes determined by groundwater (NSW State Groundwater Dependent Ecosystems Policy April 2002).

The RFEF community is a Groundwater Dependent Ecosystem (GDE) as it contains Red Gum forest.

Within this site, the impacts upon this community are limited largely to existing crossings by pathways and the creation of a new fairway crossing. The majority of this community is heavily impacted by weed invasion which limits the ability of those remnants to regenerate naturally as the Privets and Camphor Laurel are so dense that they block the light which doesn't allow regeneration to occur.

Revegetation of the riparian zone and the minimisation of soil and water disturbance will assist in limiting impacts upon the GDEs. Pre and post surface and groundwater flows into the riparian zone should be equivalent or improved to the benefit of GDEs.

(j) Coastal wetlands

Wetlands on site or adjacent

The Interactive Mapping Tool (DPE) provides updated mapping of the former SEPP 14 wetlands. No coastal wetlands are mapped within the study area or nearby.

4.3.2 Matters of national environmental significance - flora

(a) Threatened flora species (national)

A review of the schedules of the *EPBC Act* indicated the potential for a list of threatened flora species to occur within a 10 km radius of the site. These species have been considered for habitat presence and potential to occur within Appendix 1.

Based on the habitat assessment within Appendix 1, it is considered that the subject site provides varying levels of potential habitat for the following nationally listed threatened flora species:

Table 4.5 – Nationally listed threatened flora species with suitable habitat present

Scientific name	EPBC Act	Potential to occur
<i>Pimelea spicata</i>	E	Low. Marginal habitat present, mostly along northern boundary in CPW
<i>Pultenaea parviflora</i>	V	Low. Marginal habitat present, mostly along northern boundary in CPW

No nationally listed threatened flora species were observed within the study area.

(b) Threatened ecological communities (national)

One (1) nationally-listed TEC, *Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest* (CPSWSGTF), was observed within the study area. This community is listed as critically endangered under the *EPBC Act*.

It was determined that the three (3) remnants along the eastern and southern-eastern boundary did not meet the condition thresholds for inclusion as CPSWSGTF.

The proposal will impact upon 0.786 ha of CPSWSGTF, which equates to 52.05% of all CPSWSGTF within the study area. With respect to the matters of national environmental significance guidelines, it is considered that this level of impact on a critically endangered community may constitute a significant impact. **Referral to the Australian Government Minister for the Environment is recommended.**

4.4 Fauna

All fauna species recorded during surveys, key fauna habitat observations and habitat tree data are provided in Sections 3.2 and 3.3.

4.4.2 Key fauna habitat

Most notable habitat features for threatened fauna species considered with most potential to occur (see Sections 4.4.4 & 4.4.5) include:

- Medium hollow (10-30 cm) none of which will be directly impacted
- Small hollows (<10 cm)
- Diverse seasonal flowering opportunities for nectivorous species.
- Winter flowering trees
- Avenues of trees along fairways providing foraging lines for birds and bats
- Open water large adjacent river, dam sections, wetland habitat and ephemeral drainages

A complete assessment of the location of habitat trees and the size of hollows within was undertaken as part of surveys. Table 3.8 provides hollow-bearing tree data and other habitat features recorded. Figure 2 shows locations of habitat trees recorded close to development footprints.

Three (3) hollow-dependent microbat species including Eastern Coastal Free-tailed Bat, Greater Broad-nosed Bat and Large-footed Myotis were recorded during surveys. Of all other threatened fauna species considered with potential to occur only one additional microbat, the Eastern Falsistrelle, has potential to utilise small hollows. Therefore, other hollow-dependent threatened fauna with considered potential to occur including Powerful Owl, Masked owl and Gang-gang Cockatoo) or low/unlikely potential to occur (Little Lorikeet or Yellow-bellied Glider) are not considered likely to utilise the hollows present due to unsuitability of habitat. At this stage trees HT1, HT3, HT6, HT10, HT15 and HT20 are better quality habitat trees supporting potential threatened species habitat.

The Tree Assessment Report (*Travers bushfire & ecology* 2019) has identified nine (9) hollow-bearing trees containing twelve (12) small (0–10 cm entry) hollows that will be directly impacted by the proposal.

Therefore, we recommend that all hollows to be removed by the proposal are relocated into retained trees. Given that this process will require preparation time of the hollows before their installation, nest boxes will need to be installed in the interim. Twelve (12) nest boxes are considered appropriate to offset the loss of habitat. These should include eight (8) microbat boxes, two (2) small bird/mammal boxes and two (2) cockatoo / large mammal boxes. Relocated hollows and nest boxes are to be placed through the study area adjacent to the riparian habitats and in larger remaining woodland / forest remnants under the guidance of a fauna ecologist.

A microbat was observed flying out of a hollow in HT10 during tree surveys in 2017. This tree has subsequently been identified for retention with the APZ area (despite the poor health). Given the recording of hollow-dependent threatened microbats any requirement to remove this tree as part of the proposal will require further survey to identify the species present and subsequent best practice effort to effectively relocate the roost into a nearby retained tree. One habitat tree identified for removal HT6 (T732) has also been identified as a potential microchiropteran bat roost. This was not based on any observed activity but rather on the quality of hollow and apparent wear around the entry

Further hollow inspection surveys of all hollows to be removed by the proposal will be required to determine if any of the identified hollows are utilised by threatened microbats. Identifying microbat roosting hollows can sometimes prove difficult from a single visit given that roost sites may also vary through a single week. The assessment for threatened microbats has therefore recommended the retention of HT10 (T784) as well as any other hollows where possible within the development landscape.

A recorded threatened bat species roost should be retained in-situ and the proposal amended accordingly. Any direct impact on a known threatened microbat roost will be considered a potential significant impact. Where habitat trees are required for removal this is to be undertaken according to a strict protocol. This initially includes stag-watching for signs of activity.

All hollow-bearing trees not found to be utilised at the time of survey may be periodically utilised at other times. Therefore, these trees should have a careful removal process implemented as specified in Section 6.1, to ensure appropriate animal welfare outcomes for those encountered during tree removal, particularly threatened microbats.

Where a threatened microbat colony is encountered at the time of removal all efforts should be undertaken to effectively relocate the section for placement in an adjacent tree of similar height, angle and aspect. If the hollow section is large and part of the trunk system then the entire tree should be relocated and strapped to an adjacent tree. Both of these works will require use of a crane and tree climbers. Hence, for cost effectiveness and impacts together, the identification of threatened bat roosts within the site is best achieved during the further surveys advised.

4.4.3 Local fauna matters

No fauna species recorded present during survey are listed as a regionally significant species within the *Native Fauna of Western Sydney - Urban Bushland Biodiversity Survey* (NPWS 1997).

4.4.4 State legislative fauna matters

(a) Threatened fauna species (NSW)

BC Act – A search of the *Atlas of NSW Wildlife* (DPIE, 2019) provided a list of threatened fauna species previously recorded within a 10 km radius of the subject site. These species are listed in Table A1.2 (Appendix 1) and are considered for potential habitat within the subject site. Strictly estuarine and oceanic threatened species found within 10 km have not been included as no marine or aquatic habitats occur within the subject site.

Based on the habitat assessment within Appendix 1, it is considered that the subject site provides varying levels of potential habitat for the following state listed threatened fauna species:

Table 4.6 – State listed threatened fauna species with suitable habitat present

Common name	BC Act	Potential to occur
Grey-headed Flying-fox	V	recorded
Eastern Coastal Free-tailed Bat	V	recorded
Large-eared Pied Bat	V	recorded
Large Bent-winged Bat	V	recorded

Common name	BC Act	Potential to occur
Large-footed (Southern) Myotis	V	recorded
Greater Broad-nosed Bat	V	recorded
White-bellied Sea Eagle	V	✓
Gang-gang Cockatoo	V	✓
Swift Parrot	E	✓
Powerful Owl	V	✓
Barking Owl	V	✓
Varied Sittella	V	✓
Dusky Woodswallow	V	✓
Eastern Falsie Pipistrelle	V	✓
Little Bent-wing Bat	V	✓
Little Eagle	V	✓
Square-tailed Kite	V	low
Masked Owl	V	low
Regent Honeyeater	E4A	low
Cumberland Plain Land Snail	E	low
Green and Golden Bell Frog	E	unlikely
Black-necked Stork	E	unlikely
Spotted Harrier	V	unlikely
Little Lorikeet	V	unlikely
Speckled Warbler	V	unlikely
Black-chinned Honeyeater	V	unlikely
Scarlet Robin	V	unlikely
Flame Robin	V	unlikely
Diamond Firetail	V	unlikely
Koala	V	unlikely
Yellow-bellied Glider	V	unlikely
Yellow-bellied Sheath-tail-bat	V	unlikely

Note: Full habitat descriptions for these species are provided in Appendix 1.

Six (6) state listed threatened fauna species including Grey-headed Flying-fox, Large-eared Pied Bat, Eastern Coastal Free-tailed Bat, Large Bent-winged Bat, Greater Broad-nosed Bat and Large-footed Myotis were recorded present during survey. The Eastern Coastal Free-tailed Bat was only recorded to a 'probable' level of certainty.

FM Act – No habitats suitable for threatened aquatic species were observed within the subject site and as such the provisions of this act do not require any further consideration.

(b) Endangered fauna populations (NSW)

There are no endangered fauna populations within the Penrith LGA.

(c) SEPP 44 Koala Habitat Protection

SEPP 44 Koala Habitat Protection applies to land within Local Government Areas (LGAs) listed under Schedule 1 of the Policy. The study area is not required to be considered under SEPP 44 - *Koala Habitat Protection* as it falls within the Penrith LGA, which is not listed on Schedule 1 of this Policy.

(d) Ecosystem credit species

Based upon the BAM calculator and field surveys to date, the following predicted threatened fauna species were considered as candidate species:

Table 4.7 – Ecosystem credit species (fauna)

Common name	BC Act	Potential to occur	Foraging habitat absent	Excluded (justified below)	Confirmed predicted species	Associated PCT
Grey-headed Flying-fox (foraging)	V	Yes (recorded)			✓	850 / 835
Eastern Coastal Free-tailed Bat	V	Yes (recorded)			✓	850 / 835
Large Bent-wing-bat (foraging)	V	Yes (recorded)			✓	850 / 835
Greater Broad-nosed Bat	V	Yes (recorded)			✓	850 / 835
Little Bent-wing Bat (foraging)	V	Yes			✓	850 / 835
Swift Parrot (foraging)	E	Yes			✓	850 / 835
Dusky Woodswallow	V	Yes			✓	850 / 835
White-bellied Sea-Eagle (foraging)	V	Yes			✓	850 / 835
Gang-gang Cockatoo (foraging)	V	Yes			✓	850 / 835
Powerful Owl (foraging)	V	Yes			✓	850 / 835
Barking Owl (foraging)	V	Yes			✓	850 / 835
Varied Sittella	V	Yes			✓	850 / 835
Regent Honeyeater (foraging)	E4A	Yes (low)			✓	850 / 835
Masked Owl (foraging)	V	Yes (low)			✓	850 / 835
Square-tailed Kite (foraging)	V	Yes (low)			✓	850 / 835
Yellow-bellied Sheath-tail-bat	V	Yes (low)			✓	850 / 835
Little Lorikeet	V	Yes (unlikely)			✓	850 / 835
Scarlet Robin	V	Yes (unlikely)			✓	850 / 835
Flame Robin	V	Yes (unlikely)			✓	850 / 835
Diamond Firetail	V	Yes (unlikely)			✓	850 / 835
Koala (foraging)	V	Yes (unlikely)			✓	850 / 835
Speckled Warbler	V	Yes (unlikely)			✓	850 / 835
Black-chinned Honeyeater	V	Yes (unlikely)			✓	850 / 835
Little Eagle (foraging)	V	Yes (unlikely)			✓	850 / 835
Painted Honeyeater	V	Yes (unlikely)			✓	850 / 835
Spotted Harrier	V	Yes (unlikely)			✓	850
Yellow-bellied Glider	V	Yes (unlikely)			✓	850
Black-necked Stork	V	Yes (unlikely)			✓	850 / 835
Turquoise Parrot (foraging)	V	No (not likely)		✓		
Black Bittern	V	No (not likely)		✓		
Brown Treecreeper	V	No (not likely)		✓		
Australasian Bittern	E	No (not likely)		✓		
Eastern Osprey (foraging)	V	No (not likely)		✓		
Hooded Robin	V	No (not likely)		✓		
Spotted-tailed Quoll	V	No		✓		

The species that have been excluded above are excluded based on the absence of any suitable habitat, available extent of remaining habitat, geographic distribution, last known local record being old, lack of suitable geological features, isolation of particular habitats or degradation of habitats. For some species indicated this may also be backed up by an absence/lack of any recent records within 10 km.

(e) Species credit species

Based upon the BAM calculator and field surveys to date, the following predicted threatened fauna species were considered as confirmed candidate species:

Table 4.8 – Species credit species (fauna)

Common name	BC Act	Potential to occur (presence status) / Habitat	Breeding habitat absent	Survey adequacy			Presence of species		Confirmed Candidate Species	Associated PCTs
				referred Survey period (DPIE)	Actual Survey period	Survey sufficient to rule out presence	Assumed	Expert report		
Large Bent-wing-bat (breeding)	V	Yes (recorded)	✓							
Grey-headed Flying-fox (breeding)	V	Yes (recorded)	✓							
Large-footed Myotis	V	Yes (recorded)					✓ recorded		✓	850 / 835
Large-eared Pied Bat	V	Yes (recorded)	✓				✓ recorded		✓	850 / 835
Little Bent-winged Bat (breeding)	V	Yes	✓							
White-bellied Sea-Eagle (breeding)	V	Yes		Jul-Dec	Sept / Oct	✓				
Swift Parrot (breeding)	E	Yes	✓							
Gang-gang Cockatoo (breeding)	V	Yes		Oct-Jan	Sept / Oct	✓				
Little Eagle (breeding)	V	Yes		Aug-Oct	Sept / Oct	✓				
Square-tailed Kite (breeding)	V	Yes (low)		Sept-Jan	Sept / Oct	✓				
Regent Honeyeater (breeding)	E4A	Yes (low)	✓							
Cumberland Plain Land Snail	E	Yes (low)		All year	Oct	✓				
Koala (breeding)	V	Yes (unlikely)		All year	Oct	✓				
Green and Golden Bell Frog	E	Yes (unlikely)		Nov-Mar	Oct	×	✓		✓	850 / 835
Bush Stone-curlew	E	No (not likely)								
Barking Owl (breeding)	V	No (not likely)								
Powerful Owl (breeding)	V	No (not likely)								
Masked Owl (breeding)	V	No (not likely)								
Squirrel Glider	V	No (not likely)								
Eastern Osprey (breeding)	V	No (not likely)								
Eastern Pygmy Possum	V	No								
Gang-gang Cockatoo - end.pop.	E2	No								
Dural Land Snail	V	No								

Habitat polygons for the confirmed candidate species Large-footed Myotis, Large-eared Pied Bat and Green and Golden Bell Frog are provided in Figures 5, 6 & 7 respectively.

Exclusions based on habitat features / survey

Habitat assessments for all species recorded within 10 km of the study area are provided in detail and based on local records within Appendix 1. Some additional species for consideration have been generated by the BAM calculator and their potential to occur is considered here only. Species recorded present or considered with any potential to occur are then assessed for habitat presence. If these species have not been recorded some may be ruled out based on adequacy of survey (survey techniques and methodology have been described in section 3). Others may be ruled out given the absence of breeding habitat where this is the candidate species consideration.

General exclusions from assessment have been based on any number of factors. Although the BAM calculator may suggest particular species have potential habitat based upon the vegetation type, they may be excluded due to geographic distribution, last known local record being old, lack of suitable geological features, isolation of particular habitats or degradation of habitats. These factors were considered in detail to advise of which candidate species could potentially be impacted.

Excluded species are mentioned below:

Large Bent-wing Bat (breeding) and *Little Bent-wing Bat* (breeding)

There are no caves or mine shafts present in the study area that may be utilised for breeding by these species.

Gang-gang Cockatoo endangered population

The study area is not within the recognised area extent of this population within the Hornsby and Ku-ring-gai LGAs.

Grey-headed Flying-fox (breeding)

Breeding habitat is the same as roosting habitat typically located in dense shelter foliage close to water in lower depressions. Such habitat typical for use by the species is not present. No roosting activity was observed during survey.

Eastern PygmyPossum

There is no suitable understorey habitat providing appropriate shelter and containing diverse foraging opportunities. *Banksia ericifolia* is often key to driving breeding in this part of the state yet this shrub species is not present either.

Barking Owl (breeding), *Powerful Owl* (breeding) and *Masked Owl* (breeding)

Survey did not identify any suitable nesting hollows for these species within the proposed development area or nearby areas within the gold course.

Gang-gang Cockatoo (breeding), *White-bellied Sea-Eagle* (breeding), *Little Eagle* (breeding) & *Square-tailed Kite* (breeding)

Presence of breeding habitat for these species was effectively ruled out during survey in the appropriate season.

Swift Parrot (breeding)

This species does not breed locally.

Regent Honeyeater (breeding)

This species is not known to breed locally (within 5 km) in recent decades

Cumberland Plain Land Snail

Target searches were undertaken for this species in 2017, in which the species was not recorded present in most suitable habitat locations.

Koala (breeding)

Whilst Koala is considered unlikely to occur based on the poor extent of consolidated habitat and the lack of any nearby records in the locality, this species was effectively surveyed to deem absence.

Squirrel Glider

There are no recent or historical records of this species within 10 km. Spotlighting survey did not record any glider activity.

Eastern Osprey (breeding)

This species prefers coastal areas, especially the mouths of large rivers, lagoons and lakes. Nests are constructed near to and looking over large waters used for foraging. The large dams adjacent to the study area are not large enough or typical of nesting. There are no records along the larger Nepean River in the locality or within 10 km. The species was also not recorded during survey in an appropriate season.

Dural Land Snail

The study area does not support any Shale-Sandstone habitat with extensive terrestrial shelter opportunities.

Bush Stone-curlew

There are no historical records of this species within 5 km and the two records that exist within 10 km are from over 20 years ago. The species was not recorded during survey.

Inclusions based on inadequacy of survey

Green and Golden Bell Frog

The habitat assessment for the study area (Appendix 1) identifies presence of suitable habitat for Green and Golden Bell Frog. This is based on the presence of dams with fringing reeds suitable for breeding as well as nearby shelter habitat. This species is not expected to occur based on nearby grazing use of dams (causing excess nutrients to encourage chytrid fungus) and a lack of any known records in the locality out to 3.5 km. The species cannot however be ruled out for offsetting as survey has not been undertaken in the appropriate season.

Suitable habitat areas are identified as those close to riparian habitats where shelter, overwintering or foraging habitat may be present.

(f) Local data

Local data has not been used in this case.

(g) Expert reports

Expert reports have not been utilised for fauna on this project.

4.4.5 Matters of national environmental significance - fauna

(a) Threatened fauna species (National)

EPBC Act – A review of the schedules of the *EPBC Act* identified a list of threatened fauna species or species habitat likely to occur within a 10 km radius of the subject site. These species have been listed in Table A1.2 (Appendix 1).

Based on the habitat assessment within Appendix 1, it is considered that the subject site provides varying levels of potential habitat for the following nationally listed threatened fauna species:

Table 4.9 – Nationally listed threatened fauna species with suitable habitat present

Common name	TSC Act	EPBC Act	Potential to occur
Grey-headed Flying-fox	V	V	recorded
Large-eared Pied Bat	V	V	recorded
Swift Parrot	E	E	✓
Regent Honeyeater	E4A	CE	low
Green and Golden Bell Frog	E	V	unlikely
Koala	V	V	unlikely

Two (2) nationally listed threatened fauna species including Grey-headed Flying-fox and Large-eared Pied Bat were recorded present during survey. No potential roosting or breeding habitat for either of these two species will be impacted by the proposal. Based on a review of the *EPBC* significant impact criteria, no threatened species listed under this act are likely to be significantly impacted by the proposal.

(b) Protected migratory species (National)

The EPBC Act Protected Matters Report provides additionally listed terrestrial, wetland and marine migratory species of national significance likely to occur, or with habitat for these species likely to occur, within a 10 km radius of the subject site. The habitat potential of migratory species that have not been considered in the threatened species habitat assessment are considered in Table A1.3 (Appendix 1).

No protected migratory bird species were recorded present during survey. Based on a review of the *EPBC* significant impact criteria, no protected migratory species are likely to be significantly impacted by the proposal.

4.4 Vegetation connectivity

The vegetation within the study area does not contribute to any local or regional corridor of value. By definition a corridor provides habitat linkage between other areas of extensive habitat to enable the passage and dispersal of wildlife and natural floristic diversity.

The local Wallacia landscape is however a fragmented one, particularly the fertile plains east of the Nepean River. Connectivity values that remain in these areas are where remnant patches persist along the edges of watercourses. Such riparian connectivity provides the added values of supporting habitat for frogs, wading birds, waterfowl, microbats and generally a drinking resource for many remaining species.

The connectivity values associated with the study area are shown on Figure 1.4. Riparian connectivity along the northern boundary of the study area is along an unnamed drainage that runs from the Nepean River nearby to the west and narrows and almost dissipates before it reaches the eastern site boundary. Whilst it almost terminates, this connectivity has some consolidated patches as well as large open water dams that all contribute to the quality of habitat. The connectivity along the eastern edge of the Nepean River is itself quite narrow.

A secondary unnamed drainage line that runs into the first mentioned drainage runs through the western portions of the study area. This drainage also has narrow vegetation along its margins and openings however this continues to the south where it continues as larger areas of remnant habitat patches.

Habitat loss associated with the proposed development may be beneficially replaced by the restoration of the two abovementioned riparian drainage channels. The restoration of the first mentioned drainage would be of benefit given the habitat within represented by open water features and some larger patches. The restoration of the second mentioned drainage would be of benefit to provide improved linkage to adjacent larger patches to the south (these continue beyond the view of Figure 5).

More secondary connectivity is provided by remnant and planted trees along the margins of existing fairways. Some of these trees will be removed by the proposal however the limited current internal site connectivity provided by these will not be significantly altered.

Given the above considerations, the restoration of riparian channels will be recommended as an effective measure to offset the proposed habitat loss for the development. Furthermore the remaining perimeter of the study area will also be recipient to tree plantings to create a screening to the site and provide further secondary connectivity opportunity and foraging channels by birds and bats.

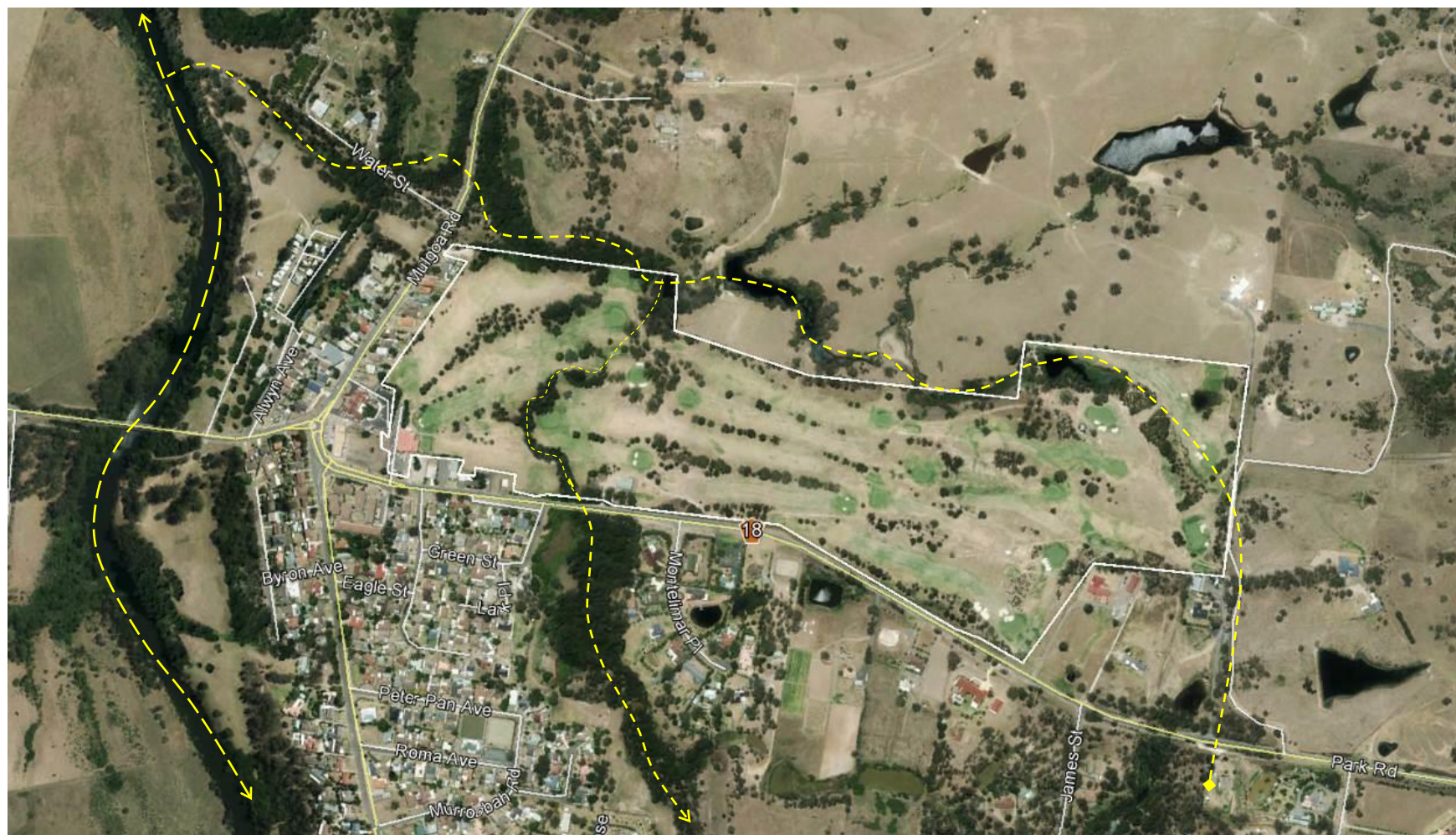


Figure 4 – Local connectivity

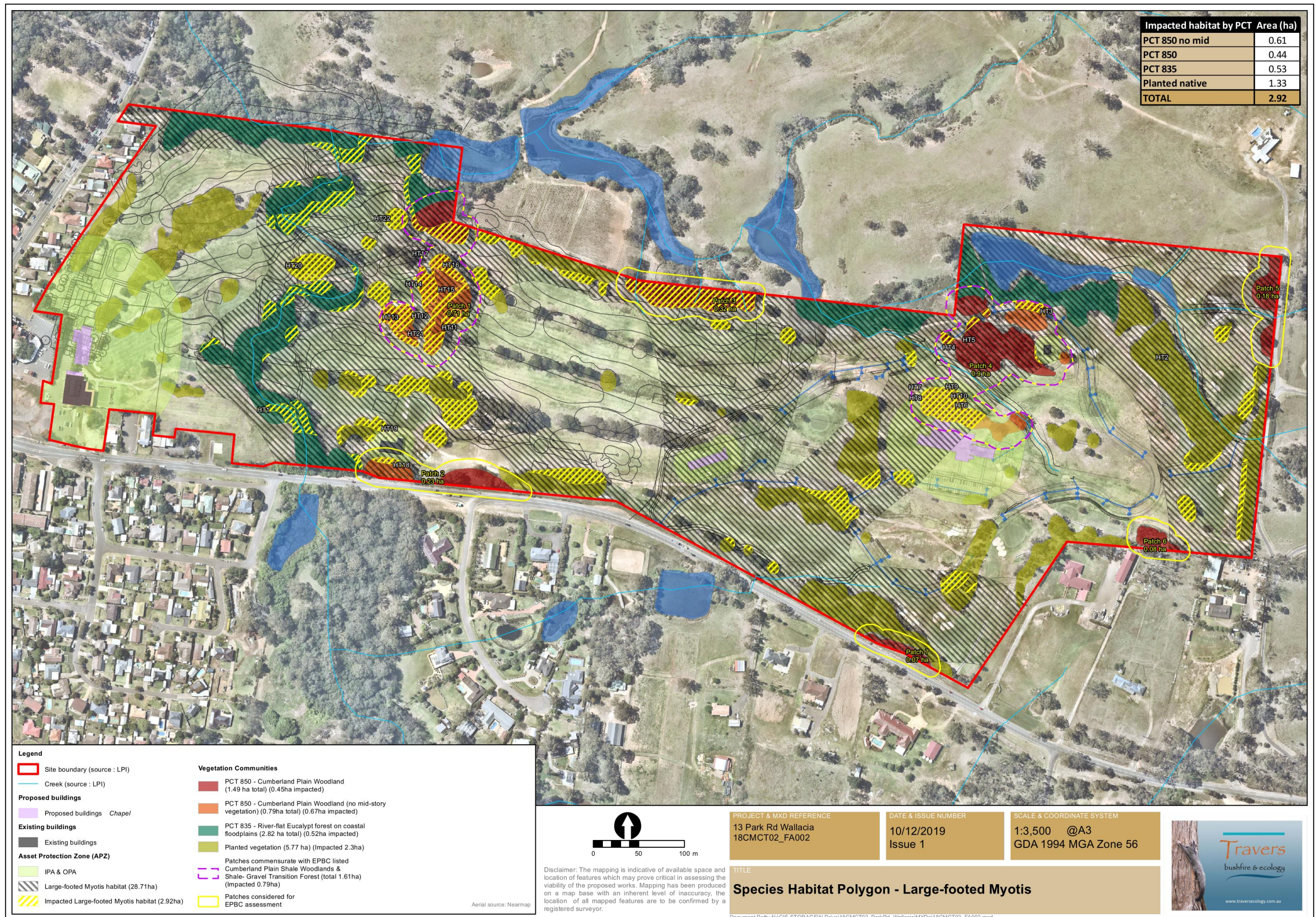


Figure 5 – Species credit species polygons – Large-footed Myotis

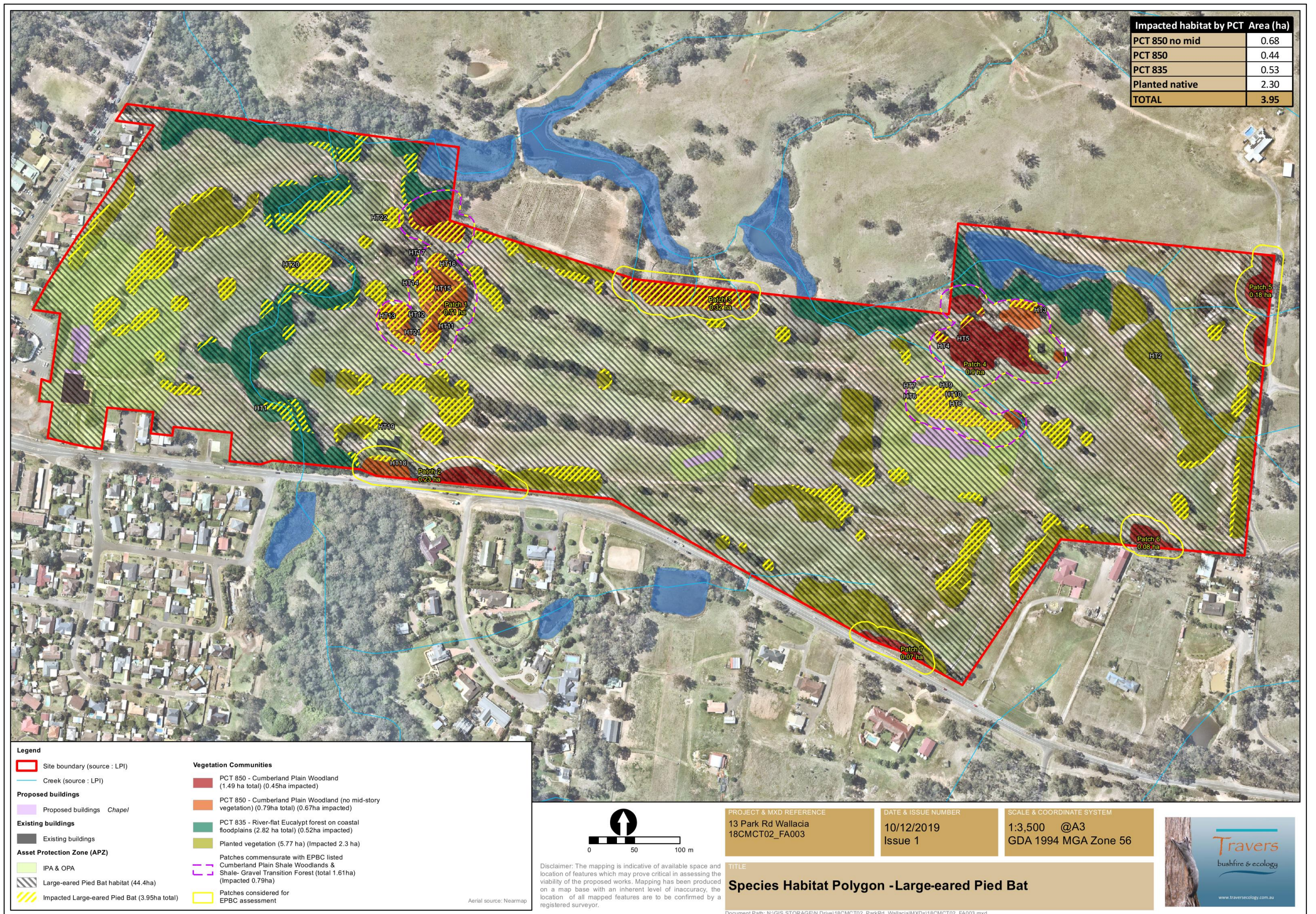


Figure 6 – Species credit species polygons – Large-eared Pied Bat

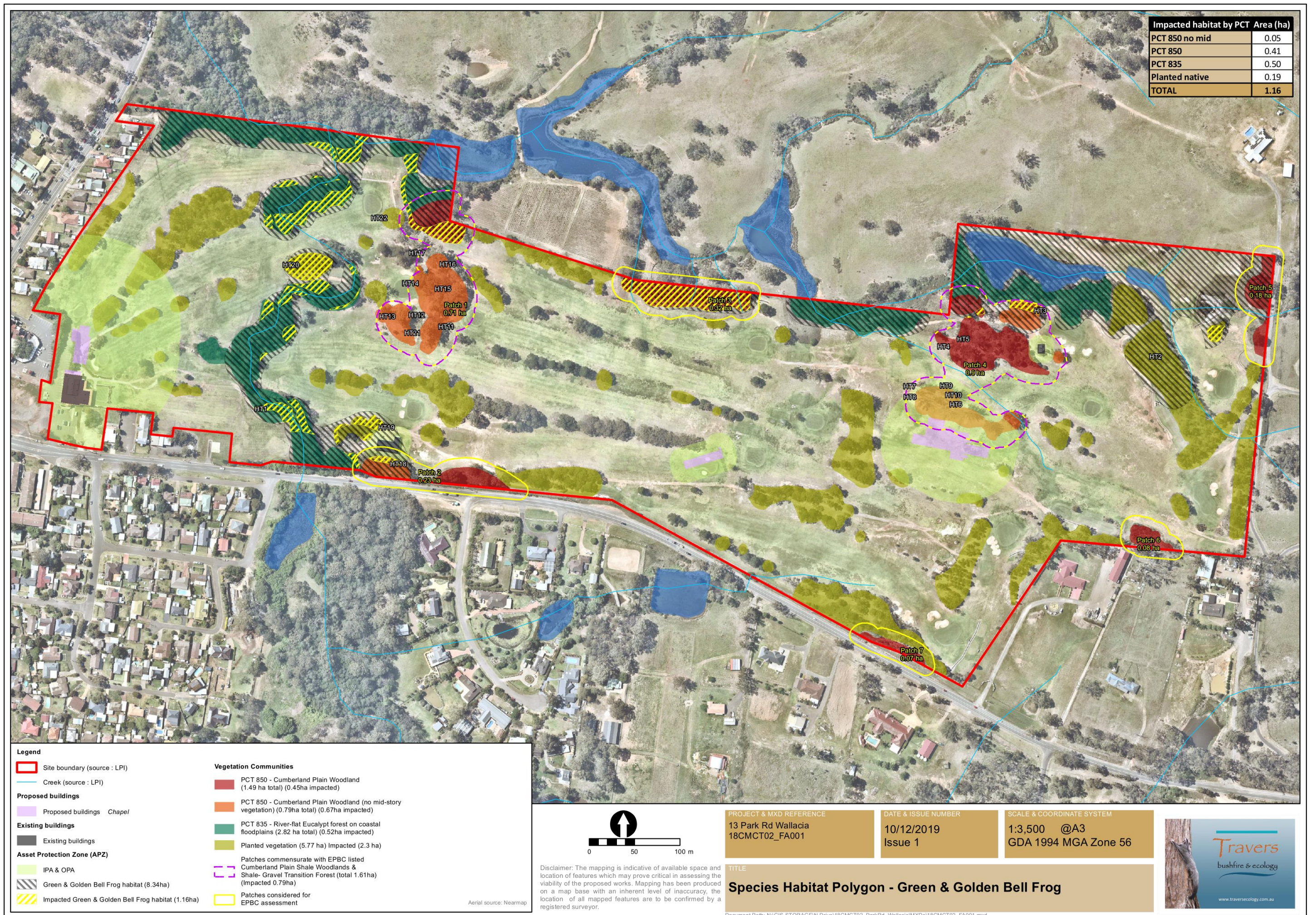


Figure 7 – Species credit species polygons – Green and Golden Bell Frog



Conclusion

5

Travers bushfire & ecology has been engaged to prepare a biodiversity development assessment report (BDAR) for a proposed development at Lot 2 DP 1108408 and Lot 512 DP 1079728, No. 13 Park Road, Wallacia.

Ecological survey and assessment has been undertaken in accordance with relevant legislation including the *Environmental Planning and Assessment Act 1979*, the *Biodiversity Conservation Act 2016*, the commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the *Fisheries Management Act 1994*.

5.1 Legislative compliance

In respect of matters required to be considered under the *EP&A Act* and relating to the species / provisions of the *BC Act*, six (6) threatened fauna species including Grey-headed Flying-fox, Large-eared Pied Bat, Eastern Coastal Free-tailed Bat, Large Bent-winged Bat, Greater Broad-nosed Bat and Large-footed Myotis, no threatened flora species, and two (2) threatened ecological communities (TECs), Cumberland Plain Woodland (CPW) and Riverflat Eucalypt Forest (RFEF), were recorded within the subject site.

Offsetting under the Biodiversity Offsets Scheme (BOS) is required for the proposed development as:

- The study area is located on lands mapped as Biodiversity Values Land, and
- The proposed clearing of native vegetation exceeds the area threshold.

A biodiversity credit offset assessment has been undertaken as part of this BDAR. Offset requirements are presented in Section 6.

In respect of matters required to be considered under the *EPBC Act*, two (2) threatened fauna species Grey-headed Flying-fox (*Pteropus poliocephalus*) and Large-eared Pied Bat, no protected migratory bird species, no threatened flora species and one (1) threatened ecological community, Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (CPSWF), listed under this Act were recorded within the subject site.

The proposed development was considered to have a potentially significant impact on CPSW, which is a matter of national environmental significance. As such a referral to Australian Government Minister for the Environment is recommended.

In respect of matters relative to the *Fisheries Management Act 1994*, no suitable habitat for threatened marine or aquatic species was observed within the subject site and there are no matters requiring further consideration under this Act.

5.2 Potential ecological impacts

The direct, indirect and cumulative ecological impacts of the proposal have been considered in respect to recorded biodiversity, threatening processes and extent of impact as a result:-

5.2.1 BC Reg Prescribed impacts

The following potential impacts on biodiversity values as a result of the proposal are prescribed (subject to subclause (2) of the *BC Reg*) as biodiversity impacts to be assessed under the biodiversity offsets scheme:

- Human made structures,
- Non-native vegetation,
- Connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range,
- Movement of threatened species that maintains their lifecycle,
- Water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining or other development),
- Vehicle strikes on threatened species of animals or on animals that are part of a threatened ecological community

5.2.2 Direct impacts

The other direct impacts of the proposal within the subject site are considered as:

- Removal / modification of 0.53 ha of PCT 835 Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - equivalent to RFEF
- Removal / modification of 0.45 ha Moderate-poor, and 0.67 ha or canopy only PCT 850 Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion - equivalent to CPW
- Removal / modification of 2.28 ha of planted native vegetation - assigned to PCT 850
- Subsequent removal of threatened fauna species foraging habitat.
- Removal of hollows suitable for recorded threatened species including Eastern Coastal Free-tailed Bat, Greater Broad-nosed Bat and Large-footed Myotis
- Removal of dead trees for perching use by raptors and woodswallows

5.2.3 Indirect impacts

The potential indirect impacts of the proposal are considered as:

- Reduced cross-site movements by small bird species such as passerines.
- Edge effects such as weed incursions caused from soil disturbance, repeated clearing and landscaping species becoming a nuisance in the adjacent remnant bushland.
- Increased spill-over from noise, activity, scent and lighting effects into the adjacent quality natural habitat areas.
- Increased soil nutrients from changes to runoff that may provide further opportunities for weed plumes.
- Concentrated stormwater runoff from solid surfaces and subsequent increased flows.

5.2.4 Cumulative impacts

The potential cumulative impacts (combined results of past, current and future activities) of the proposal are considered as:

- Cumulative loss of CPW
- Cumulative loss of RFEF
- Cumulative loss of habitat for threatened flora and fauna
- Increased risk of weed invasion and fungal mobilisation or infections
- Further fragmentation of the local connective remnants
- Increased varied human presence and activity within the remaining natural habitat areas of the adjacent bushland remnant.
- Edge effects from inappropriate use of remaining native vegetation areas such as additional clearing, dumping of materials, dumping of faecal, food or general waste and building refuse.

5.3 Avoid and minimise impacts

The following actions and designing of works have been undertaken to either avoid or minimise impacts on biodiversity values:

- Cemetery has been located taking advantage of the disturbed zones
- Proposed fairways have taken advantage of existing fairways to minimize tree removal
- Strict hollow removal process to prevent impacts on hollow-dependent fauna and permit relocating of hollows with resident animals.
- Access roads located on existing tracks or through existing cleared zones where possible
- Preparation of a Vegetation Management Plan (VMP)
- Fencing to exclude stock and general access to quality bushland areas
- Restore and rehabilitate native vegetation, in particular the CPW and RFEF
- Undertake feral pest management including control of foxes, cats, pigs, goats, avian pests, horses and any other miscellaneous species as required
- Limit vegetation removal in APZs
- Integrated weed management and control of high threat exotics
- Monitoring for evidence of disease
- Adaptive management

5.4 Recommendations

The following recommendations are made to avoid, minimise or ameliorate the above potential ecological impacts, address threatening processes and to guide a more positive ecological outcome for threatened species and their associated habitats.

- A Vegetation Management Plan has been prepared to outline the vegetation restoration areas advised by this report and to outline the extent of weed control measures. The vegetation management plan should aim to restore the riparian zone using locally occurrence native vegetation species from the communities. The VMP will revegetate 4.31 ha of RFEF 1.35 ha of CPW, and regenerate 1.76 ha of RFEF and 1.38 ha of CPW.

Canopy trees plantings are to be specified and include at least one half of locally occurring native species representing year-round nectar foraging potential.

Landscape planting of trees are to be installed around the perimeter of the site and in between fairways to provide a natural screen and connectivity, particularly along the northern boundary to restore arboreal connectivity for birds and arboreal mammals.

- Sediment and erosion control measures in accordance with *Managing Urban Stormwater: Soils and Construction* (Landcom 2004) to minimise impact of possible sedimentation to local drainage lines.
- Landscaping is to use locally-occurring native species commensurate with CPW on non-floodplain areas, and RFEF on floodplain areas adjacent to watercourses.
- A microbat was observed flying out of a hollow in HT10 during tree surveys in 2017. HT6 was also identified as a potential bat roost at this time. Despite the poor health of HT10 it has been identified for retention. Given the recording of hollow-dependent threatened microbats any requirement to remove hollow-bearing trees as part of the proposal will require further survey to identify the species and subsequent best practice effort to effectively relocate the roost into a nearby retained tree.
- All hollow-bearing trees identified to be removed are to be stag-watched during warmer months between October - March to determine any use by microbats (DEC 2004). This is to be undertaken with an ultrasonic recorder so that any emerging bats can be identified. These hollows may alternatively be inspected by tree climber and videoscope for signs of current or previous use.

Any habitat trees observed at this time to contain a threatened microbat is to be retained as a priority within the landscape with appropriate protection measures, if safe to do so. If the tree is unsafe and cannot be made safe then it is to be fenced to exclude access.

- The removal of all hollows is to be under the supervision of a fauna ecologist. This is particularly given that microbats may regularly change roost sites and surveys may not be reliable. Any hollows found to contain fauna or otherwise identified as high quality hollows by the fauna ecologist is to be prepared for reattachment to a retained tree. The management and relocation of resident fauna is to be undertaken by the fauna ecologist at the time of hollow removal and priority measures for threatened species encountered.

In this case the hollow section is to be effectively cut and relocated into a suitable nearby recipient tree to permit its ongoing use. This is particularly important given that artificially constructed bat boxes have not been demonstrated effective for most threatened microbat species. If the hollow is a large section this may require the use of a crane and advanced securing measures and the selection of a large and structurally sound recipient tree.

- It is recommended that all hollows that are not relocated to another tree are instead replaced with a constructed nest box placed along the restored riparian areas. The number and type of boxes is to be estimated and installed prior to any habitat tree removal so that a represented number of the boxes may be used as temporary housing for the recovered displaced fauna. Therefore boxes suitable for the various fauna likely to be encountered is to be provided.

5.5 Biodiversity credit requirements

5.5.1 Impacts requiring offset

The following impacts will require offsetting:

- 0.5 ha* of PCT 835 Moderate_poor
- 0.5 ha* of PCT 850 Moderate_poor
- 0.7 ha* of PCT 850 Poor_no_understorey
- 2.3 ha* of PCT 850 Poor_planted
- loss of habitat for threatened species, Large-footed Myotis, Large-eared Pied Bat, Green and Golden Bell Frog and *Marsdenia viridiflora* subsp. *viridiflora* endangered population.

*Note: the BAM calculator rounds impact requirements to the nearest 0.1 ha, hence the discrepancy with the values stated elsewhere in the BDAR.

5.5.2 Impacts not requiring offset

All areas of native vegetation impact will require offsetting and have been accounted for in the BAM calculator. All of the zones had a vegetation integrity score above the minimum requirements.

5.5.3 Areas not requiring assessment

Exotic and non-native vegetation is not required to be assessed under the BAM.

Indirect impacts are not anticipated to be large or permanent. The proposed management actions will assist in reducing these so they are only temporary, potential only, or immeasurable.

Any native vegetation beyond the subject have not been assessed in the calculator.

5.5.4 Reduction in credits

Argument to discount planted vegetation:

Planted native vegetation impacted by the proposal has been entered into the calculator as PCT 850. PCT 850 also applies to Zones 2 and 3, which are areas of remnant vegetation and commensurate with CPW. The BAM-C does not allow different Zones of the same PCT to have different designations regarding TEC status. Thus, in the BAM-C, this planted vegetation is treated as CPW. In this case the credit requirements are excessive for the actual impact, and the credit requirements for planted vegetation should be discounted. Revegetation of CPW in accordance with the prepared VMP, and screen plantings associated with the landscaping plan are adequate to offset the loss of planted vegetation.

Section 7.13 (4) of the *BC Act* states:

The consent authority may reduce or increase the number of biodiversity credits that would otherwise be required to be retired if the consent authority determines that the reduction or increase is justified having regard to the environmental, social and economic impacts of the proposed development. The consent authority must give reasons for a decision to reduce or increase the number of biodiversity credits.

In accordance with Section 7.13 (4) of the *BC Act* the consent authority, being Council, may reduce the credit requirements provided they give reasons for this decision. The planted native vegetation has been assigned to PCT 850, which is treated as CPW in the BAM-C. We recommend that this is an appropriate strategy to accurately account for impacts to the planted native vegetation within the site. Consequently we estimate that the credit requirements for PCT 850 could be reduced to 33 credits (\$1,308,925.83), which would further reduce the total ecosystem credit cost to \$1,614,842.42 (See Table 6.8). The original species credits as shown in Table 6.7 are considered valid as part or all of the planted native vegetation provides habitat for these species.

Travers bushfire & ecology consider a reduction in credits is warranted given that the majority of credits generated are due to removal of planted native trees within the golf course. This credit requirement is an unreasonable outcome for the following reasons:

- 2.28 ha of the impacted vegetation is planted
- The proposed golf course and cemetery is revegetated with an equivalent of 1.35 ha of impacted vegetation type
- The proposed golf course and cemetery landscaping will result in planting of 4.3 ha of native trees to replace the impacted trees



BAM Credit Results

6

6.1 Ecosystem credits and species credits

Ecosystem credits and species credits that measure the impact of the development on biodiversity values have been calculated, assuming full removal of vegetation for the development footprint, roads and APZs. The result of this means that all impacted areas will have a future vegetation integrity score of 0. Future vegetation integrity score for each vegetation zone at the development site is shown in Section 3.1.5.

Habitat suitability for threatened species has been considered in Section 4. Some species are considered for species credits, particularly if potential breeding habitat is compromised or impacted. Species polygons for Large-footed Myotis, Large-eared Pied Bat and Green and Golden Bell Frog are shown mapped on Figures 5, 6 and 7, respectively. Species polygons for the *Marsdenia viridiflora* subsp. *viridiflora* endangered population are equivalent to the entire areas of Zones 2 (850_Moderate_poor) and 4 (835_Moderate_poor) as shown in Figure 2 so have not been mapped separately.

Ecosystem credits for plant community types (PCTs), ecological communities and threatened species habitat is shown below in Table 6.1. Species credits for threatened species are shown in Table 6.2.

Table 6.1 – Requirement for ecosystem credits

Zone	Veg. zone name	Veg. integrity loss	Area (ha)	Candidate SAIL	Ecosystem credits
1	850_Poor_planted	30.6	2.3	True	44
2	850_Moderate_poor	53.8	0.5	True	15
3	850_Poor_no_understorey	43.8	0.7	True	18
Subtotal: 77					
4	835_Moderate_poor	42.9	0.5	False	11
Subtotal: 11					
Total: 88					

Table 6.2 – Requirement for species credits

Veg. zone name	Veg. integrity loss	Area (ha)	Candidate SAIL	Ecosystem credits
Large-eared Pied Bat				
835_Moderate_poor	42.9	0.53	True	17
850_Moderate_poor	53.8	0.45	True	18
850_Poor_no_understorey	43.8	0.67	True	22
850_Poor_planted	30.6	2.28	True	52
Subtotal: 109				
Green and Golden Bell Frog				

835_Moderate_poor	42.9	0.50	False	11
850_Moderate_poor	53.8	0.41	False	11
850_Poor_no_understorey	43.8	0.05	False	1
850_Poor_planted	30.6	0.19	False	3
				Subtotal: 26
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> - endangered population				
835_Moderate_poor	42.9	0.53	False	11
850_Moderate_poor	53.8	0.45	False	12
				Subtotal: 23
Southern Myotis (Large-footed Myotis)				
835_Moderate_poor	42.9	0.53	False	11
850_Moderate_poor	53.8	0.44	False	12
850_Poor_no_understorey	43.8	0.61	False	13
850_Poor_planted	30.6	1.33	False	20
				Subtotal: 56
				Total 214

6.2 Ecosystem credit classes

Table 6.3 – Ecosystem credit summary

PCT	TEC	Area (ha)	Credits
850 Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	CPW	0.5	11
835 Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	RFEF	3.4	77

Table 6.4 – Credit classes for PCT 877 and 1395 - Like for like options

PCT	TEC	Containing hollow-bearing trees?	Credits
850	Cumberland Plain Woodland in the Sydney Basin Bioregion. This includes PCT's: 849, 850	Yes	Cumberland , Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo <u>OR</u> any IBRA subregion that is within 100 km of the outer edge of the impacted site
835	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 686, 828, 835, 839, 941, 971, 1064, 1108, 1109, 1212, 1228, 1232, 1293, 1318, 1326, 1386, 1522, 1556, 1594, 1618, 1646, 1648, 1720, 1794, 1800	Yes	Cumberland , Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo <u>OR</u> any IBRA subregion that is within 100 km of the outer edge of the impacted site

6.3 Species credit classes

Table 6.5 – Species credit summary

Species	Area (ha)	Credits
Large-eared Pied Bat	3.9	109
Green and Golden Bell Frog	1.2	26
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> - endangered population	1	23
Southern Myotis	2.9	56
Total		214

All above-listed species need to be offset with the same species but anywhere in NSW.

6.4 Ecosystem and species credit costs

The costing of credits is provided in Table A6.6 and A6.7.

Table 6.6 – Ecosystem credit costs

IBRA sub region	PCT common name	Risk premium	Administrative cost	Methodology adjustment factor	Charge per credit	No. of ecosystem credits	Final credits price
Cumberland	835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	17.55%	\$476.01	2.4033	\$14,464.79	11	\$159,112.73
Cumberland	850 - Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	14.65%	\$1,337.19	2.0093	\$39,664.42	77	\$3,054,160.28
Subtotal (excl. GST)							\$3,213,273.01
GST							\$321,327.30
Total ecosystem credits (incl. GST)							\$3,534,600.31

Table 6.7 – Species credit costs

Species profile ID	Species	Threat status	Price per credit	Risk premium	Administrative cost	No. of species credits	Final credits price
10157	<i>Chalinolobus dwyeri</i> (Large-eared Pied Bat)	Vulnerable	\$741.31	19.9900%	\$29.65	109	\$100,187.38
10483	<i>Litoria aurea</i> (Green and Golden Bell Frog)	Endangered	\$6,194.72	19.9900%	\$247.79	26	\$199,701.67
10508	<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> - endangered population	Endangered Population	\$1,730.17	19.9900%	\$69.21	23	\$49,340.47
10549	<i>Myotis macropus</i> (Southern Myotis)	Vulnerable	\$741.31	19.9900%	\$29.65	56	\$51,472.42
10157	<i>Chalinolobus dwyeri</i> (Large-eared Pied Bat)	Vulnerable	\$741.31	19.9900%	\$29.65	109	\$100,187.38
Subtotal (excl. GST)							\$400,701.94
GST							\$40,070.19
Total species credits (incl. GST)							\$440,772.13
Grand Total (ecosystem plus species credits)							\$3,975,372.44

6.5 Estimated reduction in credits

Travers bushfire & ecology consider a reduction in credits is warranted given that the majority of credits generated are due to removal of planted native trees within the golf course. Table 6.8 presents the estimated credit requirements without the impacts for planted vegetation.

Table 6.8 – Reduced ecosystem credit costs

IBRA sub region	PCT common name	Risk premium	Administrative cost	Methodology adjustment factor	Price per credit	No. of ecosystem credits	Final credits price
Cumberland	835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	17.55%	\$476.01	2.4033	\$14,464.79	11	\$159,112.73
Cumberland	850 - Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain Sydney Basin Bioregion	14.65%	\$1,337.19	2.0093	\$39,664.42	33	\$1,308,925.83
Subtotal (excl. GST)							\$1,468,038.56
GST							\$146,803.86
Total species credits (incl. GST)							\$1,614,842.42

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Threatened & Migratory Species Habitat Assessment

A1

Table A1.1 provides an assessment of potential habitat within the subject site for state and nationally listed threatened flora species recorded within 10 km on the Atlas of NSW Wildlife (DPIE) or indicated to have potential habitat present within 10 km on the *EPBC Act* Protected Matters Tool.

Table A1.1 – Threatened flora habitat assessment

Scientific name DATABASE SOURCE	BC Act	EPBC Act	Growth form and habitat requirements	Recorded on site (✓)	If not recorded onsite				Should be Considered in assessment of significance test (✓)
					Suitable habitat present (✓)	Nearby and / or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (✓) Notes 1,2 & 3	Potential to occur	
<i>Acacia pubescens</i> DPIE	V	V	Spreading shrub 1-4m high open sclerophyll growing in open forest and woodlands on clay soils. Distribution limits N-Bilpin S-Georges River.	X	X	-	-	X	X
<i>Allocasuarina glareicola</i> EPBC	E1	E	Small shrub 1-2m high growing in open sclerophyll forest on lateritic soils derived from tertiary alluviums. Distribution limits Castlereagh NR region.	X	X	-	-	X	X
<i>Ancistrachne maidenii</i> DPIE	V	-	Decumbent grass. Grows in sandstone-derived soils. Distribution limits Berowra Waters, Brooklyn and Wisemans Ferry.	X	X	-	-	X	X

Scientific name DATABASE SOURCE	BC Act	EPBC Act	Growth form and habitat requirements	Recorded on site (✓)	If not recorded onsite				Should be Considered in assessment of significance test (✓)
					Suitable habitat present (✓)	Nearby and / or high number of record(s) (✓) <i>Notes 1,2 & 3</i>	Record(s) from recent years (✓) <i>Notes 1,2 & 3</i>	Potential to occur	
<i>Asterolasia elegans</i> EPBC	E1	E	Erect shrub 1-3m high growing in moist sclerophyll forests on Hawkesbury sandstone slopes hillsides. Distribution limits Maroota region.	x	x	-	-	x	x
<i>Cryptostylis hunteriana</i> EPBC	V	V	Saprophytic orchid. Grows in swamp heath on sandy soils. Distribution limits N-Gibraltar Range S-south of Eden.	x	x	-	-	x	x
<i>Cynanchum elegans</i> EPBC	E1	E	Climber or twiner to 1m. Grows in rainforest gullies, scrub & scree slopes. Distribution limits N-Gloucester S-Wollongong.	x	x	-	-	x	x
<i>Dillwynia tenuifolia</i> DPIE	V	-	Erect shrub 0.6-1m high. Grows in Woodlands and Open Forest on sandstone shale or laterite. Distribution limits N-Howes Valley S-Cumberland Plain.	x	marginal	8 records within 10km, nearest is 3km away	✓	low	✓
<i>Epacris purpurascens</i> var. <i>purpurascens</i> DPIE	V	-	Erect shrub to 1.5m high growing in sclerophyll forest and scrub and near creeks and swamps on Sandstone. Distribution limits N-Gosford S-Blue Mountains.	x	x	-	-	x	x
<i>Eucalyptus aggregata</i> EPBC	V	V	Small or medium sized tree to approximately 18m tall. Grows usually on alluvial soils, on cold, poorly-drained flats and hollows adjacent to creeks and small rivers. Higher altitude species. Distributed near to Blayney, Crookwell, Goulburn, Braidwood and Bungendore.	x	x	-	-	x	x

Scientific name DATABASE SOURCE	BC Act	EPBC Act	Growth form and habitat requirements	Recorded on site (✓)	If not recorded onsite				Should be Considered in assessment of significance test (✓)
					Suitable habitat present (✓)	Nearby and / or high number of record(s) (✓) <i>Notes 1,2 & 3</i>	Record(s) from recent years (✓) <i>Notes 1,2 & 3</i>	Potential to occur	
<i>Eucalyptus benthamii</i> DPIE EPBC	V	V	Blue gum to 40 m high. Wet forest on deep alluvial sandy soils. Distribution limits N-Yarramundi S-Bents Basin.	x	Substrate along watercourse on site likely to not be suitable	✓	✓	x	x
<i>Genoplesium baueri</i> EPBC	E1	E	A terrestrial orchid that grows in sparse sclerophyll forest and moss gardens over sandstone. Distribution limits N – Hunter Valley S – Nowra	x	x	-	-	x	x
<i>Grevillea juniperina</i> subsp. <i>juniperina</i> DPIE	V	-	Erect to spreading shrub 0.5-1.5m tall. Grows on laterite and Tertiary alluvium. Distribution limits St Marys-Londonderry-Prospect.	x	marginal	nearest is 2km away	✓	low	✓
<i>Grevillea parviflora</i> subsp. <i>parviflora</i> EPBC	V	V	Open to erect shrub to 1m. Grows in woodland on light clayey soils Distribution limits N-Cessnock S-Appin.	x	x	-	-	x	x
<i>Haloragis exalata</i> subsp. <i>exalata</i> EPBC	V	V	Shrub to 1.5m high. Grows in damp places near watercourses. Distribution limits N-Tweed Heads S-south of Eden.	x	x	-	-	x	x
<i>Isotoma fluviatilis</i> subsp. <i>fluviatilis</i> DPIE	-	X	Prostrate herb, rooting at nodes, growing in damp places on the Cumberland Plain.	x	x	-	-	x	x
<i>Melaleuca deanei</i> DPIE EPBC	V	V	Shrub to 3m high. Grows in heath on sandstone. Distribution limits N-Gosford S-Nowra.	x	x	-	-	x	x

Scientific name DATABASE SOURCE	BC Act	EPBC Act	Growth form and habitat requirements	Recorded on site (✓)	If not recorded onsite				Should be Considered in assessment of significance test (✓)
					Suitable habitat present (✓)	Nearby and / or high number of record(s) (✓) <i>Notes 1,2 & 3</i>	Record(s) from recent years (✓) <i>Notes 1,2 & 3</i>	Potential to occur	
<i>Micromyrtus minutiflora</i> DPIE	E1	V	Spreading shrub to 2m high. Grows in dry sclerophyll forest dominated by Scribbly gums and Ironbarks on Tertiary Alluviums. Distribution limits Western part of Cumberland Plain.	x	x	-	-	x	x
<i>Persoonia acerosa</i> EPBC	V	V	Erect to spreading shrub. Grows in heath or dry sclerophyll forest on sandstone. Distribution limits N-Bilpin S-Hill Top.	x	x	-	-	x	x
<i>Persoonia hirsuta</i> DPIE	E1	E	Erect to decumbent shrub. Grows in dry sclerophyll forest and woodland on Hawkesbury sandstone with infrequent fire histories. Distribution limits N-Glen Davis S-Hill Top.	x	x	-	-	x	x
<i>Persoonia nutans</i> DPIE	E1	E	Erect to spreading shrub. Grows in dry sclerophyll forest and woodland on laterite and alluvial sands. <i>Distribution limits Cumberland Plain.</i>	x	x	-	-	x	x
<i>Pimelea curviflora</i> var. <i>curviflora</i> DPIE EPBC	V	V	Woody herb or sub-shrub to 0.2-1.2m high. Grows on Hawkesbury sandstone near shale outcrops. Distribution Sydney.	x	x	-	-	x	x
<i>Pimelea spicata</i> DPIE EPBC	E1	E	Decumbent or erect shrub to 0.5m high. Occurs principally in woodland on soils derived from Wianamatta Shales. Distribution limits N-Lansdowne S-Shellharbour.	x	marginal	only 4 records within 10 km	x	low	✓
<i>Pomaderris brunnea</i> EPBC	V	V	Shrub to 3m high. Confined to Upper Nepean and Colo Rivers where it grows in open forest.	x	marginal	no records within 10 km	-	not likely	x

Scientific name DATABASE SOURCE	BC Act	EPBC Act	Growth form and habitat requirements	Recorded on site (✓)	If not recorded onsite				Should be Considered in assessment of significance test (✓)
					Suitable habitat present (✓)	Nearby and / or high number of record(s) (✓) <i>Notes 1,2 & 3</i>	Record(s) from recent years (✓) <i>Notes 1,2 & 3</i>	Potential to occur	
<i>Pterostylis chaetophora</i> DPIE	V	-	A terrestrial orchid with a few known locations predominately between Taree, Tea Gardens and Kurri Kurri, as well as Denman and Wingen. The preferred habitat is seasonally moist, dry sclerophyll forest with a grass and shrub understorey. Flowers September to November.	x	x	-	-	x	x
<i>Pterostylis saxicola</i> EPBC	E1	E	Terrestrial orchid. Grows in shallow sandy soil above rock shelves, usually near Wianamatta / Hawkesbury transition. Distribution limits N-Hawkesbury River S-Campbelltown.	x	x	-	-	x	x
<i>Pultenaea glabra</i> DPIE EPBC	V	V	Erect shrub. Grows in moist, sheltered section of dry sclerophyll forest on sandstone in Higher Blue Mountains and Glen Davis areas.	x	x	-	-	x	x
<i>Pultenaea parviflora</i> DPIE EPBC	E1	V	Erect shrub. Grows in dry sclerophyll forest at the intergrade between Tertiary Alluviums and Wianamatta Shales. Distribution limits Cumberland Plain.	x	marginal	many, nearest is 4km away	✓	low	✓
<i>Rhodamnia rubescens</i> DPIE	E4A	-	Shrub or small tree to 25 m high found in rainforest and riparian vegetation along the coast and up to 600m ASL. Flowers in late winter through to spring, with a peak in October, and fruits typically begin to appear in December in the Sydney region. Distribution limits N-Tweed Heads S-Batemans Bay.	x	x	-	-	x	x

Scientific name DATABASE SOURCE	BC Act	EPBC Act	Growth form and habitat requirements	Recorded on site (✓)	If not recorded onsite				Should be Considered in assessment of significance test (✓)
					Suitable habitat present (✓)	Nearby and / or high number of record(s) (✓) <i>Notes 1,2 & 3</i>	Record(s) from recent years (✓) <i>Notes 1,2 & 3</i>	Potential to occur	
<i>Syzygium paniculatum</i> EPBC	V	V	Small tree. Subtropical and littoral rainforest on sandy soil. Distribution limits N-Forster S-Jervis Bay.	x	x	-	-	x	x
<i>Tetratheca glandulosa</i> DPIE	V	-	Spreading shrub to 0.2m high. Sandy or rocky heath or scrub. Distribution limits N-Mangrove Mountain S-Port Jackson.	x	x	-	-	x	x
<i>Thelymitra</i> sp. 'Kangaloon' (<i>Thelymitra kangaloonica</i>) EPBC	E4A	CE	A terrestrial orchid with dark blue flowers, presented in mid-late spring. Only known from the Robertson area in the Southern Highlands. Often in association with the endangered ecological community <i>Temperate Highland Peat Swamps on Sandstone</i> .	x	x	-	-	x	x
<i>Thesium australe</i> EPBC	V	V	Erect herb to 0.4m high. Root parasite. Themeda grassland or woodland often damp. Distribution limits N-Tweed Heads S-south of Eden.	x	x	-	-	x	x
DPIE	- Denotes species listed within 10km of the subject site on the <i>Atlas of NSW Wildlife</i>								
EPBC	- Denotes species listed within 10km of the subject site in the <i>EPBC Act</i> habitat search								
V	- Denotes vulnerable listed species under the relevant Act								
E or E1	- Denotes endangered listed species under the relevant Act								
E4A or CE	- Denotes critically endangered listed species under the relevant Act								
NOTE:	1. This field is not considered if no suitable habitat is present within the subject site 2. 'records' refer to those provided by the <i>Atlas of NSW Wildlife</i> 3. 'nearby' or 'recent' records are species specific accounting for home range, dispersal ability and life cycle								

Table A1.2 provides an assessment of potential habitat within the subject site for state and nationally listed threatened fauna species recorded within 10 km on the *Atlas of NSW Wildlife* (DPIE) or indicated to have potential habitat present within 10 km on the *EPBC Act Protected Matters Tool*.

Table A1.2 – Threatened fauna habitat assessment

Common name Scientific name DATABASE SOURCE	BC Act	EPBC Act	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				Should be Considered in assessment of significance test (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (✓) Notes 1,2 & 3	Potential to occur	
Giant Burrowing Frog <i>Heleioporus australiacus</i> DPIE EPBC	V	V	Inhabits open forests and riparian forests along non-perennial streams, digging burrows into sandy creek banks. <i>Distribution Limit: N-Near Singleton S-South of Eden.</i>	x	x	-	-	x	x
Stuttering Frog <i>Mixophyes balbus</i> EPBC	E1	V	Terrestrial inhabitant of rainforest and wet sclerophyll forests. <i>Distribution Limit: N-near Tenterfield S-South of Bombala.</i>	x	x	-	-	x	x
Red-crowned Toadlet <i>Pseudophryne australis</i> DPIE	V	-	Prefers sandstone areas, breeds in grass and debris beside non-perennial creeks or gutters. Individuals can also be found under logs and rocks in non-breeding periods. <i>Distribution Limit: N-Pokolbin. S-near Wollongong.</i>	x	x	-	-	x	x
Green and Golden Bell Frog <i>Litoria aurea</i> DPIE EPBC	E1	V	Prefers the edges of permanent water, streams, swamps, creeks, lagoons, farm dams and ornamental ponds. Often found under debris. <i>Distribution Limit: N-Byron Bay S-South of Eden.</i>	x	✓	x	x	unlikely	✓

Common name Scientific name DATABASE SOURCE	BC Act	EPBC Act	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				Should be Considered in assessment of significance test (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (✓) Notes 1,2 & 3	Potential to occur	
Littlejohn's Tree Frog <i>Litoria littlejohnii</i> EPBC	V	V	Found in wet and dry sclerophyll forest associated with sandstone outcrops at altitudes 280-1,000m on eastern slopes of Great Dividing Range. Prefers flowing rocky streams. <i>Distribution Limit: N-Hunter River S-Eden.</i>	x	x	-	-	x	x
Broad-headed Snake <i>Hoplocephalus bungaroides</i> EPBC	E1	V	Sandstone outcrops, exfoliated rock slabs and tree hollows in coastal and near coastal areas. <i>Distribution Limit: N-Mudgee Park. S-Nowra.</i>	x	x	-	-	x	x
Black-necked Stork <i>Ephippiorhynchus asiaticus</i> DPIE	E1	-	Occurs in tropical to warm temperate terrestrial wetlands, estuarine and littoral habitats such as mangroves, tidal mudflats, floodplains, open woodlands, irrigated lands, bore drains, sub-artesian pools, farm dams and sewerage ponds. <i>Distribution Limit: N-Tweed Heads. S-Nowra.</i>	x	✓	✓	x	unlikely	✓

Common name Scientific name DATABASE SOURCE	BC Act	EPBC Act	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				Should be Considered in assessment of significance test (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (✓) Notes 1,2 & 3	Potential to occur	
Australasian Bittern <i>Botaurus poiciloptilus</i> DPIE EPBC	E1	E	Found in or over water of shallow freshwater or brackish wetlands with tall reedbeds, sedges, rushes, cumbungi, lignum and also in ricefields, drains in tussocky paddocks, occasionally saltmarsh, brackish wetlands. <i>Distribution Limit: N-North of Lismore. S- Eden.</i>	x	marginal	x	x	Not likely	x
Black Bittern <i>Ixobrychus flavicollis</i> DPIE	V	-	Found in shadowy, leafy waterside trees such as callistemons, casuarinas, paperbarks, eucalypts, mangroves and willows along tidal creeks, freshwater and brackish streams and ponds, sheltered mudflats and oyster slats. <i>Distribution Limit: N-Tweed Heads. S-South of Eden.</i>	x	marginal	x	x	Not likely	x
Spotted Harrier <i>Circus assimilis</i> DPIE	V	-	Utilises grassy plains, crops and stubblefields; saltbush, spinifex associations; scrublands, mallee, heathlands; open grassy woodlands. <i>Distribution limit: N-Tweed Heads. S-South of Eden.</i>	x	✓	x (10km)	✓	unlikely	✓
White-bellied Sea Eagle <i>(Haliaeetus leucogaster)</i> DPIE	V	-	Occupies coasts, islands, estuaries, inlets, large rivers, inland lakes and reservoirs. <i>Sedentary; dispersive. N-Tweed Heads. S-South of Eden.</i>	x	✓	✓	✓	✓	✓

Common name Scientific name DATABASE SOURCE	BC Act	EPBC Act	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				Should be Considered in assessment of significance test (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (✓) Notes 1,2 & 3	Potential to occur	
Square-tailed Kite <i>Lophoictinia isura</i> DPIE	V	-	Utilises mostly coastal and sub-coastal open forest, woodland or lightly timbered habitats and inland habitats along watercourses and mallee that are rich in passerine birds. <i>Distribution Limit: N-Goondiwindi. S-South of Eden.</i>	x	✓	✓	x	low	✓
Little Eagle <i>Hieraaetus morphnoides</i> DPIE	V	-	Utilises plains, foothills, open forests, woodlands and scrublands; river red gums on watercourses and lakes. <i>Distribution limit - N-Tweed Heads. S-South of Eden.</i>	x	✓	✓	✓	✓	✓
Bush Stone-curlew <i>Burhinus grallarius</i> DPIE	E1	-	Utilises open forests and savannah woodlands, sometimes dune scrub, savannah and mangrove fringes. <i>Distribution Limit: N-Border Ranges National Park. S-Near Nowra.</i>	x	✓	x	x	Not likely	x
Australian Painted Snipe <i>Rostratula australis</i> EPBC	E1	E	Most numerous within the Murray-Darling basin and inland Australia within marshes and freshwater wetlands with swampy vegetation. <i>Distribution Limit: N-Tweed Heads. S-South of Eden.</i>	x	marginal	x	x	Not likely	x
Curlew Sandpiper <i>Callidris ferruginea</i> EPBC	E1	CE	Mainly coastal, but many inland feeding along tidal mudflats, salt marsh, salt fields, fresh, brackish or saline wetlands and sewerage ponds. <i>Distribution Limit: N-Tweed Heads. S-South of Eden.</i>	x	marginal	x	x	Not likely	x

Common name Scientific name DATABASE SOURCE	BC Act	EPBC Act	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				Should be Considered in assessment of significance test (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (✓) Notes 1,2 & 3	Potential to occur	
Black-tailed Godwit <i>Limosa limosa</i> DPIE	V	-	Regular summer migrant that forages along tidal mudflats, estuaries, sandspits, shallow river margins, sewerage ponds, inland on large shallow fresh or brackish waters. <i>Distribution Limit: N-Tweed Heads. S-South of Eden.</i>	x	marginal	x	x	Not likely	x
Eastern Curlew <i>Numenius madagascariensis</i> EPBC	-	CE	Primarily coastal especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. Occasionally on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. Often recorded among saltmarsh and on mudflats fringed by mangroves and also in coastal saltworks and sewage farms. <i>Distribution Limit: N-Tweed Heads. S-South of Eden.</i>	x	x	-	-	x	x
Gang-gang Cockatoo <i>Callocephalon fimbriatum</i> DPIE	V	-	Prefers wetter forests and woodlands from sea level to > 2,000m on the Great Dividing Range, timbered foothills and valleys, timbered watercourses, coastal scrubs, farmlands and suburban gardens. <i>Distribution Limit: mid north coast of NSW to western Victoria.</i>	x	✓	✓	✓	✓	✓

Common name Scientific name DATABASE SOURCE	BC Act	EPBC Act	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				Should be Considered in assessment of significance test (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (✓) Notes 1,2 & 3	Potential to occur	
Glossy Black-Cockatoo <i>Calyptorhynchus lathamii</i> DPIE	V	-	Open forests with <i>Allocasuarina</i> species and hollows for nesting. <i>Distribution Limit: N-Tweed Heads. S-South of Eden.</i>	x	x	-	-	x	x
Little Lorikeet <i>Glossopsitta pusilla</i> DPIE	V	-	Inhabits forests, woodlands; large trees in open country; timbered watercourses, shelterbeds, and street trees. <i>Distribution Limit: N-Tweed Heads. S-South of Eden.</i>	x	✓	x	✓	unlikely	✓
Swift Parrot <i>Lathamus discolor</i> DPIE EPBC	E1	CE	Inhabits eucalypt forests and woodlands with winter flowering eucalypts. <i>Distribution Limit: N-Border Ranges National Park. S-South of Eden.</i>	x	✓	x	✓	✓	✓
Turquoise Parrot <i>Neophema pulchella</i> DPIE	V	-	Inhabits coastal scrubland, open forest and timbered grassland, especially ecotones between dry hardwood forests and grasslands. <i>Distribution Limit: N-Near Tenterfield. S-South of Eden.</i>	x	marginal	x	x	Not likely	x
Barking Owl <i>Ninox connivens</i> DPIE	V	-	Inhabits principally woodlands but also open forests and partially cleared land and utilises hollows for nesting. <i>Distribution Limits: N-Border Ranges National Park. S-Eden.</i>	x	marginal	✓	✓	✓	✓

Common name Scientific name DATABASE SOURCE	BC Act	EPBC Act	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				Should be Considered in assessment of significance test (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (✓) Notes 1,2 & 3	Potential to occur	
Powerful Owl <i>Ninox strenua</i> DPIE	V	-	Forests containing mature trees for shelter or breeding and densely vegetated gullies for roosting. <i>Distribution Limits: N-Border Ranges National Park. S-Eden.</i>	x	✓	✓	✓	✓	✓
Masked Owl <i>Tyto novaehollandiae</i> DPIE	V	-	Open forest and woodlands with cleared areas for hunting and hollow trees or dense vegetation for roosting. <i>Distribution Limit: N-Border Ranges National Park. S-Eden.</i>	x	✓	x	✓	low	✓
Sooty Owl <i>Tyto tenebricosa</i> DPIE	V	-	Tall, dense, wet forests containing trees with very large hollows. <i>Distribution Limit: N-Border Ranges National Park. S-South of Eden.</i>	x	x	-	-	x	x
Speckled Warbler <i>Chthonicola sagittata</i> DPIE	V	-	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. <i>Distribution Limit: N-Urbanville. S-Eden.</i>	x	✓	x	✓	unlikely	✓
Regent Honeyeater <i>Xanthomyza phrygia</i> DPIE EPBC	E4A	CE	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. <i>Distribution Limit: N-Urbanville. S-Eden.</i>	x	✓	✓	x	low	✓

Common name Scientific name DATABASE SOURCE	BC Act	EPBC Act	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				Should be Considered in assessment of significance test (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (✓) Notes 1,2 & 3	Potential to occur	
Painted Honeyeater <i>Grantiella picta</i> EPBC	V	V	A nomadic bird occurring in low densities within open forest, woodland and scrubland feeding on mistletoe fruits. Inhabits primarily Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. <i>Distribution Limit: N-Boggabilla. S-Albury with greatest occurrences on the inland slopes of the Great Dividing Range.</i>	x	marginal	x	x	Not likely	x
Black-chinned Honeyeater <i>Melithreptus gularis gularis</i> DPIE	V	-	Found in woodlands containing box-ironbark associations and River Red Gums, also drier coastal woodlands of the Cumberland Plain and Hunter Richmond and Clarence. <i>Distribution Limit: N-Cape York Pen. Qld. S-Victor H. Mt Lofty Ra & Flinders Ra. SA.</i>	x	✓	x	✓	unlikely	✓
Varied Sittella <i>Daphoenositta chrysoptera</i> DPIE	V	-	Open eucalypt woodlands / forests (except heavier rainforests); mallee, inland acacia, coastal tea-tree scrubs; golf courses, shelterbelts, orchards, parks, scrubby gardens. <i>Distribution Limit: N-Border Ranges National Park. S-South of Eden.</i>	x	✓	✓	✓	✓	✓

Common name Scientific name DATABASE SOURCE	BC Act	EPBC Act	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				Should be Considered in assessment of significance test (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (✓) Notes 1,2 & 3	Potential to occur	
Dusky Woodswallow <i>Artamus cyanopterus cyanopterus</i> DPIE	V	-	Found in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. It has also been recorded in shrublands and heathlands and various modified habitats, including regenerating forests; very occasionally in moist forests or rainforests. Prefers habitat with an open understorey. Often observed in farmland tree patches or roadside remnants. <i>Widespread in eastern, southern and southwestern Australia.</i>	x	✓	✓	✓	✓	✓
Hooded Robin <i>Melanodryas cucullata cucullata</i> DPIE	V	-	Found in Eucalypt woodlands, <i>Acacia</i> scrubland, open forest, and open areas adjoining large woodland blocks, with areas of dead timber. <i>Distribution Limit: N-Central Qld. S-Spencer Gulf SA.</i>	x	marginal	x	x	Not likely	x
Scarlet Robin <i>Petroica boodang</i> DPIE	V	-	Found in foothill forests, woodlands, watercourses; in autumn-winter, more open habitats: river red gum woodlands, golf courses, parks, orchards, gardens. <i>Distribution Limit: N-Tweed Heads. S-South of Eden.</i>	x	✓	x	x	unlikely	✓

Common name Scientific name DATABASE SOURCE	BC Act	EPBC Act	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				Should be Considered in assessment of significance test (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (✓) Notes 1,2 & 3	Potential to occur	
Flame Robin <i>Petroica phoenicea</i> DPIE	V	-	Summer: forests, woodlands, scrubs, from sea-level to c. 1800 m. Autumn-winter: open woodlands, plains, paddocks, golf courses, parks, orchards. <i>Distribution Limit: N northern NSW tablelands. S-South of Eden.</i>	x	✓	x	x	unlikely	✓
Diamond Firetail <i>Stagonopleura guttata</i> DPIE	V	-	Found in Eucalypt woodlands, forests and mallee where there is grassy understorey west of the Great Div. also drier coastal woodlands of the Cumberland Plain and Hunter Richmond and Clarence River Valleys. <i>Distribution Limit: N-Rockhampton Q. S-Eyre Pen Kangaroo Is. SA.</i>	x	✓	✓	x	unlikely	✓
Spotted-tailed Quoll <i>Dasyurus maculatus</i> DPIE EPBC	V	E	Dry and moist open forests containing rock caves, hollow logs or trees. <i>Distribution Limit: N-Mt Warning National Park. S-South of Eden.</i>	x	x	-	-	x	x
Koala <i>Phascolarctos cinereus</i> DPIE EPBC	V	V	Inhabits both wet and dry eucalypt forest on high nutrient soils containing preferred feed trees. <i>Distribution Limit: N-Tweed Heads. S-South of Eden.</i>	x	Sub-optimal	x	✓	unlikely	✓

Common name Scientific name DATABASE SOURCE	BC Act	EPBC Act	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				Should be Considered in assessment of significance test (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (✓) Notes 1,2 & 3	Potential to occur	
Eastern Pygmy Possum <i>Cercatetus nanus</i> DPIE	V	-	Found in a variety of habitats from rainforest through open forest to heath. Feeds on insects but also gathers pollen from banksias, eucalypts and bottlebrushes. Nests in banksias and myrtaceous shrubs. <i>Distribution Limit: N-Tweed Heads. S-Eden.</i>	x	x	-	-	x	x
Yellow-bellied Glider <i>Petaurus australis</i> DPIE	V	-	Tall mature eucalypt forests with high nectar producing species and hollow bearing trees. <i>Distribution Limit- N-Border Ranges National Park. S-South of Eden.</i>	x	✓	x	x	unlikely	✓
Greater Glider <i>Petauroides volans</i> DPIE EPBC	-	V	Favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species. Population density is optimal at elevation levels at 845 m above sea level. Prefer overstorey basal areas in old-growth tree stands. Highest abundance typically in taller, montane, moist eucalypt forests, with relatively old trees and abundant hollows <i>Distribution Limit: N-Border Ranges National Park. S- South of Eden.</i>	x	x	-	-	x	x

Common name Scientific name DATABASE SOURCE	BC Act	EPBC Act	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				Should be Considered in assessment of significance test (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (✓) Notes 1,2 & 3	Potential to occur	
Brush-tailed Rock-wallaby <i>Petrogale penicillata</i> DPIE EPBC	E1	V	Found in rocky gorges with a vegetation of rainforest or open forests to isolated rocky outcrops in semi-arid woodland country. <i>Distribution Limit: N-North of Tenterfield. S-Bombala.</i>	x	x	-	-	x	x
Grey-headed Flying-fox <i>Pteropus poliocephalus</i> DPIE EPBC	V	V	Found in a variety of habitats including rainforest, mangroves, paperbark swamp, wet and dry open forest and cultivated areas. Forms camps commonly found in gullies and in vegetation with a dense canopy. <i>Distribution Limit: N-Tweed Heads. S-Eden.</i>	✓	-	-	-	-	✓
Eastern Coastal Free-tailed Bat <i>Micronomus norfolkensis</i> DPIE	V	-	Inhabits open forests and woodlands foraging above the canopy and along the edge of forests. Roosts in tree hollows, under bark and buildings. <i>Distribution Limit: N-Woodenbong. S-Pambula.</i>	✓	-	-	-	-	✓
Large-eared Pied Bat <i>Chalinolobus dwyeri</i> DPIE EPBC	V	V	Warm-temperate to subtropical dry sclerophyll forest and woodland. Roosts in caves, tunnels and tree hollows in colonies of up to 30 animals. <i>Distribution Limit: N-Border Ranges National Park. S-Wollongong.</i>	✓	-	-	-	-	✓

Common name Scientific name DATABASE SOURCE	BC Act	EPBC Act	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				Should be Considered in assessment of significance test (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (✓) Notes 1,2 & 3	Potential to occur	
Eastern False Pipistrelle <i>Falsistrellus tasmaniensis</i> DPIE	V	-	Recorded roosting in caves, old buildings and tree hollows. <i>Distribution Limit: N-Border Ranges National Park. S-Pambula.</i>	x	✓	x	✓	✓	✓
Little Bent-wing Bat <i>Miniopterus australis</i> DPIE	V	-	Roosts in caves, old buildings and structures in the higher rainfall forests along the south coast of Australia. <i>Distribution Limit: N-Border Ranges National Park. S-Sydney.</i>	x	✓	x	✓	✓	✓
Large Bent-wing Bat (Large Bent-winged Bat) <i>Miniopterus orianae oceanensis</i> DPIE	V	-	Prefers areas where there are caves, old mines, old buildings, stormwater drains and well-timbered areas. <i>Distribution Limit: N-Border Ranges National Park. S-South of Eden.</i>	✓	-	-	-	-	✓
Large-footed Myotis (Southern Myotis) <i>Myotis macropus</i> DPIE	V	-	Roosts in caves, mines, tunnels, buildings, tree hollows and under bridges. Forages over open water. <i>Distribution limits: N-Border Ranges National Park. S-South of Eden.</i>	✓	-	-	-	-	✓

Common name Scientific name DATABASE SOURCE	BC Act	EPBC Act	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				Should be Considered in assessment of significance test (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (✓) Notes 1,2 & 3	Potential to occur	
Greater Broad-nosed Bat <i>Scoteanax rueppellii</i> DPIE	V	-	Inhabits areas containing moist river and creek systems, especially tree lined creeks. <i>Distribution Limit: N-Border Ranges National Park. S-Pambula.</i>	✓	-	-	-	-	✓
Yellow-bellied Sheathtail-bat <i>Saccolaimus flaviventris</i> DPIE	V	-	Rainforests, sclerophyll forests and woodlands. <i>Distribution limit: N-North of Walgett. S-Sydney.</i>	x	Sub-optimal	x	✓	low	✓
Cumberland Plain Land Snail <i>Meridolum corneovirens</i> DPIE	E	-	Inhabits remnant eucalypt woodland of the Cumberland Plan. Shelters under logs, debris, clumps of grass, around base of trees and burrowing into loose soil. <i>Distribution Limit: Cumberland Plain of Sydney Basin Region.</i>	x	Sub-optimal	x	✓	low	✓
Dural Land Snail <i>Pommerhelix duralensis</i> EPBC	-	E	Inhabits shale-influenced habitat along the north-western fringes of the Cumberland Plan on shale-sandstone transitional landscapes. Occur in low abundance and shelters under logs, debris, and leaf litter. <i>Distribution Limit: St Albans to Mulgoa with most records from The Hills LGA.</i>	x	x	-	-	x	x

Common name Scientific name DATABASE SOURCE	BC Act	EPBC Act	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				Should be Considered in assessment of significance test (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) <i>Notes 1,2 & 3</i>	Record(s) from recent years (✓) <i>Notes 1,2 & 3</i>	Potential to occur	
Macquarie Perch <i>Macquaria australasica</i> EPBC	V (FM Act 1994)	E	Occurs in south east Australia at moderate to high altitudes in rivers and reservoirs. Historical records show the species was widespread and abundant in the upper reaches of the Lachlan, Murrumbidgee and Murray Rivers and their tributaries. Allen (1989) states that introduced populations are present in Nepean River and water supply dams in the Sydney area. Occurs in lakes and flowing streams, usually in deep holes.	x	x	-	-	x	x
Australian Greyling <i>Prototroctes maraena</i> EPBC	Part 2, Section 19 – Protected Fish (FM Act 1994)	V	Clear, moderate to fast flowing water in the upper reaches of rivers (sometimes to altitudes above 1,000m). Typically found in gravel bottom pools. Often forming aggregations below barriers to upstream movement (e.g. weirs, waterfalls).	x	x	-	-	x	x
DPIE	- Denotes species listed within 10km of the subject site on the <i>Atlas of NSW Wildlife</i>								
EPBC	- Denotes species listed within 10km of the subject site in the <i>EPBC Act</i> habitat search								
V	- Denotes vulnerable listed species under the relevant Act								
E/E1	- Denotes endangered listed species under the relevant Act								
E4A/CE	- Denotes critically endangered listed species under the relevant Act								
NOTE:	1. This field is not considered if no suitable habitat is present within the subject site 2. 'records' refer to those provided by the <i>Atlas of NSW Wildlife</i> 3. 'nearby' or 'recent' records are species specific accounting for home range, dispersal ability and life cycle								

Table A1.3 provides an assessment of potential habitat within the subject site for nationally *protected* migratory fauna species recorded within 10km on the *EPBC Act* Protected Matters Tool. Nationally *threatened* migratory species are considered in Table A1.2.

Table A1.3 – Migratory fauna habitat assessment

Common name Scientific name	Preferred habitat Migratory breeding	Suitable habitat present (✓)	Recorded on site (✓)	Comments
Oriental or Horsfield's Cuckoo (<i>Cuculus optatus</i>)	It mainly inhabits forests, occurring in coniferous, deciduous and mixed forest. It feeds mainly on insects and their larvae, foraging for them in trees and bushes as well as on the ground.	x	-	-
White-bellied Sea Eagle (<i>Haliaeetus leucogaster</i>)	Coasts, islands, estuaries, inlets, large rivers, inland lakes, reservoirs. <i>Sedentary; dispersive.</i>	✓	x	-
White-throated Needletail (<i>Hirundapus caudacutus</i>)	Airspace over forests, woodlands, farmlands, plains, lakes, coasts, towns; companies forage often along favoured hilltops and timbered ranges. <i>Breeds Siberia, Himalayas, east to Japan. Summer migrant to eastern Australia.</i>	✓	x	-
Rainbow Bee-eater (<i>Merops ornatus</i>)	Open woodlands with sandy, loamy soil; sandridges, sandspits, riverbanks, road cuttings, beaches, dunes, cliffs, mangroves, rainforest, woodlands, golf courses. <i>Breeding resident in northern Australia. Summer breeding migrant to south east and south west Australia.</i>	✓	x	-
Spectacled Monarch (<i>Monarcha trivirgatus</i>)	Understorey of mountain / lowland rainforest, thickly wooded gullies, waterside vegetation, mostly well below canopy. <i>Summer breeding migrant to south-east Qld and north-east NSW down to Port Stephens from Sept/Oct to May. Uncommon in southern part of range.</i>	x	-	-
Black-faced Monarch (<i>Monarcha melanopsis</i>)	Rainforests, eucalypt woodlands; coastal scrubs; damp gullies in rainforest, eucalypt forest; more open woodland when migrating. <i>Summer breeding migrant to coastal south east Australia, otherwise uncommon.</i>	✓	x	-
Yellow Wagtail (<i>Motacilla flava</i>)	The yellow wagtail typically forages in damp grassland and on relatively bare open ground at edges of rivers, lakes and wetlands, but also feeds in dry grassland and in fields of cereal crops.	✓	x	-
Satin Flycatcher (<i>Myiagra cyanoleuca</i>)	Heavily vegetated gullies in forests, taller woodlands, usually above shrub-layer; during migration, coastal forests, woodlands, mangroves, trees in open country, gardens. <i>Breeds mostly south east Australia and Tasmania over warmer months, winters in north east Qld.</i>	✓	x	-

Common name Scientific name	Preferred habitat Migratory breeding	Suitable habitat present (✓)	Recorded on site (✓)	Comments
Rufous Fantail (<i>Rhipidura rufifrons</i>)	Undergrowth of rainforests / wetter eucalypt forests / gullies; monsoon forests, paperbarks, sub-inland and coastal scrubs; mangroves, watercourses; parks, gardens. On migration, farms, streets buildings. <i>Breeding migrant to south east Australia over warmer months. Altitudinal migrant in north east NSW in mountain forests during warmer months.</i>	✓	x	-
Great Egret (<i>Ardea alba</i>)	Shallows of rivers, estuaries; tidal mudflats, freshwater wetlands; sewerage ponds, irrigation areas, larger dams, etc. <i>Dispersive; cosmopolitan.</i>	✓	x	-
Cattle Egret (<i>Ardea ibis</i>)	Stock paddocks, pastures, croplands, garbage tips, wetlands, tidal mudflats, drains. <i>Breeds in summer in warmer parts of range including NSW.</i>	✓	x	-
Latham's Snipe (<i>Gallinago hardwickii</i>)	Soft wet ground or shallow water with tussocks and other green or dead growth; wet parts of paddocks; seepage below dams; irrigated areas; scrub or open woodland from sea-level to alpine bogs over 2,000m; samphire on saltmarshes; mangrove fringes. <i>Breeds Japan. Regular summer migrant to Australia. Some overwinter.</i>	✓	x	-
Common Greenshank (<i>Tringa nebularia</i>)	Found in a wide variety of inland wetlands and sheltered coastal habitats (with large mudflats and saltmarsh, mangroves or seagrass) of varying salinity. Habitats include embayments, harbours, river estuaries, deltas and lagoons. It uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and saltflats. Also artificial wetlands, including sewage farms and saltworks dams, inundated rice crops and bores. In NSW the Hunter River estuary has been identified as a site of international importance. <i>Breeds in Eurasia, the northern British Isles, Scandanavia, east Estonia and north-east Belarus, through Russia and east.</i>	✓	x	-
Osprey (<i>Pandion haliaetus</i>)	Favours coastal areas, especially the mouths of large rivers, lagoons and lakes. Feeds on fish over clear, open water. Breeds from July to September in NSW. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometer of the sea.	x	-	-

Common name <i>Scientific name</i>	Preferred habitat <i>Migratory breeding</i>	Suitable habitat present (✓)	Recorded on site (✓)	Comments
Fork-tailed Swift (<i>Apus pacificus</i>)	Aerial: over open country, from semi-arid deserts to coasts, islands; sometimes over forests, cities. <i>Breeds Siberia, Himalayas, east to Japan south east Asia. Summer migrant to east Australia. Mass movements associated with late summer low pressure systems into east Australia. Otherwise uncommon.</i>	✓	x	-



SAI Impact Assessment Species

A2

The additional impact assessment provisions for threatened species to determine a Serious and Irreversible Impact (SAI) are outlined under Section 10.2.3 of the BAM (2017) and have been applied to the recorded Large Bent-wing Bat and Large-eared Pied Bat as follows:

(a) *The action and measures taken to avoid the direct and indirect impact on the potential entity for an SAI*

No specific measures are considered necessary to apply to these species given that no important habitat will be likely directly or indirectly impacted.

(b) *The size of the local population directly and indirectly impacted by the development, clearing or biodiversity certification*

Due to the migratory nature of the Large Bent-wing Bat to breeding caves within inland regions of the state, the local population is difficult to predict at any time. This species is expected to be well represented in the locality with regular recordings.

The Large-eared Pied Bat population stronghold based on statewide records (Bionet 2019) is likely supported by the connective mountainous National Parks systems extending to the north-west and south-west through Wollemi NP, Yengo NP, Blue Mountains NP down to Nattai NP where extensive clustered records are known. These mountains support cave systems which are fundamental to roosting and breeding.

These two species will be indirectly impacted by the loss of foraging habitat. The size of the populations indirectly impacted by the loss of foraging habitat would amount to only about 1-5 individuals on any given night. Based on the habitat present and number of recorded passes site foraging for both species is not high or close to important roosting habitat.

(c) *The extent to which the impact exceeds any threshold for the potential entity that is specified in the Guidance to assist a decision-maker to determine a serious and irreversible impact 46 Biodiversity Assessment Method*

No breeding habitat (maternity caves) will be impacted for these species and no such habitat is present nearby.

(d) *The likely impact (including direct and indirect impacts) that the development, clearing or biodiversity certification will have on the habitat of the local population, including but not limited to:*

(i) *An estimate of the change in habitat available to the local population as a result of the proposed development*

The habitat for these species will remain virtually unchanged. The Large Bent-wing Bat is known to forage along streetlights and around developed

landscapes. The foraging opportunities for large-eared Pied Bat in the local landscape continue as extensive.

(ii) The proposed loss, modification, destruction or isolation of the available habitat used by the local population, and

The proposal will remove approximately 3.26 ha of vegetated habitat which may provide prey species habitat.

(iii) Modification of habitat required for the maintenance of processes important to the species' life cycle (such as in the case of a plant – pollination, seed set, seed dispersal, germination), genetic diversity and long-term evolutionary development. BioNet Atlas records or other documented, quantifiable means must be used by the assessor to estimate what percentage of the species' population and habitat is likely to be lost in the long term within the IBRA subregion due to the direct and indirect impacts of the development

No habitat important to the life-cycle of these species will be impacted.

(e) The likely impact on the ecology of the local population. At a minimum, address the following:

(i) for Fauna:

- ***Breeding*** – No breeding habitat will be impacted
- ***Foraging*** – Negligible foraging habitat will be impacted
- ***Roosting, and*** – No likely roosting will be impacted
- ***Dispersal or movement pathways*** – these species are highly mobile over local landscapes. The proposal will not inhibit or reduce the local movement pathways.

(ii) for Flora, address how the proposal is likely to affect the ecology and biology of any residual plant population that will remain post development including where information is available:

- ***Pollination cycle*** – N/A
- ***Seedbanks*** – N/A
- ***Recruitment, and*** – N/A
- ***Interactions with other species*** – N/A
(e.g. pollinators, host species, mycorrhizal associations)

(f) A description of the extent to which the local population will become fragmented or isolated as a result of the proposed development

The proposal will not likely cause any fragmentation or isolation of habitat for the local population of either species.

(g) The relationship of the local population to other population/populations of the species. This must include consideration of the interaction and importance of the local population to other population/populations for factors such as breeding, dispersal and genetic viability/diversity, and whether the local population is at the limit of the species' range

For the Large Bent-wing Bat, all individuals in the locality, region and extending out to this part of the state are part of the same population.

The Large-eared Pied Bat appears to exist in a number of small populations throughout its range. Colonies seldom contain more than 50 individuals, but the level of interaction between adjacent colonies has not been ascertained. The largest known populations of the Large-eared Pied Bat occur in those areas dominated by sandstone escarpments.

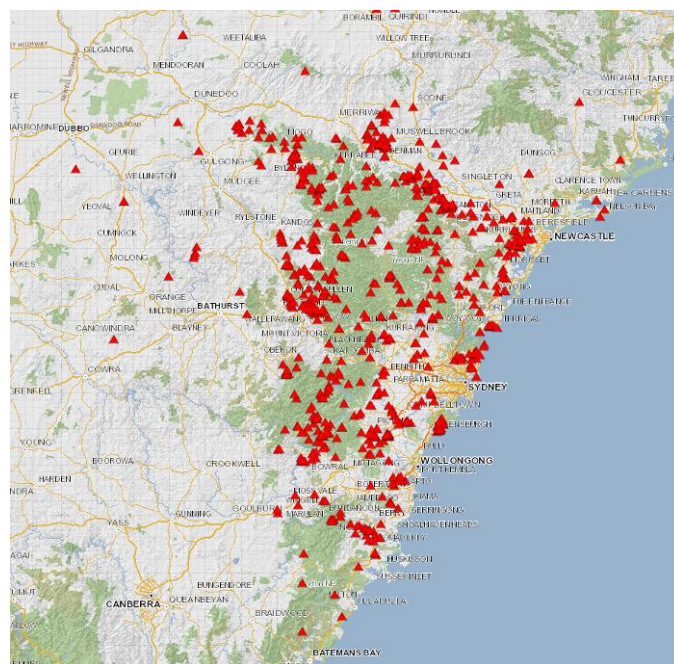
Important populations supporting higher numbers of individuals include those present in the sandstone escarpments of the Hunter Valley, Sydney Basin and Southern Tablelands of NSW. Additional smaller populations of importance occur in limestone caves and caves and mines with rocks of volcanic origin in the western and north-east parts of its range in NSW, south-eastern Queensland, as well as Shoalwater Bay north of Rockhampton (Hoye 2005).

(h) The extent to which the proposed development will lead to an increase in threats and indirect impacts, including impacts from invasive flora and fauna, that may in turn lead to a decrease in the viability of the local population

No such threats are likely to arise from the development.

(i) An estimate of the area, or number of populations and size of populations that is in the reserve system in NSW, the IBRA region and the IBRA subregion

This is difficult to predict for these species. As mentioned above for the Large-eared Pied Bat, population strongholds based on state-wide records on Bionet (2019) is likely supported by the connective mountainous National Parks systems extending through Goulbourn River NP, Wollemi NP, Yengo NP, Blue Mountains NP down to Nattai NP where extensive clustered records are known. The insert below shows these records over the national parks and protected reserves marked in green.



The Large Bent-wing Bat disperses from breeding locations throughout the eastern half of the state and foraging extent is expected to be relatively evenly represented in the reserve system in NSW, the IBRA region and the IBRA subregion.

(j) The measure/s proposed to contribute to the recovery of the species in the IBRA subregion.

- Control foxes and feral cats around roosting sites, particularly maternity caves.
- Retain native vegetation around roost sites, particularly within 300 m of maternity caves.
- Minimise the use of pesticides in foraging areas.
- Protect roosting sites from damage or disturbance.

None of the above measure are considered of relevance to the proposal. No roosting sites have been identified or are expected within the subject site for either species.



SAIL Impact Assessment Communities

A3

The additional impact assessment provisions for threatened ecological communities (TECs) to determine a Serious and Irreversible Impact (SAIL) are outlined under Section 10.2.2 of the BAM (2017) and have been applied to the recorded Cumberland Plain Woodland (CPW) as follows:

(a) The action and measures taken to avoid the direct and indirect impact on the potential entity for an SAIL

The development plan allows for the retention of several patches of CPW covering a total of 2.28 ha within the study area. The proposed development will remove approximately 1.12 ha of CPW.

The loss of CPW vegetation will be offset through the BOS.

Mitigation measures include the implementation of the proposed VMP which will involve regeneration of retained areas of CPW, and the revegetation of 1.35 ha of vegetation to fully-structured CPW, including trees, mid-storey and groundcover species.

(b) The area (ha) and condition of the TEC to be impacted directly and indirectly by the proposed development. The condition of the TEC is to be represented by the vegetation integrity score for each vegetation zone

0.45 ha of moderate–poor quality CPW and 0.67 ha of poor quality (canopy only) CPW is to be removed by the proposed development. The vegetation integrity scores for each Zone treated as CPW are as follow:

Vegetation zone name	Area (ha)	Current vegetation integrity score
850_Moderate_poor	0.45	53.8
850_Poor_no_understorey	0.67	43.8

(c) A description of the extent to which the impact exceeds the threshold for the potential entity that is specified in the Guidance to assist a decision-maker to determine a serious and irreversible impact

Thresholds for CPW have not yet been provided by DPIE.

(d) The extent and overall condition of the potential TEC within an area of 1000 ha, and then 10,000 ha, surrounding the proposed development footprint

The following figures are based on the Native Vegetation of the Cumberland Plain mapping (2002):

Table A6.1 – Extant CPW within 1000 ha and 10,000 ha

Canopy cover	Extant area within 1000 ha (ha)	Extant area within 10,000 ha (ha)
>10% cover	52.76	570.39
<10% cover	132.34	804.86
Total	185.11	1375.26

- (e) An estimate of the extant area and overall condition of the potential TEC remaining in the IBRA subregion before and after the impact of the proposed development has been taken into consideration**

The following figures are based on the Native Vegetation of the Cumberland Plain mapping (2002):

Table A6.2 – Extant CPW within the Cumberland IBRA sub-region

Canopy cover	Extant area - Cumberland IBRA sub-region (ha)
>10% cover	10877.09
<10% cover	16661.91
Total	27539

The proposed development will remove 1.12 ha of CPW, which is 0.004% of the estimated extant CPW within the Cumberland IBRA sub-region. The proposal is likely to improve the condition of the retained CPW through weed control, bush regeneration and enrichment planting as part of the prepared VMP.

- (f) An estimate of the area of the potential TEC that is in the reserve system within the IBRA region and the IBRA subregion**

The following figures are based on the Native Vegetation of the Cumberland Plain mapping (2002):

Table A6.3 – Extant CPW within the Cumberland IBRA sub-region

IBRA region / sub-region	Extant area of CPW (ha)
Cumberland sub-region	1146.95
Sydney region	1275.69

- (g) The development, clearing or biodiversity certification proposal's impact on:**

- i. abiotic factors critical to the long-term survival of the potential TEC; for example, how much the impact will lead to a reduction of groundwater levels or the substantial alteration of surface water patterns**

Abiotic factors will be impacted at an insignificant level and are not considered likely to be critical to this community's survival. CPW is not a groundwater dependant ecosystem and the proposed development should not alter groundwater levels or surface water patterns.

ii. characteristic and functionally important species through impacts such as, but not limited to, inappropriate fire/flooding regimes, removal of understorey species or harvesting of plants

The proposal will directly remove CPW vegetation but beyond this will not specifically impact on characteristic and functionally important species in isolation.

iii. the quality and integrity of an occurrence of the potential TEC through threats and indirect impacts including, but not limited to, assisting invasive flora and fauna species to become established or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants which may harm or inhibit growth of species in the potential TEC

Establishment of invasive flora and fauna is a possible threat due to the presence of such species and the highly modified nature of the CPW within the study area. The prepared VMP provides a schedule of works for weed control and the implementation of this VMP will mitigate these threats.

The continued management of parts of the site as a golf course should not lead to the increased mobilisation of fertilisers, herbicides or other chemicals or pollutants beyond what is currently the case. Similarly, the changing management of further parts of the study area to become a cemetery should not lead to the increased mobilisation of fertilisers, herbicides or other chemicals or pollutants beyond what is currently the case.

(h) Direct or indirect fragmentation and isolation of an important area of the potential TEC

The CPW remnants within the site are already isolated or fragmented to all aspects by existing roads and residential lots. The proposed development will not further isolate these remnants but will reduce the amount of CPW within the study area.

(i) The measures proposed to contribute to the recovery of the potential TEC in the IBRA subregion.

Travers bushfire & ecology has prepared a VMP that details restoration measures to contribute to the recovery of CPW within the study area. 1.38 ha of existing CMP will be regenerated through weed control, natural bush regeneration and enrichment plantings. A further 1.35 ha is to be revegetated to fully-structured CPW, including trees, mid-storey and groundcover species. This restoration has the potential to provide greater vegetation integrity through more structured plantings including shrubs and groundcovers.



Plot Datasheets

A4

400 m ² plot: Sheet _ of _		Survey Name	Plot Identifier	Recorders
Date	3/12/2019	18CMCTOLBMR-1G1		GP

GF Code	Top 3 native species in each growth form group. Full species name mandatory. All other native and exotic species. Full species name where practicable.	N, E or HTE	Cover	Abund	Strat	Notes
T	1 E. amplifolia	N	20	6		
T	2 E. teretifolia	N	10	3		
T	3 Canarina glauca	N	10	16		
F	4 Dianella caerulea	N	0.1	3		
/	5 Ligustrum lucidum	HTE	30	50		
/	6 Ligustrum sinense	HTE	5	20		
/	7 Smilax sp. Crataegus sarmentosa	E	0.5	20		
G	8 Juniperus horizontalis	N	0.1	10		
/	9 Chinese tree - Celtis chinensis	E	0.5	10		
/	10 Elacharta erecta	HTE	2	50		
/	11 Kalmia latifolia	HTE	0.1	3		
T	12 White cedar - Melia azedarach	N	3	5		
/	13 Modiola cordifolia	E	0.1	3		
F	14 Dichondra repens	N	0.1	10		
F	15 Euphorbia trigona	N	0.1	5		
O	16 Glycine tabacina	N	0.1	3		
/	17 Phlox x canariensis	HTE	0.1	1		
G	18 Chloris transcantata verticosa	N	0.1	5		
/	19 Sonchus oleraceus	E	0.1	3		
/	20 Allium	E	0.1	10		
/	21 Spurge	E	0.1	10		
G	22 Lonicera longifolia	N	0.2	3		
G	23 Microseris stipitata	N	0.2	10		
/	24 Sida rhombifolia	E	0.1	3		
/	25 Solanum pseudocapsicum	E	1	10		
G	26 Opismenus aculeatus	N	0.2	10		
/	27 Cinnamomum camphora	HTE	4	3		
/	28 Solanum nigrum	E	0.1	3		
	29					
	30					
	31					
	32					
	33					
	34					
	35					
	36					
	37					
	38					
	39					
	40					

GF Code: see Growth Form definitions in Appendix 1 N: native, E: exotic, HTE: high threat exotic GF - circle code if 'top 3'.
 Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
 Abundance: 1, 2, 3, ..., 10, 20, 30, ..., 100, 200, ..., 1000, ...

BAM Site – Field Survey Form Site Sheet no: 1 of 1

Date		3/12/19	Survey Name	18CM02	Zone ID	Recorders		
Zone	Datum		Plot ID	G1	Plot dimensions		Photo #	✓
Easting	Northing		IBRA region		Midline bearing from 0 m		Magnetic °	
Vegetation Class							Confidence:	
Plant Community Type			835				EEC: ✓	
							Confidence:	
							H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m ² plot)	Sum values
Trees	4
Shrubs	0
Grasses etc.	5
Forbs	3
Ferns	0
Other	1
Count of Native Richness	
Trees	43
Shrubs	0
Grasses etc.	0.8
Forbs	0.3
Ferns	0
Other	0.1
Sum of Cover of native vascular plants by growth form group	
High Threat Weed cover	41.2

BAM Attribute (1000 m ² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	1	
50 – 79 cm	111	
30 – 49 cm	✓	1
20 – 29 cm	✓	
10 – 19 cm	✓	1
5 – 9 cm	✓	
< 5 cm	✓	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	18 + 16 + 2 + 6	Tally space (42)

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	95 75 100 30 90	2 6 0 10 0	0 0 0 10 0	0 0 0 0 0
Average of the 5 subplots	78			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type	Landform Element	Landform Pattern	Microrelief
Lithology	Soil Surface Texture	Soil Colour	Soil Depth
Slope	Aspect	Site Drainage	Distance to nearest water and type

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0 none evidence, 1 slight, 2 moderate, 3 severe

Age: Recent (0-5yrs), NR recent (5-10yrs), Old (>10yrs)

400 m ² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date: 21/12/19	18CMOT02	GL	GP

GF Code	Top 3 native species in each growth form group: Full species name mandatory. All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	status	Notes
T	1 E. teretizornis	N	8	4		
T	2 E. punctata	N	3	1		
T	3 E. robusta	N	6	1		
T	4 E. microscopus	N	5	1		
G	5 Cyperodon distyloides	N	50	2000		
\	6 Buffalo grass	HTE	2	10		
\	7 Sporobolus africanus	E	0.2	20		
\	8 Paspalum dilatatum	E	0.1	3		
\	9 Eragrostis amabilis	E	0.1	10		
\	10 Conyza bonariensis	E	0.1	10		
\	11 Solanum pseudocapsicum	E	0.1	3		
T	12 Melia azadirachta	N	0.1	4		
\	13 Richardia scabra	E	0.1	10		
G	14 Eragrostis brownii	N	1	20		
\	15 Indica albiterm Amaranthus papulosus	HTE	0.1	1		
G	16 Cyperus gracilis	N	0.1	10		
\	17 Scaevola taccada	E	0.1	3		
\	18 Pinus sp. T57	HTE	8	2		
F	19 Waltheria indica	N	0.1	3		
\	20 Hypochaeris glabra - grass	HTE	0.1	3		
\	21 Briza sp. subaristata	HTE	0.1	10		
\	22 Chinese tree - Celtis chinensis	E	0.1	3		
O	23 Chinese tobacco	N	0.1	3		
\	24 Mithras	HTE	0.1	3		
\	25 Dandelion	E	0.1	3		
F	26 Dichroa repens	N	0.1	10		
\	27 Senecio mad.	HTE	0.1	5		
\	28 Eriogonum cicut	HTE	1	50		
\	29 Eragrostis curvula	HTE	0.1	3		
\	30 Lantana camara	HTE	0.1	1		
	31					
	32					
	33					
	34					
	35					
	36					
	37					
	38					
	39					
	40					

GF Code: see Growth Form definitions in Appendix 1

N: native, E: exotic, HTE: high threat exotic

GF - circle code if 'top 3'

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ..., 100% (foliage cover); Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m

Abundance: 1, 2, 3, ..., 10, 20, 30, ..., 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 1 of 1

Date		Survey Name	Zone ID	Recorders	
3/12/19		Kauaia		GP	
Zone	Datum	Plot ID	Plot dimensions	Photo #	
		G2			✓
Easting	Northing	IBRA region	In m	Midline bearing from 0 m	Magnetic °
Vegetation Class				Confidence:	
				H M L	
Plant Community Type				EEC:	
				H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m ² plot)	Sum values
Trees	5
Shrubs	0
Grasses etc.	3
Forbs	2
Ferns	0
Other	1
Count of Native Richness	
Trees	22
Shrubs	0
Grasses etc.	51.1
Forbs	0.2
Ferns	0
Other	0.1
Sum of Cover of native vascular plants by growth form group	
High Threat Weed cover	11.7

BAM Attribute (1000 m ² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm	1	
30 – 49 cm	✓	
20 – 29 cm	✓	
10 – 19 cm		
5 – 9 cm		
< 5 cm		n/a
Length of logs (m) (≥ 10 cm diameter, > 50 cm in length)	0	Tally space

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30, ..., 100, 200, 300, ...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	20 30 40 50 60	10 20 30 40 50	0 1 2 3 4 5	0 1 2 3 4 5
Average of the 5 subplots	36	40	0.2	0

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type	Landform Element	Landform Pattern	Microrelief
Lithology	Soil Surface Texture	Soil Colour	Soil Depth
Slope	Aspect	Site Drainage	Distance to nearest water and type

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=none evidence, 1=light, 2=moderate, 3=severe

Age: Recent (0-5yrs), NR recent (6-10yrs), Older (>10yrs)

400 m ² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 31/12/19	18CMCTO2BAR:G3	GP	

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	Height m	Notes
T 1	<i>E. eugenioides</i>	N	3	0		
T 2	<i>E. tereticornis</i>	N	25	9		
T 3	<i>E. mollucana</i>	N	5	1		
S 4	<i>Acaia lycopodium implexa</i> ?	N	4	1		
S 5	<i>Acaia falciformis</i>	N	8	2		
F 6	<i>Eriodictyon trigonum</i>	N	1	30		
S 7	Det <i>Hyptis</i> <i>Maytenus spicata</i>	N	3	1		
G 8	<i>Cyperus distylon</i>	N	20	100		
F 9	<i>Lagenifera stipitata</i> ? ph.	N	0.1	3		
T 10	<i>Acaia brevifolia</i>	N	4	1		
/ 11	<i>Sporobolus africanus</i>	E	0.1	10		
/ 12	<i>Paspalum dilatatum</i>	HTE	1	20		
/ 13	<i>Cenurus clandestina</i>	HTE	3	100		
/ 14	<i>Dandelion - Taraxacum officinale</i>	E	0.1	3		
F 15	<i>Dichondra repens</i>	N	0.1	10		
/ 16	<i>Bomus carthartensis</i>	E	0.1	10		
/ 17	<i>Elytaria cresta</i>	HTE	0.5	20		
G 18	<i>Cyperus gracilis</i>	N	0.1	10		
G 19	<i>Comandra sp.</i>	N	0.1	3		
/ 20	<i>Sida rhombifolia</i>	E	0.1	3		
/ 21	<i>Albizia</i>	E	0.1	10		
/ 22	<i>Soliva sessilis</i>	E	0.1	10		
/ 23	<i>Gnaphalium sp.</i>	E	0.1	3		
G 24	<i>Microlaena hypoleuca</i>	N	0.1	10		
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						

GF Code: see Growth Form definitions in Appendix 1

N: native, E: exotic, HTE: high threat exotic

GF - circle code if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 1 of 1

Date		Survey Name		Zone ID		Recorders	
3/12/19		18CMG02				CVP	
Zone	Datum	Plot ID	Plot dimensions		Photo #	✓	
		G3					
Easting	Northing	IBRA region	1a m	Midline bearing from 0 m	Magnetic °		
Vegetation Class						Confidence: H M L	
Plant Community Type		850				EEC: / Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m ² plot)		Sum values
Count of Native Richness	Trees	4
	Shrubs	3 3
	Grasses etc.	10 4
	Forbs	2
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	37
	Shrubs	15
	Grasses etc.	20.3
	Forbs	0.2
	Ferns	0
	Other	0
High Threat Weed cover		4.5

BAM Attribute (1000 m ² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	///	
50 – 79 cm		
30 – 49 cm	✓	/
20 – 29 cm	✓	
10 – 19 cm	✓	
5 – 9 cm	✓	
< 5 cm	✓	n/a
Length of logs (m) (≥10 cm diameter, ≥50 cm in length)	Tally space	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	50 50 90 50 100	10 10 20 1 0 20	0 0 0 0 0	0 0 0 0 0
Average of the 5 subplots	65			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type	Landform Element	Landform Pattern	Microrelief
Lithology	Soil Surface Texture	Soil Colour	Soil Depth
Slope	Aspect	Site Drainage	Distance to nearest water and type

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/black)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=No evidence, 1=light, 2=moderate, 3=severe

Age: Recent (0-5yrs), NR=not recent (3-10yrs), Old (>10yrs)

400 m ² plot: Sheet _ of _	Survey Name	Plot identifier	Recorders
Date 3/12/2019		G4	GP

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	1000 m ²	100 m ²
T 1	<i>E. taeteticornis</i>	N	30	3		
2	<i>Pinus radiata</i>	HTE	15	2		
T 3	<i>E. fibrosa</i>	N	8	1		
S 4	<i>Bursaria spinosa</i>	N	40	200		
5	<i>Olea europaea</i>	HTE	5	6		
6	<i>Lantana camara</i>	HTE	20	100		
7	<i>Ligustrum sinense</i>	HTE	1	3		
F 8	<i>E. hadia trigonos</i>	N	1	20		
S 9	<i>Acacia salicifolia</i> ^{Dillwynia sieberi}	N	0.1	3		
O 10	<i>Kennedia rubicunda</i>	N	0.1	3		
F 11	<i>Crotonia leucocarpa</i>	N	0.5	10		✓
G 12	<i>Aristida vagans</i>	N	20	200		
G 13	<i>Themeda triandra</i>	N	2	20		
T 14	<i>Acacia parsonii</i>	N	2	3		
F 15	<i>Dichondra repens</i>	N	0.1	3		
O 16	<i>Calyptrocline taberna</i>	N	0.1	3		
17	<i>Eragrostis curvula</i>	HTE	2	100		
F 18	<i>Veronica cinerea</i>	N	0.1	3		
G 19	<i>Lomandra multi</i>	N	0.1	3		
S 20	<i>Metaleuca stypheloides</i>	N	6	1		
G 21	<i>Microseris stipes</i>	N	15	2000		
22	<i>Moss vine</i>	HTE	2.1	3		
23	<i>Ligustrum lucidum</i>	HTE	1	7		
F 24	<i>Bromeliella australis</i>	N	0.1	3		
T 25	<i>E. crebra</i>	N	100	2		
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						

GF Code: see Growth Form definitions in Appendix 1

N: native, E: exotic, HTE: high threat exotic

GF - circle code if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ..., 100% (foliage cover): Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m.

Abundance: 1, 2, 3, ..., 10, 20, 30, ..., 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 1 of 1

Date		Survey Name		Zone ID		Recorders	
3/12/19		18CHCT02				GP	
Zone	Datum	Plot ID	Plot dimensions		Photo #	✓	
		G4					
Easting	Northing	IBRA region	In m	Midline bearing from 0 m	Magnetic		
Vegetation Class						Confidence:	
						H M L	
Plant Community Type		850				EEC: ✓	
						Confidence:	
						H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m ² plot)	Sum values
Count of Native Richness	
Trees	4
Shrubs	3
Grasses etc.	4
Forbs	5
Ferns	0
Other	2
Sum of Cover of native vascular plants by growth form group	
Trees	48
Shrubs	46.1
Grasses etc.	37.1
Forbs	1.8
Ferns	0
Other	0.2
High Threat Weed cover	54.1

BAM Attribute (1000 m ² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm	✓	
20 – 29 cm	✓	
10 – 19 cm	✓	
5 – 9 cm	✓	
< 5 cm	✓	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	Tally space	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30, ..., 100, 200, 300...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	100 60 85 30 65	0 0 10 0 0	0 0 0 0 0	0 0 0 0 0
Average of the 5 subplots	68			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type	Landform Element	Landform Pattern	Microrelief
Lithology	Soil Surface Texture	Soil Colour	Soil Depth
Slope	Aspect	Site Drainage	Distance to nearest water and type

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: None evidence, 1=light, 2=moderate, 3=severe

Age: Recent (0-5yrs), NR recent (6-10yrs), Old (>10yrs)

400 m ² plot: Sheet <u> </u> of <u> </u>	Survey Name: <u>18CUC102B002</u>	Plot Identifier: <u>G5</u>	Recorders: <u>GP</u>
Date: <u>3/12/19</u>			

GF Code	Top 3 native species in each growth form group. Full species name mandatory. All other native and exotic species. Full species name where practicable	N, E or HTE	Cover	Abund	Stem m	Notes
T	1 Eucalyptus populus	N	25	3		
T	2 E. tereticornis	N	105	2		
G	3 Cyperus garbis	N	0.2	20		
\	4 Chlorella cecba	HTE	3	20		
\	5 Cavermy dundestinus	HTE	5	50		
\	6 Alced	E	0.1	5		
\	7 grass Vulpia muralis	E	1	20		
\	8 Ipobolus africanus	E	0.5	10		
F	9 Dichanthera repens	N	0.1	10		
\	10 Flat weed ph. Canyasp.	E	0.1	10		
G	11 Chlorella 5-6 X bunched, dent.	N	4	50		
\	12 Mediola caroliniana.	E	0.1	5		
\	13 Plantago lance.	E	0.1	10		
\	14 Eragrostis curvula	HTE	2	20		
G	15 Cyrtospora dactyloides	N	3	200		
\	16 Furry weed ph	E	0.1	10		
\	17 Paspalum dilatatum	HTE	0.1	10		
O	18 Glycine tab	N	0.1	3		
\	19 grass		0.1	3		
F	20 Enadisa trigonos	N	0.1	3		
F	21 Enadisa hystata	N	0.1	3		
3T	22 E. pumilata	N	5	1		
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					
	36					
	37					
	38					
	39					
	40					

GF Code: see Growth Form definitions in Appendix 1

N: native, E: exotic, HTE: high threat exotic

GF – circle code if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ..., 100% (foliage cover); Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m.

Abundance: 1, 2, 3, ..., 10, 20, 30, ..., 100, 200, ..., 1000, ...

Date <u>3/12/19</u>		Survey Name <u>18CMOT02</u>	Zone ID	Recorders <u>GP</u>		
Zone	Datum	Plot ID <u>Q5</u>	Plot dimensions		Photo #	☒
Easting	Northing	IBRA region	1a m	Midline bearing from 0 m	Magnetic °	
Vegetation Class				Confidence: H M L		
Plant Community Type				EEC:		Confidence: H M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m ² plot)		Sum values
Count of Native Richness	Trees	3
	Shrubs	0
	Grasses etc.	3
	Forbs	3
	Ferns	0
	Other	1
Sum of Cover of native vascular plants by growth form group	Trees	3.5
	Shrubs	0
	Grasses etc.	7.2
	Forbs	0.3
	Ferns	0
	Other	0.1
High Threat Weed cover		10.1

BAM Attribute (1000 m ² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	1	
50 – 79 cm	1	
30 – 49 cm	✓	
20 – 29 cm	✓	
10 – 19 cm	✓	
5 – 9 cm	✓	
< 5 cm	✓	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	Tally space	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	2 25 0 5 4	70 60 100 10 90	0 0 0 0 0	0 0 0 0 0
Average of the 5 subplots	7.8			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type	Landform Element	Landform Pattern	Microrelief
Lithology	Soil Surface Texture	Soil Colour	Soil Depth
Slope	Aspect	Site Drainage	Distance to nearest water and type

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/block)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=none evidence, 1=faint, 2=moderate, 3=severe

Age: Recent (<5yrs), NR=not recent (>5-10yrs), Old (>10yrs)

400 m ² plot: Sheet <u> </u> of <u> </u>	Survey Name <u> </u>	Plot Identifier <u> </u>	Recorders <u> </u>
Date <u>3/12/19</u>	<u>BCHGTORBAR-Gb</u>	<u>AP</u>	

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	Strat m	Gr
T	1 <i>Casuarina glauca</i>	N	10	4		
T	2 <i>Casuarina corymb</i>	N	20	12		
RAF	3 <i>Commelina cypripes</i>	N	5	200		
/	4 crab grass	E	2	50		
F	5 <i>Einadia hastata</i>	N	1	20		
/	6 <i>Syntherisma alocurus</i>	E	0.1	3		
/	7 <i>Solanum nigrum</i>	E	0.1	3		
O	8 <i>Glycine tomentosa</i>	N	0.1	3		
/	9 <i>Euphorbia</i> sp.	E	0.1	3		✓
/	10 <i>Ipomoea caroliniana</i>	E	0.1	10		
O	11 <i>Hardenbergia violacea</i>	N	0.1	3		
/	12 <i>Coussa baroniensis</i>	E	0.1	20		
F	13 <i>Einadia trigona</i>	N	0.1	30		
F	14 <i>Euphorbia polygonifolia</i>	N	0.1	3		
G	15 <i>Chloris</i> 6-branched tenniflorus	N	0.1	3		
/	16 <i>Verbena</i> -like	E	0.1	3		
/	17 <i>Aucaramulus viridis</i>	E	0.1	3		
/	18 milk vine	HTE	1	3		
/	19 forb herb	E	0.1	5		
/	20 spurge	E	0.1	5		
/	21 <i>Gnaphalium</i> sp.	E	0.1	5		
/	22 <i>Rubus fruticosus</i>	HTE	0.1	3		
/	23 <i>Macleaya</i> vine	HTE	0.2	10		
F	24 <i>Dichondra repens</i>	N	0.1	10		
/	25 <i>Sida rhombifolia</i>	E	0.2	10		
G	26 <i>Cyperus gracilis</i>	N	0.1	10		
/	27 <i>Solanum linnaeanum</i>	E	0.1	3		
G	28 <i>Microplasma stipoides</i>	N	3	200		
/	29 <i>Solidago serotina</i>	E	0.1	10		
/	30 <i>Senecio</i> weed	HTE	0.1	5		
/	31 <i>Centropogon tenuiflorus</i>	E	0.1	3		
/	32 <i>Centropogon</i> weed	E	0.1	8		
/	33 <i>Eriochloa crus-galli</i>	E	0.1	3		
F	34 <i>Dysphania carinata</i>	N	0.5	20		
G	35 <i>Chloris</i> 6-branched tenniflorus	N	0.2	10		
/	36 <i>Pink mallard</i>	E	0.1	10		
	37					
	38					
	39					
	40					

GF Code: see Growth Form definitions in Appendix 1 N: native, E: exotic, HTE: high threat exotic GF – circle code if 'top 3'.
Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ..., 100% (foliage cover); Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m.
Abundance: 1, 2, 3, ..., 10, 20, 30, ..., 100, 200, ..., 1000, ...

		Survey Name	Zone ID	Recorders		
Date	3/12/19	18MOTOL		GP		
Zone	Datum	Plot ID	C6	Plot dimensions		Photo # ☒
Easting	Northing	IBRA region	1a m	Midline bearing from 0 m		Magnetic °
Vegetation Class						Confidence: H M L
Plant Community Type		EEC:				Confidence: H M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m ² plot)	Sum values	
Count of Native Richness	Trees	2
	Shrubs	0
	Grasses etc.	4
	Forbs	6
	Ferns	0
	Other	2
Sum of Cover of native vascular plants by growth form group	Trees	30
	Shrubs	0
	Grasses etc.	3.4
	Forbs	10.7
	Ferns	0
	Other	0.2
High Threat Weed cover	2.4	

BAM Attribute (1000 m ² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
< 5 cm		n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	Tally space	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (e.g. 10, 20, 30..., 100, 200, 300...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	90 100 90 50 95	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0
Average of the 5 subplots	85			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type	Landform Element	Landform Pattern	Microrelief
Lithology	Soil Surface Texture	Soil Colour	Soil Depth
Slope	Aspect	Site Drainage	Distance to nearest water and type

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: None evidence 1=light 2=moderate 3=severe

Age: Recent (<5yr) NR recent (5-10yr) Old (>10yr)

400 m ² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 3/12/19	18MCTO2019	97	GP

GF Code	Top 3 native species in each growth form order. Full species name mandatory. All other native and exotic species. Full species name where practicable	N, E or HTE	Cover	Abund	Strat m	Notes
T	1 E. moluccana	N	15	5		
T	2 E. eugenioides	N	10	2		
\	3 Eragrostis ciliaris	NTE	50	200		
\	4 Lantana camara	NTE	20	50		
G	5 Mimosa triandra	N	3	20		
T	6 Acacia parvifolia	N	1	3		
F	7 Brunoniella australis	N	0.1	10		
O	8 Cypripedium pubescens	N	0.1	3		
F	9 Oridophriza repens	N	0.1	10		
	10 Eragrostis sp		0.1	3		
\	11 Sida rhombifolia	E	0.1	10		
F	12 Eragrostis inaequalis	N	0.1	3		
\	13 Eragrostis	NTE	0.1	3		
G	14 Lomandra multiflora	N	0.2	10		
S	15 Bursaria spinosa	N	2	5		
S	16 Acacia implexa	N	0.5	4		
\	17 Aca eucalyptus	NTE	0.5	3		
F	18 Cordyline hederacea	N	0.1	3		
O	18 Desmodium varians	N	0.1	3		
\	20 Verbena bonariensis	E	0.1	3		
G	21 Lomandra filiformis	N	0.1	3		
G	22 Microstachya stipoides	N	3	100		
\	23 Paspalum dilatatum	NTE	0.1	3		
\	24 Stenanthium prostratum	N	0.1	3		
\	25 Cirsium vulgare	E	0.1	3		
G	26 Euphorbia gracilis	N	0.2	20		
G	27 Aca eucalyptus	N	2	20		
	28 Dillwynia viridis	N	0.5	3		
	29					
	30					
	31					
	32					
	33					
	34					
	35					
	36					
	37					
	38					
	39					
	40					

GF Code: see Growth Form definitions in Appendix 1

N: native, E: exotic, HTE: high threat exotic

GF - circle code if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ..., 100% (foliage cover); Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m.

Abundance: 1, 2, 3, ..., 10, 20, 30, ..., 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 1 of 1

Date		Survey Name	Zone ID	Recorders	
3/12/19		80m x 100m Bore	GP	GP	
Zone	Datum	Plot ID	Plot dimensions	Photo #	
		7			✓
Easting	Northing	IBRA region	In m	Midline bearing from 0 m	Magnetic
Vegetation Class					Confidence:
					H M L
Plant Community Type		850			EEC: ✓
					H M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m ² plot)	Sum values
Count of Native Richness	
Trees	3
Shrubs	2
Grasses etc.	6
Forbs	4
Ferns	0
Other	2
Sum of Cover of native vascular plants by growth form group	
Trees	26
Shrubs	7
Grasses etc.	8.5
Forbs	0.4
Ferns	0
Other	0.2
High Threat Weed cover	71.6

BAM Attribute (1000 m ² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm	111	
30 – 49 cm	✓	
20 – 29 cm	✓	
10 – 19 cm	✓	
5 – 9 cm	✓	
< 5 cm	✓	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	6+1+	Tally space 1

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	80 85 60 60 75	0 1 5 5 6	0 0 0 0 0	0 0 0 0 0
Average of the 5 subplots	72			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type	Landform Element	Landform Pattern	Microrelief
Lithology	Soil Surface Texture	Soil Colour	Soil Depth
Slope	Aspect	Site Drainage	Distance to nearest water and type

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: None (0), Minor (1), Moderate (2), Severe (3)

Age: Recent (0-5y), Intermediate (5-10y), Old (10-20y)



National - Significant Impact Criteria

A5

Under the *EPBC Act* an action will require approval from the Australian Government Environment Minister if the action has, will have, or is likely to have, a significant impact on a matter of national environmental significance. The following significant impact criteria were sourced from the *EPBC Act* Policy Statement 1.1 (May 2006):

CRITICALLY ENDANGERED AND ENDANGERED SPECIES

Significant impact criteria

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- Lead to a long-term decrease in the size of a population;
- Reduce the area of occupancy of the species;
- Fragment an existing population into two or more populations;
- Adversely affect habitat critical to the survival of a species;
- Disrupt the breeding cycle of a population;
- Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;
- Introduce disease that may cause the species to decline; or
- Interfere with the recovery of the species.

>> What is a population of a species?

A 'population of a species' is defined under the *EPBC Act* as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:

- a geographically distinct regional population, or collection of local populations; or
- a population, or collection of local populations, that occurs within a particular bioregion.

>> What is habitat critical to the survival of a species or ecological community?

'Habitat critical to the survival of a species or ecological community' refers to areas that are necessary:

- For activities such as foraging, breeding, roosting, or dispersal;
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- To maintain genetic diversity and long term evolutionary development; or
- For the reintroduction of populations or recovery of the species or ecological community.

Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the Minister under the *EPBC Act*.

VULNERABLE SPECIES

Significant impact criteria

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of an important population of a species;
- reduce the area of occupancy of an important population;
- fragment an existing important population into two or more populations;
- adversely affect habitat critical to the survival of a species;
- disrupt the breeding cycle of an important population;
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;
- introduce disease that may cause the species to decline; or
- interfere substantially with the recovery of the species.

>> What is an important population of a species?

An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- Key source populations either for breeding or dispersal;
- Populations that are necessary for maintaining genetic diversity; and/or
- Populations that are near the limit of the species range.

CRITICALLY ENDANGERED AND ENDANGERED ECOLOGICAL COMMUNITIES

Significant impact criteria

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

- Reduce the extent of an ecological community;
- Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines;
- Adversely affect habitat critical to the survival of an ecological community;
- Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns;
- Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting;
- Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:
 - assisting invasive species, that are harmful to the listed ecological community, to become established; or
 - causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community; or
- Interfere with the recovery of an ecological community.

MIGRATORY SPECIES

Significant impact criteria

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;
- Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or
- Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

>> What is important habitat for a migratory species?

An area of 'important habitat' for a migratory species is:

- a) Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or
- b) Habitat that is of critical importance to the species at particular life-cycle stages; and/or
- c) Habitat utilised by a migratory species which is at the limit of the species range; and/or
- d) Habitat within an area where the species is declining.

>> What is an ecologically significant proportion?

Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore, what is an 'ecologically significant proportion' of the population varies with the species (each circumstance will need to be evaluated). Some factors that should be considered include the species' population status, genetic distinctiveness and species specific behavioural patterns (for example, site fidelity and dispersal rates).

>> What is the population of a migratory species?

'Population', in relation to migratory species, means the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries including Australia.