TRAVERS BUSHFIRE & ECOLOGY

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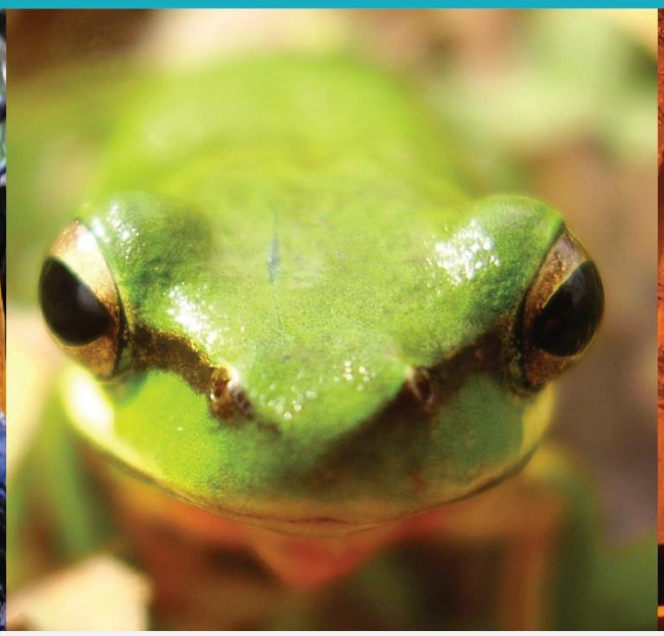

BIODIVERSITY ASSESSMENT REPORT

Proposed Subdivision

Lot 4, DP 1213869

192 Narellan Road

Campbelltown

13 July 2021

(REF: 18IND04)

BIODIVERSITY ASSESSMENT REPORT

Proposed Subdivision

Lot 4 DP 1213869, 192 Narellan Road, Campbelltown

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File:	18IND04

Disclaimer:

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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.

EXECUTIVE SUMMARY

Travers bushfire & ecology has been engaged to prepare a biodiversity assessment report for the proposed residential subdivision at 192 Narellan Road, Campbelltown. The entire area bounded by Lot 4, DP 1213869 has been subject to detailed survey effort and will hereafter be referred to as the 'study area'.

The area of direct impact from the development will hereafter be referred to as the 'development footprint'.

Development proposal

The proposed development is for a 20-lot residential subdivision with roads, kerbs and services such as NBN, power, water and sewage system. The area will include a proposed park as well as an on-site stormwater detention basin (OSD). A variable width asset protection zone (APZ) will be provided around the subdivision for bushfire protection purposes.

Recorded biodiversity

Ecological survey and assessment has been undertaken in accordance with the *Biodiversity Assessment Methodology* (BAM) as well as 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*, five (5) threatened fauna species including Little Lorikeet (*Glossopsitta pusilla*), Dusky Woodswallow (*Artamus cyanopterus*), Little Eagle (*Hieraaetus morphnoides*), Grey-headed Flying-fox (*Pteropus poliocephalus*) and Southern Myotis (*Myotis macropus*) were recorded within or beyond the study area. No threatened flora species, and one (1) threatened ecological community (TEC), Cumberland Plain Woodland, were recorded within the development footprint.

In respect of matters required to be considered under the *EPBC Act*, one (1) threatened fauna species Grey-headed Flying-fox (*Pteropus poliocephalus*), no protected migratory bird species, no threatened flora species and one (1) TEC, Cumberland Plain Shale Woodland and Shale Gravel Transition Forest, listed under this Act were recorded within the development footprint.

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

Impact assessment

The resultant direct, indirect and cumulative ecological impacts of the proposal have been carefully considered in Section 5.3. Further recommended mitigation measures to minimise these impacts, to address threatening processes and to create a more positive ecological outcome for threatened biodiversity have been outlined within Section 6.2.

The Development Proposal will see the impact of 0.20 ha of native vegetation, included planted native vegetation which contains a ground layer of Cumberland Plain Woodland grasses, herbs and forbs.

The assessment of significance test in accordance with Section 7.2 of the *BC Act* concluded that the proposal will not have a significant effect on any threatened species, or endangered communities, or their habitat. Therefore, a species impact statement or offsetting under the BOS are not required for the proposed activity.

There will be no significant impact on matters listed under the *FM Act* as the proposal does not impact vegetation or habitat within any riparian habitats.

The proposal was not considered to have a significant impact on matters of national environmental significance. As such a referral to Department of Agriculture, Water and the Environment should not be required.

Biodiversity Offsets Scheme (BOS) – Threshold Assessment

The proposed development is not within biodiversity values land and does not exceed the nominated threshold trigger of 0.25 ha. The proposal will therefore be assessed with a test of significance.

The test of significance concludes a not-significant impact on the relative entities being tested.

LIST OF ABBREVIATIONS

APZ	asset protection zone
BAM	Biodiversity Assessment Method (2020)
BAR	Biodiversity Assessment Report
BC Act	Biodiversity Conservation Act (2016)
BC Reg	Biodiversity Conservation Regulation (2017)
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
CM Act	Coastal Management Act 2016
CPW	Cumberland Plain Woodland
DAWE	Department of Agriculture, Water and the Environment.
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 OEH from April 2011)
DEWHA	Commonwealth Department of Environment, Water, Heritage & the Arts (superseded by SEWPAC)
DOEE	Commonwealth Department of Environment & Energy (superseded by DAWE)
DPIE	NSW Department of Planning, Industry and Environment
EEC	endangered ecological community
EPA	Environment Protection Authority
EP&A Act	Environmental Planning and Assessment Act (1979)
EPBC Act	Environment Protection and Biodiversity Conservation Act (1999)
FM Act	Fisheries Management Act
IBRA	Interim Biogeographic Regionalisation for Australia
LEP	local environmental plan
LGA	local government area
LLS Act	Local Land Services Act (2013)
NES	national environmental significance
NPW Act	National Parks and Wildlife Act (1974)
NRAR	Natural Resources Access Regulator (NSW)
NSW DPI	NSW Department of Industry and Investment
OEH	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
TSC Act	Threatened Species Conservation Act (1995) – Superseded by the Biodiversity Conservation Act (2016)
VMP	vegetation management plan

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1. INTRODUCTION

Travers bushfire & ecology has been engaged to undertake an ecological impact assessment within Lot 4, DP 1213869, at 192 Narellan Road, Campbelltown within City of Campbelltown local government area (LGA). The extent of this entire lot is shown in Figure 1-1 below and will hereafter be referred to as the 'study area'.

A twenty (20) lot residential development is proposed within the study area. The development area including roads, APZs and other associated services incurring direct impacts on habitat features within is hereafter referred to as the 'development footprint' (refer to Figure 1-3).

The proposal shall be assessed under the *Biodiversity Conservation Act* (*BC Act*), 2016.

Figure 1-1 – Study area (red) and development footprint (black)

1.1 Purpose

The purpose of this Biodiversity Assessment Report (BAR) 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 an assessment 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*.), and
    d) Fisheries Management Act 1994 (*FM Act*).

1.1.1 Terminology

Throughout this report the terms development footprint and study area are used. It is important to have a thorough understanding of these terms as they apply to the assessment.

Development footprint means the area directly affected by the proposal. It has the same meaning as “subject land” defined below.

Study area is the portion of land that encompasses all surveys undertaken and is usually all land contained within the designated property boundary. The study area extends as far as is necessary to assess all important biodiversity values known and likely to occur within the subject land and includes the development footprint and any additional areas which are likely to be affected by the proposal, either directly or indirectly.

Subject land is land to which the BAM is applied in Stage 1 to assess the biodiversity values. It includes land that may be a development site, clearing site, proposed for biodiversity certification or land that is proposed for a biodiversity stewardship agreement. In this case, it refers to the area designated as the development footprint, and has the same meaning for the purposes of this report. The terms “subject land” and “development footprint” are interchangeable in this regard.

Direct impacts are those that directly affect the habitat and individuals. They include, but are not limited to, death through clearing, 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 Figure 1-4 and Figure 1-5 (site and location maps).

Table 1-1 – Site features

Location	Lot 4, DP 1213869, 192 Narellan Road, Campbelltown
Location description	The site is located approximately 2 km north-west of Campbelltown train station. The site is surrounded on the western and southern sides by rural residential properties, on the eastern side by urban residential development and by the Hume Motorway to the north.
Area	7.78 ha
Local government area	City of Campbelltown
Zoning	R3 – Medium Density Residential
Grid reference MGA-56	296355E 6229029N
Elevation	Approximately 89-111 m AHD
Topography	The study area has a central road running from north-west to south-east. This road is runs along the highest portion of the site, with a gentle slope running either side of this road.
Catchment and drainage	The site drains via overland flow towards the east to Biriwiri Creek. There are no riparian areas within the subject land. A tributary of Bow Bowing Creek occurs near the western boundary of the study area however due to the topography, the drainage is more likely to head towards Biriwiri Creek than the Bow Bowing tributary.
Existing land use	Vacant paddocks

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

Patch size	5–24 ha
IBRA bioregions and subregions	Sydney Basin bioregion – Cumberland subregion (Figure 1-4 and Figure 1-5)
NSW landscape region and area (ha)	Cumberland Plain
vCleared areas	Approximately 7.78 ha of land within the study area is cleared
Evidence to support differences between mapped vegetation extent and aerial imagery	Mapped vegetation closely matches aerial imagery. Unmapped vegetation is exotic. The edges of the vegetation have all been mapped by hand-held GPS.
Rivers and streams classified according to stream order	The site map (Figure 1-4) shows the study area with first, second and third order streams

Wetlands within, adjacent to and downstream of the site, including important wetlands	There is a stream along the western boundary of the study area, which flows into a dam located approximately 420 metres to the south (Figure 1-4)
Connectivity features	There is existing residential development to the east, while the Hume Motorway is to the north. Lands to the south and west of the study area, as well as lands north of the Hume Motorway are large areas of cleared grassy pasture with sparsely scattered trees. The location map (Figure 1-5) shows an overview of the extent of native vegetation in the locality.
Geology and soils	Geology; Wianamatta Group (Bringelly Shale). Soils; Luddenham Soil Landscape (erosional) – on slopes and rolling hills with shallow soils on crests to moderately deep on upper and lower slopes and in riparian areas.
Identification of method applied (i.e. linear or site-based)	Site based assessment

1.2.3 Zoning

The site is currently zoned R3 under the Campbelltown LEP of 2015 (Figure 1-2) which is for medium density residential.

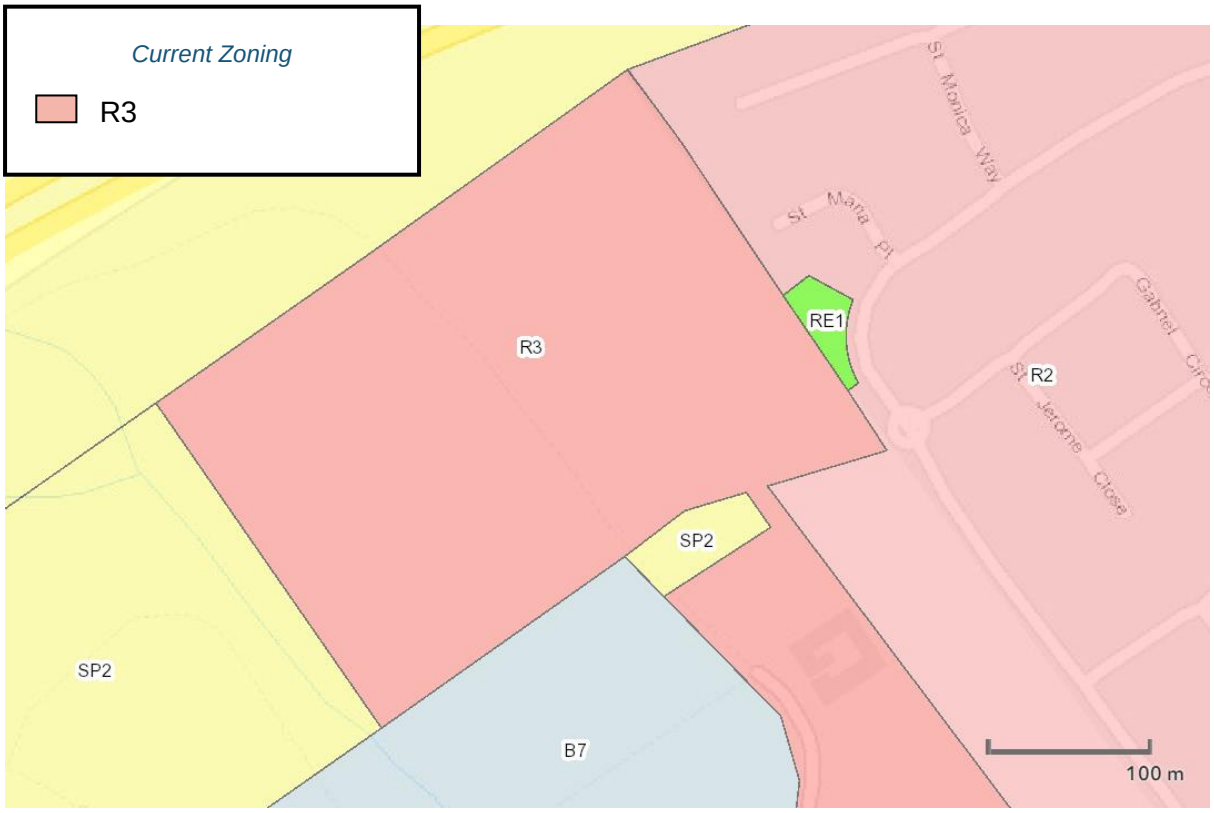

Figure 1-2 – Zoning

(Source: Planning Portal, 2021)

1.3 Proposed development

The proposed development is for a 20-lot residential subdivision with roads, kerbs and services such as NBN, power, water and sewage. The area will include a proposed park as well as an on-site stormwater detention basin (OSD).

Asset protection zones (APZs) will apply to the subdivision. A 30 m APZ will apply to land to the north-west and north-east, and a 50 m APZ will apply to the south-west.

1.3.1 Identification of development site footprint

Whilst the entire study area is over 7 ha, the proposed subject land occupies only the south-east portion. The development footprint is likely to occupy the entire subject land to create the subdivided lots, park, OSD and services. APZs will be applied externally and will form part of the development footprint and consideration of site impacts.

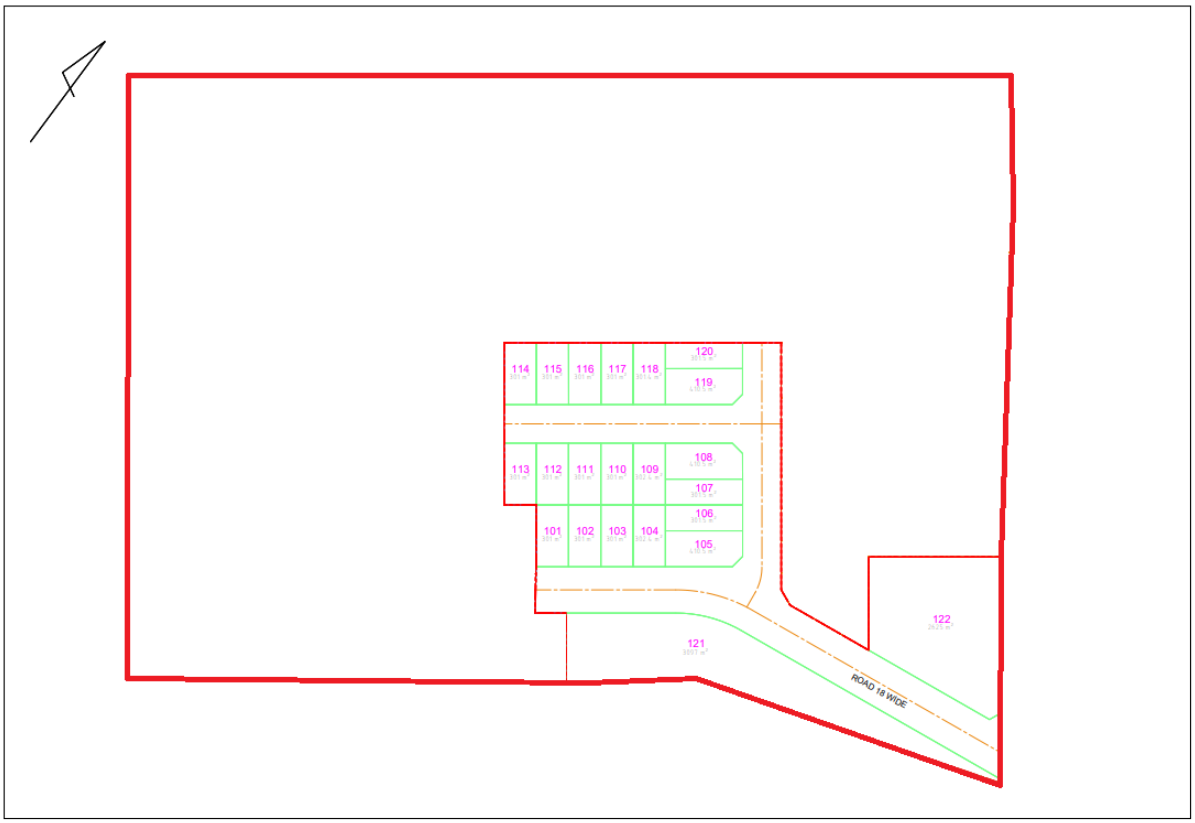

Figure 1-3 – Proposed development layout

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 are 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).

The BOS applies to:

- local development (assessed under Part 4 of the *Environmental Planning and Assessment Act 1979*) that triggers a BOS threshold or is likely to significantly affect threatened species based on the test of significance in section 7.3 of the *Biodiversity Conservation Act 2016*
- state significant development and state significant infrastructure projects, unless the Secretary of the Department of Planning, Industry and Environment and the environment agency head determine that the project is not likely to have a significant impact
- biodiversity certification proposals
- clearing of native vegetation in urban areas and areas zoned for environmental conservation that exceeds a BOS threshold and does not require development consent
- clearing of native vegetation that requires approval by the Native Vegetation Panel under the *Local Land Services Act 2013*
- activities assessed and determined under Part 5 of the *Environmental Planning and Assessment Act 1979* (generally, proposals by government entities) if proponents choose to 'opt in' to the Scheme.

Proponents will need to supply evidence relating to the triggers for the BOS thresholds and the test of significance (where relevant) when submitting their application to the consent authority.

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 (SAII) on biodiversity values. The determination of SAII 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* (*EP&A 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 *EP&A Act.*

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 Agriculture, Water and the Environment (DAWE) 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 applies 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 DAWE 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.

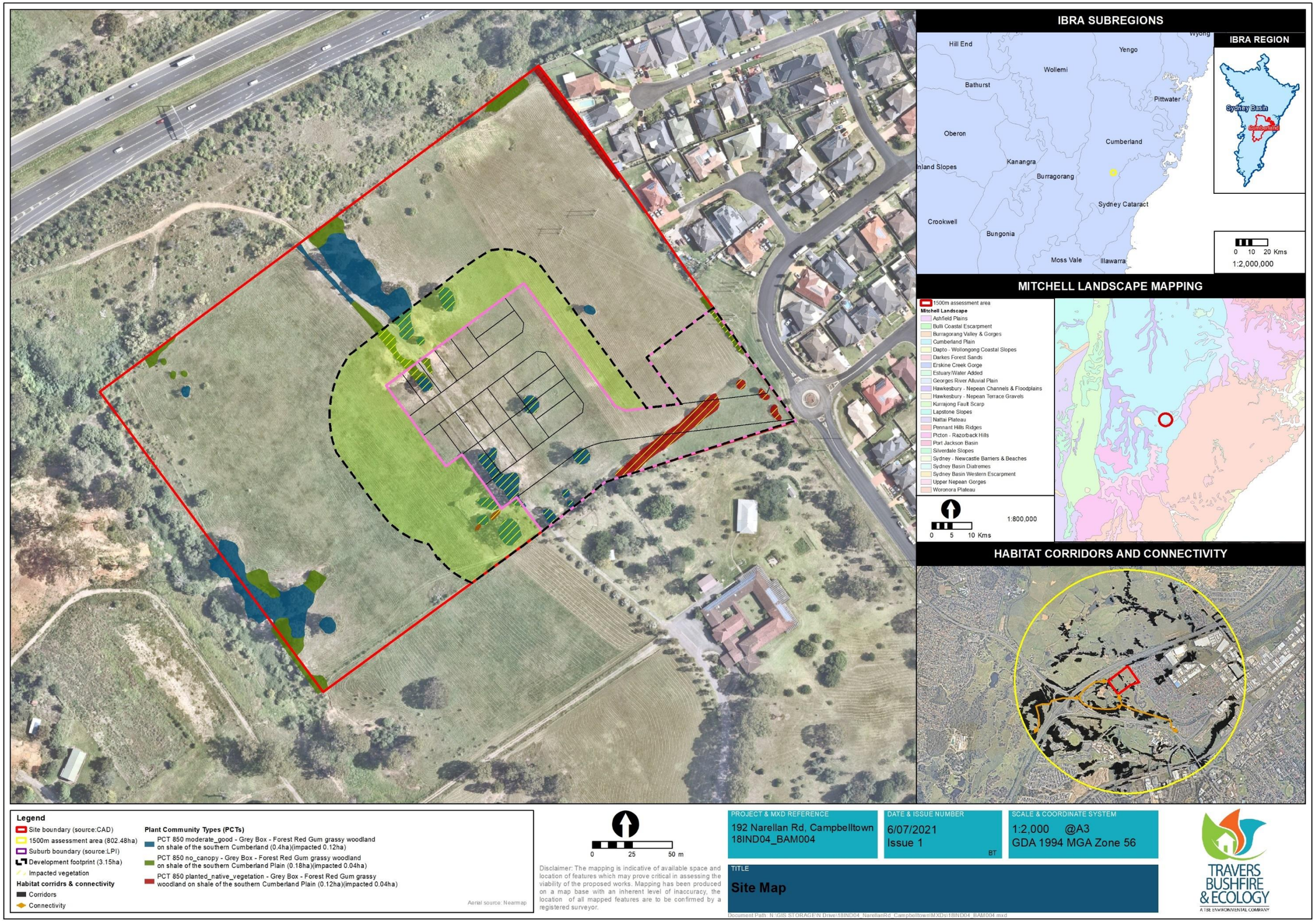

Figure 1-4 – Site map

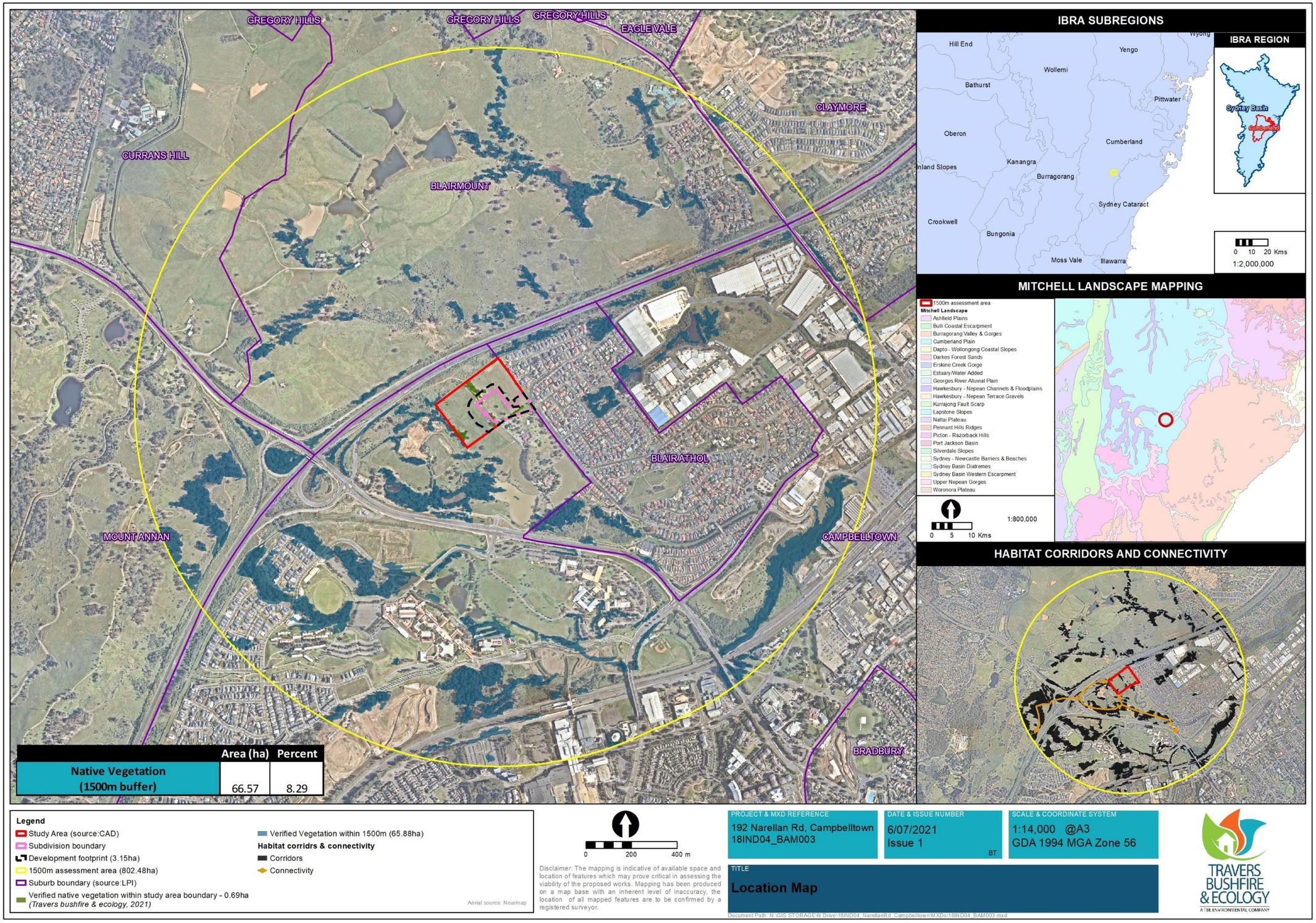

Figure 1-5 – Location map

2. SURVEY METHODOLOGY

2.1 Presurvey information collation & resources

Documents reviewed:

- Vegetation Management Plan (*Travers bushfire & ecology* 2021)
- Bushfire Protection Assessment (*Travers bushfire & ecology* 2021)
- Campbelltown Comprehensive Koala Plan of Management (2020)
- Native vegetation of the Sydney Metropolitan Area (2016)
- Site plans from RPS Group.

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

- Survey guidelines for Australia's threatened birds (DEWHA 2010)
- Survey guidelines for Australia's threatened frogs (DEWHA 2010)
- Survey guidelines for Australia's threatened mammals (DEWHA 2011)
- Survey guidelines for Australia's threatened bats (DEWHA. 2010)
- Survey guidelines for Australia's threatened reptiles (DEWHA 2011)
- 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)
- Region based guide to the echolocation calls of Microchiropteran bats (DEC 2004)
- Species credit threatened bats and their habitats (DPIE 2018)
- Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment Method (DPIE 2020)
- Biodiversity Assessment Methodology (2020)

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)
- ESpade – DPIE tool for checking soil types

Threatened species records

- BioNet database which holds data from a number of custodians (June / July to 10 km)
- EPBC Protected Matters Search Tool - DAWE (2021 to 10 km)

Vegetation mapping/resources:

- BioNet Vegetation Classification System
- Native Vegetation of the Sydney Metropolitan Area (Version 3.0, 2016)

2.2 Flora survey methodology

Flora survey was undertaken on 8 March 2021. A review of the *Atlas of NSW Wildlife* (DPIE 2021) was undertaken prior to the site visit to determine threatened species previously recorded within 10 km of the subject site, and relevant target searches were undertaken as suited, generally as near-linear transects underneath or adjacent to remnant canopy vegetation. Given the non-treed parts of the site have been grazed previously and contain limited native species cover, they are likely to be too disturbed to host threatened flora species. Only limited searches were undertaken in these areas. Given that the remnant trees are often isolated or are very small patches, the BAM plots were undertaken across the entire study area in patches of sufficient size for the vegetation type and its status

Stratified survey using the BAM was undertaken. The following information was collected at each of four (4) BAM plots:

- Native overstorey, mid-storey and ground cover recorded for all observed species and an estimate of stems (20 m x 20 m, or 10 m x 40 m).
- Stratum (and layer): stratum and layer in which each species occurs (20 m x 20 m, or 10 m x 40 m)
- Growth form: growth form for each recorded species (20 m x 20 m, or 10 m x 40 m)
- Species name: scientific name and common name (20 m x 20 m, or 10 m x 40 m)
- Percent projected foliage cover of the understorey strata and exotic vegetation (20 m x 20 m, or 10 m x 40 m)
- Number of trees with hollows visible from the ground (20 m x 50 m or 10 x 100 m)
- The total length of fallen logs >10 cm in diameter (20 m x 50 m or 10 x 100 m)
- The proportion of regenerating overstorey species (20 m x 50 m or 10 x 100 m)
- Number of large trees (20 m x 50 m or 10 x 100 m)
- Estimates of leaf litter cover, at five (5) locations along the central transect (20 m x 50 m or 10 x 100 m)

The ground layer of vegetation amongst the small patches of remnant vegetation is quite poor, and the open grassland areas are unlikely to be suitable for threatened species. Target searches were limited to survey on the one day given the poor quality. Vegetation in the northern-central portion of the broader study area is better quality and more likely to host threatened species habitat. This is outside of the DA lands for this project.

All plot sheets utilised for the BAM calculator are provided in Appendix 5.

2021

Botanical survey was initially undertaken on 8 March 2021 over a time frame of approximately 8 hrs.

Botanical survey included a random meander in accordance with *Cropper* (1993) to gain a full species list of the plants within the site. Four (4) BAM plots were conducted to accurately determine the vegetation communities within the site. A review of the *Atlas of NSW Wildlife* (DPIE 2021) was undertaken prior to the site visit to determine threatened species previously recorded within 10 km of the subject site, and relevant target searches were undertaken as suited.

2.3 Fauna survey methodology

Site survey effort accounting for techniques deployed, duration, and weather conditions are outlined in Table 2-1 and are depicted on Figure 2-1.

Diurnal birds

Five (5) diurnal bird census points were undertaken within the immediate study area, concentrating on quality vegetated habitats present. A minimum of 15 minutes of survey was undertaken at each census point in an area radiating out to between 30-50 m. Bird census points were selected to give an even spread and representation across the site and its communities (see Figure 2-1). Census points were also commenced in locations where bird activity was apparent, as often different small bird species are found foraging together. Opportunistic diurnal bird survey was conducted between census points and whilst undertaking other diurnal surveys.

Nocturnal birds

Given the marginal suitability of habitat present, Masked Owl (*Tyto novaehollandiae*), Powerful Owl (*Ninox strenua*) and Barking Owl (*Ninox connivens*) were targeted by call-playback techniques.

Arboreal and terrestrial mammals

Given the presence of potential Koala habitat as defined by SEPP (Koala Habitat Protection) 2020, one Rapid-SAT (Spot Assessment Technique) Koala survey point was undertaken.

Rapid-SAT is a survey technique outlined but not yet published by Koala expert Stephen Phillips and staff at Biolink. It is an occupancy-focused assessment tool informed by the presence/absence of diagnostic Koala faecal pellets around the bases of Preferred Koala Food Tree (PKFT) species. The Rapid-SAT approach is predicated by knowledge that in areas being utilised by koalas, there is an ~ 50% probability of faecal pellets occurring within 1 m of the base of any PKFT species ≥ 300 mm diameter at breast height (DBH) (Phillips & Wallis 2016). In applying the technique, assessment at a given point ceases upon one or more koala faecal pellets being detected within the prescribed search area (1 m) around the base of each PKFT that is searched. Conversely, if no pellets are detected, sampling ceases once a minimum of five to (ideally) a maximum of seven PKFTs ≥ 300 mm DBH have been assessed, these numbers affording a high level of statistical confidence (95% or 99% respectively) that koalas are not using habitat in the immediate vicinity (Phillips & Wallis 2016).

The rapid-SAT included a collective analysis of seven of the largest Forest Red Gum trees present within the study area, with representative trees located in the south-west, central and north-west fringes of the site.

Bats

Active recording was undertaken during stag-watching and throughout the nocturnal survey undertaken on 9 March 2021. Associated spotlighting was undertaken throughout the development footprint with a view on all trees present as well as along both sides of the riparian vegetated fringes to the west.

Amphibians

The presence of Green & Golden Bell Frog was considered highly unlikely at this site based on the poor quality of breeding opportunities within the adjacent drainage channel. This quality is based on the dominance of weeds and exotic grasses, absence of typical sedges and reeds fringing open water and the channel hydrology (as opposed to floodplain wetland). Nonetheless local records to the east are known so this species was targeted by broadcasting

recorded calls through a 15-watt Toa 'Faunatech' amplifier. The call was played for a 5-minute period with 5-minute quiet listening for response along the open water locations of the drainage line. This was followed with quiet listening and spotlighting. Call-playback stations are shown on Figure 2-1.

Reptiles

Reptiles were predominantly targeted during habitat searches undertaken for snails (see below).

Invertebrates

Given the proximity to previous Bionet records of Cumberland Plain Land Snail (*Meridolum corneovirens*) and the recorded presence of its typical host community, target surveys were undertaken. Habitat searches were undertaken at locations where litter and bark exfoliations occur below remnant trees within PCT 850 (moderate-good) indicated as blue on Figure 2-1..

Leaf litter with likely moisture retaining properties were opportunistically scraped using a three-pronged rake. Logs, stumps and artificial refuse were also turned over where present including a large log pile located within the central southern boundary.

Habitat trees

Hollow-bearing trees were identified and recorded within the development footprint on a *Trimble* handheld GPS unit during surveys. All data such as hollow types, hollow size, tree species, diameter at breast height, canopy spread and overall height were collected and a metal tag with the tree number placed on the trunk for field relocation purposes. Other habitat features such as nests and significant sized mistletoe for foraging were also noted.

A summary of hollow-bearing tree results is provided in Table 3-5.

2.4 Field survey effort

Table 2-1 and Table 2-2 below detail the flora and fauna survey effort undertaken for the development footprint.

Table 2-1 – Fauna survey effort

Fauna group	Date	Weather conditions	Survey technique(s)	Time effort (24hr)
Diurnal birds	9/3/21	6/8 cloud, light SE wind, no rain, temp 29-24ºC	Diurnal census x4 / opportunistic	5hrs 15min 1200 - 1715
		8/8 cloud, no wind, no rain, temp 22ºC	Diurnal census x1 / opportunistic	1hrs 20min 1815 - 1935
Nocturnal birds	9/3/21	8/8 cloud, no wind, no rain, temp 21ºC	Spotlighting	1hrs 45min 1935 - 2120
			Call playback (Section 2.5 species)	Commenced @ 2030
Arboreal mammals	9/3/21	8/8 cloud, no wind, no rain, temp 21ºC	Spotlighting	1hrs 45min 1935 - 2120
			Call playback (Section 2.5 species)	Commenced @ 2030
Terrestrial mammals	9/3/21	8/8 cloud, no wind, no rain, temp 21ºC	Spotlighting	1hrs 45min 1935 - 2120
Bats	9/3/21	8/8 cloud, no wind, no rain, temp 21ºC	Spotlighting (Active monitoring)	1hrs 45min 1935 - 2120
Reptiles	9/3/21	6/8 cloud, light SE wind, no rain, temp 29-24ºC	Diurnal opportunistic / habitat searches	5hrs 15min 1200 - 1715
Amphibians	9/3/21	8/8 cloud, no wind, no rain, temp 21ºC	Spotlighting / call identification	1hrs 45min 1935 - 2120
			Call-playback (GGBF)	Commenced @ ~2040
			Nearby ref site: Spotlighting / Call-playback (GGBF)	1hr 25min 2120 - 2200
Molluscs	9/3/21	6/8 cloud, light SE wind, no rain, temp 29-24ºC	Opportunistic habitat searches	5hrs 15min 1200 - 1715

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	8 March 2021
Stratified sampling	Four (4) BAM plots within areas of remnant native vegetation across the study area that were large enough to support a BAM plot, to determine the Plant Community Type(s) present.	8 March 2021
Targeted searches	Targeted searches in known or potential habitats. Opportunistic searches during all on-foot traverses across the site.	8 March 2021

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 development footprint 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 development footprint 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.

For *Pimelea spicata,* flowering is unpredictable and rain dependent. The guidelines require survey to be conducted 4 weeks after at least a 30 mm rainfall event. In drier times plants are often not visible above ground unless soils remain moist. Multiple surveys may be required. Survey should be conducted at least 3 times, each at least a month apart unless found.

Survey in March 2021 occurred 5 weeks after a 30 mm rainfall event on Feb 2 (Campbelltown BOM weather data). It is believed that one session is sufficient due to the small area of native vegetation being impacted, previous disturbance history and edge effects.

Fauna survey limitations

Snail surveys were undertaken during dry conditions. Living snails are more readily found at the soil surface following rainfall and prolonged surface water retention.

Green and Golden Bell Frog call-playback surveys were also undertaken out of ideal wet weather conditions. Given that a recent nearby breeding location has been recorded at Blair Athol on the edge of industrial premises approximately 530m to the east in 2013-2018. Given this recorded proximity, further survey during more suitable conditions is advised within the adjacent drainage line, dams in the neighbouring property to the west as well as stormwater detention areas to the immediate east along the Hume Motorway road southern corridor.

Microbat survey was undertaken as active monitoring during the single night's nocturnal fauna survey period. This also included stag-watching the single tree containing hollows. Microbats were noted to be inactive at the habitat tree and within the entire development footprint area at this time. Microbats, including likely threatened species, are expected to periodically forage within the subject site are.

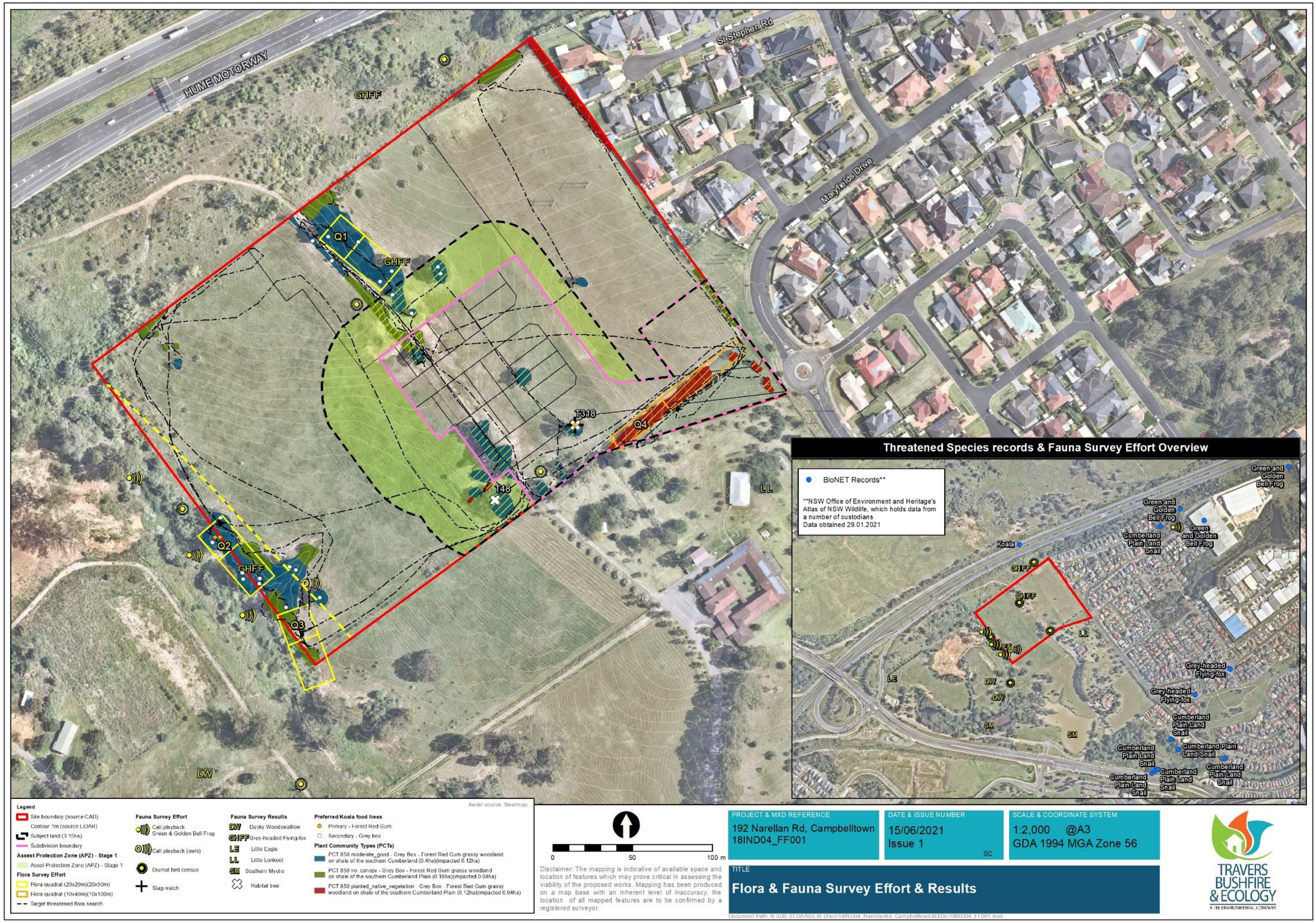

Figure 2-1 – Flora and fauna survey effort and results

3. SURVEY RESULTS

3.1 Flora results

3.1.1 Native vegetation extent

Within the development footprint, there is 0.2 ha of native vegetation. Whilst a small portion of this has been planted, native vegetation must be attributed to a plant community type (PCT). Given that there are some remnant endemic species in the ground layer, all vegetation has been attributed to PCT 850 which is a component of the critically endangered ecological community (*BC Act*), Cumberland Plain Woodland.

3.1.2 Flora species

The plants observed within the vegetation communities of the study area are listed in the Table 3-1 below.

Table 3-1 – Flora observations within the study area

Scientific name	Common name
Trees	
Acacia implexa	Hickory Wattle
Acacia parramattensis	Parramatta Wattle
Corymbia citriodora	Lemon-scented Gum
Corymbia maculata	Spotted Gum
Eucalyptus crebra	Narrow-leaved Ironbark
Eucalyptus eugenioides	Thin-leaved Stringybark
Eucalyptus moluccana	Grey Box
Eucalyptus tereticornis	Forest Red Gum
Gleditsia triacanthos	Honey Locust
Ligustrum lucidum	Large-leaved Privet
Lophostemon confertus	Brush Box
Melaleuca linariifolia	Flax-leaved Paperbark
Melia azedarach	White Cedar
Toxicodendron succedaneum	Rhus Tree
Shrubs	
Acacia falcata	Hickory Wattle
Bursaria spinosa	Native Blackthorn
Callistemon viminalis	Weeping Bottlebrush
Citrus sinensis	Orange
Cotoneaster glaucophyllus	Glaucous Cotoneaster
Dodonaea viscosa	Sticky Hop-bush
Lantana camara	Lantana
Leptospermum polygalifolium subsp polygalifolium	Tantoon
Lycium ferocissimum	African Boxthorn
Musa acuminata	Edible banana
Nerium oleander	Oleander
Olea europaea	Common Olive

Scientific name	Common name
Photinia spp.	
Polygala virgata	
Pyracantha spp.	
Ricinus communis	Castor Oil Plant
Rosa spp.	
Groundcovers	
Aloe vera	
Alternanthera denticulata	Lesser Joyweed
Alternanthera pungens	Khaki Weed
Anthoxanthum spp.	Vernal Grass
Aristida ramosa	Purple Wiregrass
Axonopus fissifolius	Narrow-leafed Carpet Grass
Bidens pilosa	Cobbler's Pegs
Bracteantha bracteata	Golden Everlasting
Brassica fruticulosa	Twiggy Turnip
Brassica juncea	Indian Mustard
Brunoniella spp.	
Bryophyllum delagoense	Mother of millions
Bulbine bulbosa	Bulbine Lily
Carthamus lanatus	Saffron Thistle
Cenchrus clandestinus	Paspalum
Centaurium erythraea	Common Centaury
Cheilanthes sieberi	Rock Fern
Chloris gayana	Rhodes Grass
Chloris truncata	Wilndmill Grass
Cirsium vulgare	Spear Thistle
Commelina cyanea	Native Wandering Jew
Conyza bonariensis	Flaxleaf Fleabane
Conyza sumatrensis	Tall Fleabane
Cymbonotus lawsonianus	Bear's Ear
Cymbopogon refractus	Barbed Wire Grass
Cynodon dactylon	Common Couch
Cyperus eragrostis	Umbrella Sedge
Cyperus gracilis	Slender Flat-sedge
Dianella longifolia	Blueberry Lily
Dichelachne crinita	Longhair Plumegrass
Dichondra repens	Kidney Weed
Echinopogon caespitosus	Bushy Hedgehog-grass
Ehrharta erecta	Panic Veldtgrass
Einadia nutans	Climbing Saltbush
Einadia trigonos	Fishweed
Eragrostis curvula	African Lovegrass
Euchiton sphaericus	Star Cudweed
Euphorbia peplus	Petty Spurge
Glycine clandestina	Twining glycine
Glycine tabacina	Variable Glycine
Gomphocarpus fruticosus	Narrow-leaved Cotton Bush
Holcus lanatus	Yorkshire Fog

Scientific name	Common name
Hypericum gramineum	Small St John's Wort
Hypochoeris radicata	Catsear
Juncus usitatus	
Lepidium africanum	Common Peppercress
Lysimachia arvensis	Scarlet Pimpernel
Medicago polymorpha	Burr Medic
Microlaena stipoides	Weeping Grass
Modiola caroliniana	Red-flowered Mallow
Oxalis purpurea	
Panicum effusum	Hairy Panic
Panicum simile	Two-colour Panic
Paspalum dilatatum	Paspalum
Pavonia hastata	
Phyllanthus spp.	
Phytolacca octandra	Inkweed
Plantago lanceolata	Lamb's Tongues
Portulaca oleracea	Pigweed
Richardia stellaris	
Rubus fruticosus	Blackberry complex
Rumex crispus	Curled Dock
Rytidosperma tenuius	A Wallaby Grass
Senecio madagascariensis	Fireweed
Setaria parviflora	
Sida rhombifolia	Paddy's Lucerne
Solanum nigrum	Black-berry Nightshade
Sonchus aspera	Prickly Sowthisle
Sonchus oleraceus	Common Sowthistle
Sporobolus africanus	Parramatta Grass
Sporobolus creber	Slender Rat's Tail Grass
Stenotaphrum secundatum	Buffalo Grass
Taraxacum spp.	Dandelion
Themeda triandra	Kangaroo Grass
Urochloa panicoides	Urochloa Grass
Verbena bonariensis	Purpletop
Verbena brasiliensis	
Veronica plebeia	Trailing Speedwell
Wahlenbergia gracilis	Sprawling Bluebell
Zantedeschia aethiopica	Arum Lily
Zornia dyctiocarpa	Zornia
Vines and Epiphytes	
Amyema gaudichaudii	
Aptenia cordifolia	Heartleaf Ice Plant
Araujia sericifera	Mothvine
Asparagus asparagoides	Bridal Creeper
Asparagus officinalis	Asparagus
Clematis glycinoides.	Headache Vine
Hardenbergia violacea	False Sarsaparilla
Ipomoea indica	Morning Glory

Scientific name	Common name
Passiflora edulis	Common Passionfruit
Polymeria calycina	
Solanum sisymbriifolium	

3.1.3 Plant community types (PCTs)

Evidence used to identify a PCT

Native species in the plots were put through the Bionet vegetation classification tool. When the vegetation was filtered to only include the Cumberland IBRA sub-region, the top results for the plots were as follows:

Plot 1

PCT_ID	Formation	Class	Common_Name
849	Grassy Woodlands	Coastal Valley Grassy Woodlands	Cumberland shale plains woodland
850	Grassy Woodlands	Coastal Valley Grassy Woodlands	Cumberland shale hills woodland
830	Grassy Woodlands	Coastal Valley Grassy Woodlands	Cumberland moist shale woodland

Plot 2

1800	Forested Wetlands	Coastal Floodplain Wetlands	Cumberland Swamp Oak riparian forest
835	Forested Wetlands	Coastal Floodplain Wetlands	Cumberland riverflat forest
850	Grassy Woodlands	Coastal Valley Grassy Woodlands	Cumberland shale hills woodland

Plot 1 cleared identified the vegetation as being Cumberland Plain Woodland. PCT 850 was chosen as the best fit due to the presence of *Acacia implexa* which is a dominant sub-canopy species of this PCT.

Plot 2 slightly favoured PCT 1800 and 835 which form part of the River-flat Eucalypt Forest on Coastal Floodplains EEC. Whilst it is not unreasonable to link the vegetation to either of those PCTs, the few species that have swung the count that way are low in vegetation coverage. The vegetation is also within a creek line where there is a niche for species that like wetter conditions. *Acacia implexa* may not be present within the plot, but it was recorded adjacent. Observations of *Angophora floribunda* were made approximately 50m south of the site which is representative of River-flat Eucalypt Forest on Coastal Floodplains. This is more in line with regional vegetation mapping which shows no River-flat Eucalypt Forest on Coastal Floodplains within the study area. In addition to the above, note that the placement of the plots is with a patch that is big enough for a plot, and is more or less representative of what has been recorded within the development footprint. Therefore again, PCT 850 appears to be the best fit for Plot 2.

Table 3-2 – 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	Euc..moluccana Euc. tereticornis Bursaria spinosa Acacia implexa Micro. stipoides Themeda triandra	Grassy Woodlands	Coastal Valley Grassy Woodlands	88	0.2 ha to be impacted	Cumberland Plain Woodland

3.1.4 Vegetation descriptions of observed communities

The following vegetation communities have been ground-truthed across the study area:

- PCT 850 moderate_good - Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland (0.4 ha) (impacted 0.12 ha)
- PCT 850 no_canopy - Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain (0.18 ha) (impacted 0.04 ha)
- PCT 850 planted_native_vegetation - Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain (0.12 ha) (impacted 0.04 ha)

PCT 850 moderate_good

Vegetation with moderately intact canopy, with or without a native mid-storey or shrub layer, and a ground layer made up of at least 30% native groundcovers.

PCT 850 no_canopy

Areas of remnant vegetation in a state of regrowth that lack the present of Eucalyptus trees. Some shrub growth may exist and the ground layer made up of at least 30% native groundcovers.

Summary of common species in PCT 850 moderate_good and no_canopy

Common canopy species – *Eucalyptus moluccana, Eucalyptus tereticornis* and *Eucalyptus crebra* 15-30% cover and close to 20m in height on average.

Mid-storey – Highly variable in composition and often monotypic if present. Common species include *Acacia implexa* as a sub-canopy species and *Acacia falcata* and *Bursaria spinosa* as smaller shrub species.

Common groundcovers – *Microlaena stipodes, Themeda triandra, Rytidosperma tenuius, Aristida ramosa, Dichelachne crinite, Cynodon dactylon, Chloris truncate, Sporobolus creber, Einadia nutans* subsp. *linifolia, Dichondra repens, Commelina cyanea, Cyperus gracilis, Einadia trigonos* and *Glycine clandestina.*

Photo 1 – Moderate_good remnant with E. crebra as the dominant species

Photo 2 – Example of standalone trees in the development footprint

Photo 3 – Non-canopy vegetation along development footprint edge adjacent to proposed site entry

PCT 850 planted_native_vegetation

This includes vegetation near the proposed site entry which includes an avenue of planted native trees with a canopy width of 5-10m. There is no native shrub layer, however the ground layer may contain 20-70% native groundcovers. Native groundcovers are more dominant directly under the tree canopies.

Common planted trees include *Lophostemon confertus,* and *Corymbia maculata.*

Plot 4 was undertaken almost the planted canopy along the proposed site entry road. Common name groundcovers include *Microlaena stipoides, Themeda triandra, Panicum effusum, Cymbopogon refractus, Einadia nutans* subsp. *linifolia* and *Dichondra repens.*

Photo 4 – Planted Lophostemon confertus

Photo 5 – Planted vegetation near the proposed site entrance

Photo 6 – Cleared vegetation in the northern portion of the proposed development footprint

3.2 Fauna results

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

Table 3-3 – Fauna recorded within the study area

Common name	Scientific name	Method observed
Birds		March 2021
Australian Magpie	*Cracticus tibicen*	OW
Australian Raven	*Corvus coronoides*	OW
Bell Miner	*Manorina melanophrys*	OW
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	OW
Collared Sparrowhawk	*Accipiter cirrhocephalus*	O
Common Myna *	*Sturnus tristis*	OW
Common Starling *	*Sturnus vulgaris*	OW
Crested Pigeon	*Ocyphaps lophotes*	O
Dusky Woodswallow TS	*Artamus cyanopterus*	OW
Eastern Rosella	*Platycercus eximius*	OW
Eurasian Coot	*Fulica atra*	O
European Goldfinch *	*Carduelis carduelis*	OW
Fairy Martin	*Hirundo ariel*	O^{PR}
Galah	*Eolophus roseicapillus*	W
Grey Butcherbird	*Cracticus torquatus*	W
Little Eagle TS	*Hieraaetus morphnoides*	O
Little Lorikeet TS	*Glossopsitta pusilla*	W
Magpie-lark	*Grallina cyanoleuca*	OW
Masked Lapwing	*Vanellus miles*	W

Common name	Scientific name	Method observed
Mistletoebird	*Dicaeum hirundinaceum*	OW
Noisy Miner	*Manorina melanocephala*	OW
Rainbow Lorikeet	*Trichoglossus haematodus*	OW
Red-browed Finch	*Neochmia temporalis*	OW
Red Wattlebird	*Anthochaera carunculata*	O
Red-rumped Parrot	*Psephotus haematonotus*	OW
Red-whiskered Bulbul *	*Pycnonotus jocosus*	OW
Restless Flycatcher	*Myiagra inquieta*	OW
Sacred Kingfisher	*Todiramphus sanctus*	W
Silvereye	*Zosterops lateralis*	OW
Spotted Turtle-Dove *	*Streptopelia chinensis*	O
Striated Pardalote	*Pardalotus striatus*	O
Superb Fairy-wren	*Malurus cyaneus*	OW
Tree Martin	*Petrochelidon nigricans*	OW
Welcome Swallow	*Hirundo neoxena*	OW
White-cheeked Honeyeater	*Phylidonyris niger*	OW
White-plumed Honeyeater	*Lichenostomus penicillatus*	OW
Willie Wagtail	*Rhipidura leucophrys*	OW
Yellow Thornbill	*Acanthiza nana*	OW
Yellow-faced Honeyeater	*Caligavis chrysops*	W
Mammals		
European Red Fox *	*Vulpes vulpes*	O P
Grey-headed Flying-fox TS	*Pteropus poliocephalus*	O W
Rabbit *	*Oryctolagus cuniculus*	O P
Southern Myotis TS	*Myotis macropus*	O U
Reptiles		
Cream-striped Shining Skink	*Cryptoblepharus virgatus*	O
Delicate Skink	*Lampropholis delicata*	O
Eastern Water Skink	*Eulamprus quoyii*	O PO
Grass Skink	*Lampropholis guichenoti*	O
Red-bellied Black Snake	*Pseudechis porphyriacus*	O
Amphibians		
Striped Marsh Frog	*Limnodynastes peronii*	W
Mollusc		
Brown Garden Snail *	*Cornu aspersum*	O

Note: * indicates introduced species

TS indicates threatened species

MS indicates Migratory 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 – low-moderate level of confidence

E - Nest/roost	H - Hair/feathers/skin	P - Scat	W - Heard call
F- Tracks/scratchings	K- Dead	Q- Camera	X- In scat
FB - Burrow	O - Observed	T - Trapped/netted	Y - Bone/teeth/shell
G - Crushed cones	OW- Obs & heard call	U- Anabat/ultrasound	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 3-4 - 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				
None present				
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 HOLLOWS:	Large	Medium	Small ✓	
TREE HOLLOW TYPES	Spouts / branch ✓	Trunk	Broken Trunk ✓	Basal Cavities	Stags
GROUND HOLLOWS:	Large	Medium	Small	
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) ✓	Creek(s)	River(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)	

Topography			
FOREIGN MATERIALS:	Sheet	Pile / refuse	

3.3.2 Habitat trees

One hollow-bearing tree and one tree with bark exfoliations suitable for roosting use by microbats were recorded within development footprint. Data on these trees are tabled below and locations are shown on Figure 2-1.

No significant habitat trees containing either large hollows suitable for use by owls and/or containing numerous good quality hollows and/or of notable importance to threatened fauna were recorded within development footprint. Some such trees are located nearby within adjacent lands to the west. Based on survey results and known occurrences in the locality, none of these hollows are expected of importance to owls or cockatoos, such that they may be indirectly impacted by the proposal.

Some of these nearby trees did contain good quality hollows with signs of use and this may include use by the Southern Myotis recorded foraging on the adjacent dams. A family party of Dusky Woodswallows were also observed within the adjacent lands to the south and are suspected to be nesting in this locality. This tree, where present, would be regarded as significant but is not expected to be within or close to the development footprint based on survey observations.

Table 3-5 – Habitat tree data

Tree No	Common Name	DBH (cm)	Height (m)	Spread (m)	Vigour (%)	Hollows
T048	Eucalyptus crebra	96	23	19	80	2x 0-5cm bark exfoliations
T318	Eucalyptus tereticornis	90,90,120,36,40	23	17	65	2x 0-5cm branch 2x 5-10cm branch spout 1x 10-15cm broken trunk

4. BIODIVERSITY ASSESSMENT

4.1 Previous surveys reviewed

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

Native Vegetation Mapping of the Sydney Metropolitan Area v3 (2016)

None of the vegetation on site has been mapped by this project as being part of a native vegetation community. Clearly, the site has not been previously ground-truthed and documented.

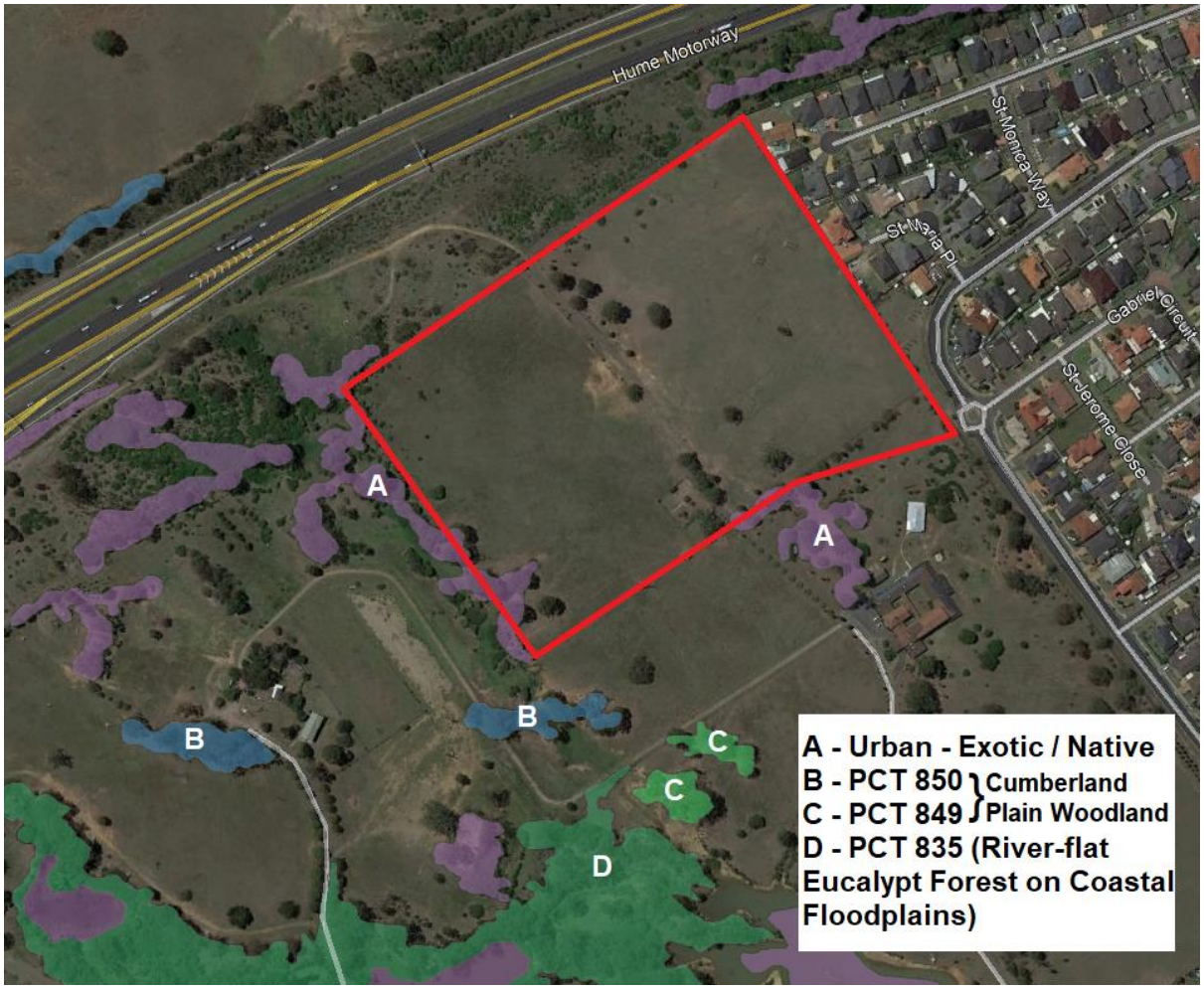

Figure 4-1 – Native vegetation mapping of the Sydney metropolitan area near to the study area (red outline)

4.2 Flora

No threatened flora species were observed.

All species are listed in Table 3-1.

4.2.1 State legislative flora matters

(a) Threatened flora species (NSW)

BC Act – A search of the *Atlas of NSW Wildlife* (DPIE 2021) 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 A1.1 (Appendix 1).

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

Table 4-1 – State listed threatened flora species with suitable habitat present

Scientific name	*BC Act*	Potential to occur
Acacia bynoeana	E1	low
Acacia pubescens	V	low
Eucalyptus benthamii	V	no
Eucalyptus scoparia	E1	no, unless planted
Genoplesium baueri	E1	no
Grevillea parviflora subsp. parviflora	V	low
Gyrostemon thesioides	E1	not likely
Hibbertia puberula	E1	not likely
Leucopogon exolasius	V	no
Leucopogon fletcheri subsp. fletcheri	E1	no
Melaleuca deanei	V	no
Persoonia hirsuta	E1	no
Pimelea spicata	E1	yes
Pomaderris brunnea	E1	no
Pterostylis saxicola	E1	no
Pultenaea aristata	V	no
Pultenaea pedunculata	E1	not likely
Syzygium paniculatum	E1	no, unless planted
Thesium australe	V	not likely

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

No state listed threatened flora species were observed during the botanical survey undertaken. A detailed significance of impact assessment has been applied to this/these species within Appendix 2 in accordance with Section 7.2 of the *BC Act*. The test of significance for threatened flora species has concluded a not significant impact. Therefore, (a) a Species Impact Statement is not required in respect to flora for the proposal and (b) biodiversity offsetting is not required.

(b) Endangered flora populations (NSW)

- *Marsdenia viridiflora* subsp. *viridiflora* population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas

Grows in vine thickets and open shale woodland.

Typical habitat for the species is considered to be absent due to previous disturbances on site which have caused most of the shrub layer to be lost.

Representative specimens of this endangered flora population are not present within the study area.

(c) Threatened ecological communities (NSW)

PCT 850 is representative of the critically endangered ecological community, Cumberland Plain Woodland. The proposal will remove 0.2 ha of this community which contributes to ongoing cumulative loss.

Cumberland Plain Woodland has been assessed in detail within Appendix 2. The conclusion reached is that the proposal will not cause a significant impact, therefore biodiversity offsetting or a species impact statement is not required.

(d) SEPP (Vegetation in non-rural areas, 2017)

The State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017 (Vegetation SEPP) was one of a suite of Land Management and Biodiversity Conservation (LMBC) reforms that commenced in New South Wales on 25 August 2017. The Vegetation SEPP works together with the *Biodiversity Conservation Act 2016* and the *Local Land Services Amendment Act 2016* to create a framework for the regulation of clearing of native vegetation in NSW.

The Vegetation SEPP will ensure the biodiversity offset scheme (established under the Land Management and Biodiversity reforms) will apply to all clearing of native vegetation that exceeds the offset thresholds in urban areas and environmental conservation zones that does not require development consent.

The City of Campbelltown is within an area to which the SEPP is applied. This means that the proposal needs to be considered in light of the above-mentioned Acts and noting that the BOS will apply for clearing of native vegetation mapped as having biodiversity values, or if clearing exceeds the threshold.

4.2.2 Matters of national environmental significance - flora

(a) Threatened flora species (national)

EPBC Act – A search of the *BioNet* (DPIE, 2021) and the *EPBC Act* Coordinate Search Tool provided a list of nationally threatened fauna species previously recorded, or with considered potential habitat, within a 10 km radius of the development footprint. These species have been listed and considered for habitat potential based on proximity and year of records in Table A1.1 (Appendix 1).

Based on this, it is considered that the development footprint provides varying levels of potential habitat for the following nationally listed threatened flora species:

Table 4-2 – Nationally listed threatened flora species with suitable habitat present

Scientific name	*EPBC Act*	Potential to occur
Acacia bynoeana	V	low
Acacia pubescens	V	low
Allocasuarina glariecola	E	no
Astrotricha crassifolia	V	no
Caladenia tessellata	V	no
Cryptostylis hunteriana	V	no
Cynanchum elegans	E	not likely
Eucalyptus benthamii	V	no
Eucalyptus scoparia	V	no, unless planted

Scientific name	*EPBC Act*	Potential to occur
Genoplesium baueri	E	no
Grevillea parviflora subsp. parviflora	V	low
Haloragis exalata susbp. *exalata*	V	no
Leucopogon exolasius	V	no
Melaleuca deanei	V	no
Persicaria elatior	V	no
Persoonia bargoensis	V	no
Persoonia hirsuta	E	no
Persoonia nutans	E	no
Pimelea curviflora var. *curviflora*	V	no
Pimelea spicata	E	yes
Pomaderris brunnea	V	no
Pterostylis gibbose	E	no
Pterostylis saxicola	E	no
Pultenaea aristata	V	no
Rhizanthella slateri	E	no
Rhodamnia rubescens	E4A	no
Syzygium paniculatum	V	no, unless planted
Thelymitra kangaloonica	E4A	no
Thesium australe	V	not likely

Botanical surveys of the development footprint and general study area have not identified any species which are currently listed under the *EPBC Act.*

(a) Threatened ecological communities (national)

PCT 850 may be commensurate with Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest. To be nominated however, it must meet conditional threshold criteria.

It should be noted that the vegetation is comprised of a low diversity of understorey species including no shrub layer or no canopy at selected locations.

The moderate_good PCT 850 fits the key threshold criteria for nomination as the critically endangered ecological community under the *EPBC Act.* This equates to 0.12 ha of native vegetation within the development footprint. Refer to Figure 4-2.

The PCT 850 no_canopy and PCT 850 planted_native_vegetation does not meat the first criteria and is not part of the critically endangered ecological community under the *EPBC Act.* Refer to Figure 4-3.

Despite its CEEC status, the importance of the remnant to be impacted is low because of its condition, fragmentation and isolation. In addition, the loss of 0.12 ha is very minor and the vegetation proposed for impact has no significant role in the recruitment of native vegetation in the locality. The proposal is unlikely to cause a significant impact on matters of NES after review of the factors considered in Appendix 3.

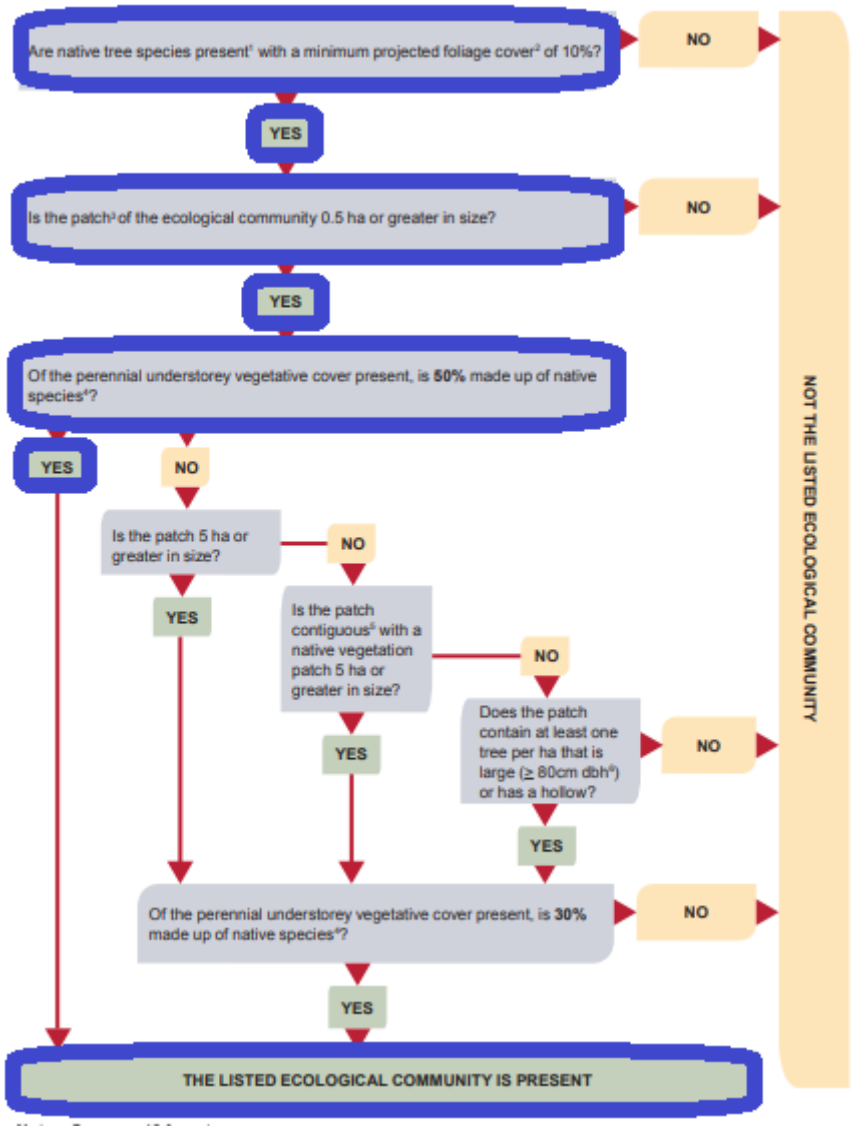

Figure 4-2 – Flowchart for identifying Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest – PCT 850 moderate_good

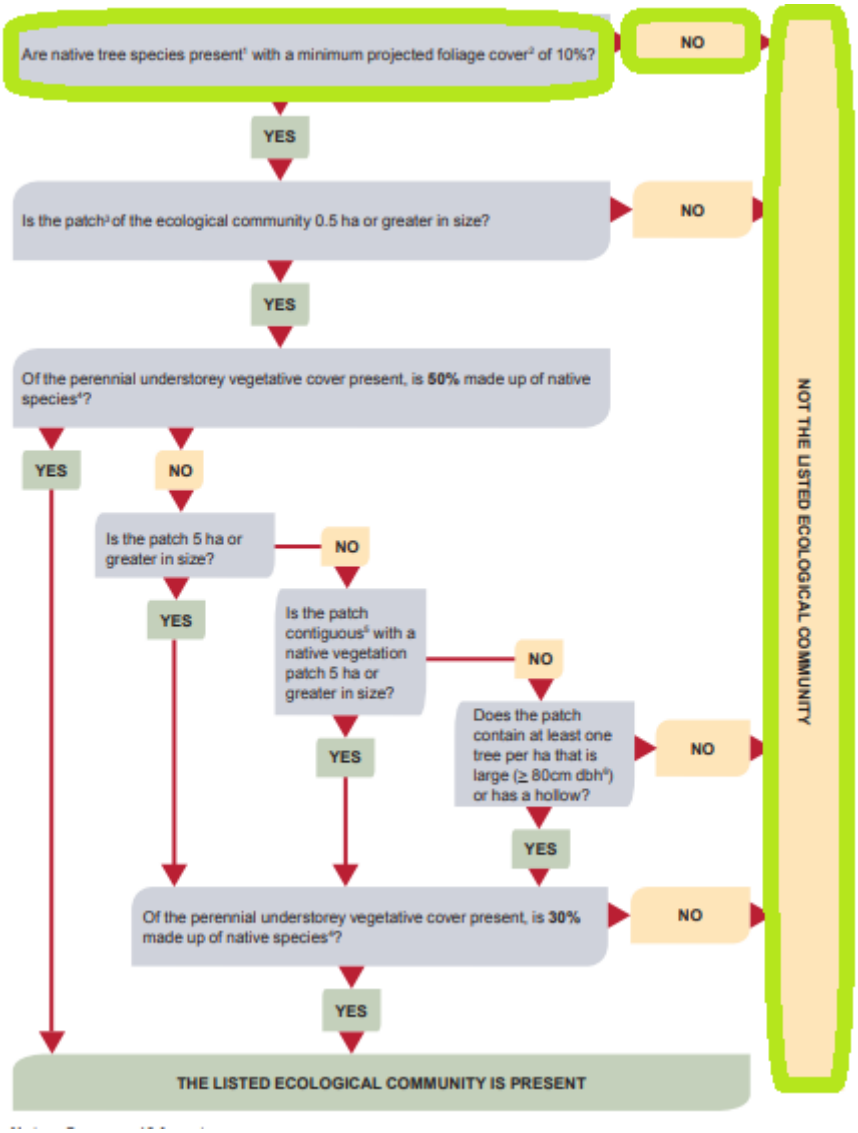

Figure 4-3 – Flowchart for identifying Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest – PCT 850 no_canopy and planted_native_vegetation

4.3 Fauna

All fauna species recorded during survey, key fauna habitat observations and habitat tree data are provided in Section 3.

4.3.1 Key fauna habitat

Most notable habitat features for threatened fauna species recorded or considered with most potential to occur include:

- Medium hollows (10-30cm) within a single tree;
- Small hollows and cracks/bark exfoliations (<10cm) within two recorded trees
- Adjacent drainage line lined with remnant trees and mid-storey shelter, albeit mostly exotic;
- Diverse seasonal flowering opportunities for nectivorous species.
- Winter flowering trees
- Nearby large open water habitat and fringing wetland vegetation
- Small areas of bark exfoliations and accumulated leaf litter at the base of native eucalypts suitable for shelter by snails

A complete assessment of the location of habitat trees and the size of hollows within was undertaken as part of surveys. Table 3-5 provides hollow-bearing tree data and Figure 2-1 shows locations of habitat trees.

No large hollows suitable for threatened owls were recorded present within the development footprint. Two hollow-dependent threatened fauna species were recorded present during survey including the Southern Myotis and the Little Lorikeet. Neither of these two species are suspected to utilise the recorded hollows based on their quality and proximity to available foraging habitat.

A strict removal of hollows process is recommended in Section 5.4 to prevent impacts on hollow-dependent fauna. This includes the initial identification of all hollows, supervision of their removal to effectively recover fauna and the relocation of hollows (or replacement with nest boxes) within the conserved and restored riparian habitat areas of the site.

4.3.2 Local fauna matters

Fauna species recorded present during survey and listed as a regionally significant species within the Native Fauna of Western Sydney - Urban Bushland Biodiversity Survey (NPWS 1997) include the Little Eagle and Restless Flycatcher. Neither of these two species are expected to be utilising the development footprint for any breeding importance, however adjacent lands to the nearby west may well be of breeding importance for Restless Flycatcher.

4.3.3 State legislative fauna matters

(a) Threatened fauna species (NSW)

BC Act – A search of the *Atlas of NSW Wildlife* (DPIE, 2021) provided a list of threatened fauna species previously recorded within a 10 km radius of the development footprint. These species are listed in Table A1.2 (APPENDIX 1) and are considered for potential habitat within the development footprint. Strictly estuarine and oceanic threatened species found within 10 km have not been included as no marine / aquatic habitats occur within the development footprint.

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

Table 4-3 – State listed threatened fauna species with suitable habitat present

Common name	*BC Act*	Potential to occur
Little Eagle	V	recorded
Little Lorikeet	V	recorded
Dusky Woodswallow	V	recorded
Grey-headed Flying-fox	V	recorded
Southern Myotis	V	recorded
Swift Parrot	E	✓
Yellow-bellied Sheathtail-bat	V	✓
Eastern Coastal Free-tailed Bat	V	✓
Greater Broad-nosed Bat	V	✓
Large Bent-winged Bat	V	✓
White-bellied Sea Eagle	V	low
Square-tailed Kite	V	low
Gang-gang Cockatoo	V	low
Powerful Owl	V	low

Common name	*BC Act*	Potential to occur
Varied Sittella	V	low
Scarlet Robin	V	low
Koala	V	low
Eastern False Pipistrelle	V	low
Little Bent-winged Bat	V	low
Cumberland Plain Land Snail	E	low
Green and Golden Bell Frog	E	unlikely
Turquoise Parrot	V	unlikely
Barking Owl	V	unlikely
Masked Owl	V	unlikely
Brown Treecreeper	V	unlikely
Regent Honeyeater	E4A	unlikely
Black-chinned Honeyeater	V	unlikely
Large-eared Pied Bat	V	unlikely

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

BC Act – Five (5) state listed threatened fauna species including Little Lorikeet (*Glossopsitta pusilla*), Dusky Woodswallow (*Artamus cyanopterus*), Little Eagle (*Hieraaetus morphnoides*), Grey-headed Flying-fox (*Pteropus poliocephalus*) and Southern Myotis (*Myotis macropus*) were recorded within or just beyond the study area.

A detailed significance of impact assessment has been applied to these species within Appendix 2 in accordance with Section 7.2 of the *BC Act*. The test of significance for threatened fauna species has concluded a not significant impact. Therefore, (a) a Species Impact Statement is not required in respect to fauna for the proposal and (b) biodiversity offsetting is not required.

FM Act – No habitats suitable for threatened aquatic species were observed within the development footprint or immediately adjacent 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 Campbelltown LGA.

(c) Campbelltown Comprehensive Koala Plan of Management

SEPP (Koala Habitat Protection) 2019 was implemented in March 2020 and later revised in October 2020. The NSW Government then announced the implementation of SEPP (Koala Habitat Protection) 2020 in November 2020. This was fundamentally a reinstatement of the old SEPP 44 - Koala Habitat protection (SEPP 44), which was in force from 1995 through to 2019. SEPP (Koala Habitat Protection) 2021 then came into effect in March 2021 reinstating the policy framework of the 2019 Koala SEPP only for non-rural zones in the interest of farmers, with the exception of some LGAs.

Under Part 2 Clause 10 of Koala SEPP 2021, council's determination of the development assessment process is to be consistent where an approved Koala Plan of Management applies. An approved Comprehensive Koala Plan of Management (CKPoM) for Campbelltown was prepared by Dr Stephen Phillips (Biolink) in 2018.

With consideration to the application of the plan (Figure 6.1 of the CKPoM) the following process has been considered:

- The development is located within the Campbelltown LGA;

- The DA has an area of > 1hectare and requires vegetation removal;
- The subject site is not identified as 'Core Koala Habitat' on Figure 5.1 of the CKPoM;
- The subject site is not identified as 'Potential Koala Habitat' on Figure 5.1 of the CKPoM;
- A Vegetation Assessment Report (VAR) is required (as follows).

Vegetation Assessment Report

1. Study Area

A description of the tallest stratum cover, as well as details of the species composition of each vegetation community is provided in Section 3.1.4. Eighty-three (83) trees with a DBH >15cm were surveyed within the study area that forms varying quality PCT 850. In summary these trees include:

- 8x planted Brush Box (*Lophostemon confertus*)
- 3x dead trees
- 3x Forest Red Gum (*Eucalyptus tereticornis*)
- 20x Grey Box (*Eucalyptus moluccana*)
- 4x Hickory Wattle (*Acacia implexa*)
- 5x planted Lemon-scented Gum (*Eucalyptus citriodora*)
- 37 Narrow-leaved Ironbark (*Eucalyptus crebra*)
- 1x Netted Bottlebrush (*Melaleuca linariifolia*)
- 1x Spotted Gum (*Corymbia maculata*)
- 1x Thin-leaved Stringybark (*Eucalyptus eugenioides*)

2. Development Footprint

Fifty-four (54) trees with a DBH >15cm were surveyed present within the varying quality Plant Community Type (PCT) 850 located within the development footprint. In summary, these trees include:

- 8x planted Brush Box (*Lophostemon confertus*)
- 3x dead trees
- 1x Forest Red Gum (*Eucalyptus tereticornis*)
- 4x Grey Box (*Eucalyptus moluccana*)
- 5x planted Lemon-scented Gum (*Corymbia citriodora*)
- 30x Narrow-leaved Ironbark (*Eucalyptus crebra*)
- 1x Netted Bottlebrush (*Melaleuca linariifolia*)
- 1x Spotted Gum (*Corymbia maculata*)
- 1x Thin-leaved Stringybark (*Eucalyptus eugenioides*)

Under Section 5.1 of the CKPoM, it states for purposes of the Plan the term 'potential koala habitat' means any area of native vegetation where the trees of the types listed in Schedule 2 of SEPP44 (being KFTs) constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.

We note that the current SEPP 2021 has a new list of Koala Use Trees. However, the CKPoM relies on the list of Koala Foraging Tree Species as listed in the old SEPP 44. Therefore, the CKPoM only requires the assessor to address the SEPP 44 list.

The development footprint contains less than 2% KFTs represented by one (1) Forest Red Gum tree. Therefore, the development footprint contains less than 15% KFTs.

As a result of the Koala Habitat Assessment determined by the CKPoM, compensation for loss of Koala habitat is to demonstrate consideration of design requirements contained within

Section 11.4 of the DCP. The design requirements outlined by the DCP are not considered appropriate for the proposed development for the following reasons:

- Only one KFT will be removed by the proposal. This tree did not show any historical use indicated by scratches on the smooth bark.
- No PKFTs will be removed by the proposal (see locations on Figure 2-1)
- Transient Koalas are unlikely to occupy the subject site area given that its highly fragmented from connective vegetated habitat.

The Koala Assessment report recommends replacement planting of koala tree use trees in the riparian corridor on the south-western edge of the study area.

4.3.4 Matters of national environmental significance - fauna

(a) Threatened fauna species (National)

EPBC Act – A search of the *BioNet* (DPIE, 2021) and the *EPBC Act* Coordinate Search Tool provided a list of nationally threatened fauna species previously recorded, or with considered potential habitat, within a 10km radius of the development footprint. These species have been listed and considered for habitat potential based on proximity and year of records in Table A1.2 (Appendix 1).

Based on this, it is considered that the development footprint provides varying levels of potential habitat for the following nationally listed threatened fauna species:

Table 4-4 – Nationally listed threatened fauna species with suitable habitat present

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

One (1) nationally listed threatened fauna species, Grey-headed Flying-fox (*Pteropus poliocephalus*), was recorded foraging on flowering Grey Box tree within the study area to the north of the development footprint during nocturnal survey. This is a state listed fauna species and a detailed assessment under state legislation (*EP&A Act*) is undertaken within the state test of significance (Appendix 2).

The Significant Impact Criteria for a vulnerable species listed under the *EPBC Act* 1999 (Appendix 3) was reviewed to assess the impacts on Grey-headed Flying-fox as a result of the proposed subdivision layout within the development footprint. As the development footprint does not contain any likely roosting or subsequent breeding habitat and foraging habitat will remain well represented in the locality, it is concluded that there will not be any significant impact on this species, or other nationally listed threatened fauna species with potential to occur, as a result of the subdivision 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 development footprint. 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 nationally protected migratory bird species were recorded present during survey.

The impact assessment for nationally protected migratory species with potential to occur has concluded a not significant impact.

4.4 Watercourses, GDEs & Wetlands

4.4.1 Endangered wetland communities

A number of wetland communities have been listed as TECs under the *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.

No endangered wetland communities were present within the development footprint and therefore a referral to NRAR is not required for impacts on waterfront land.

4.4.2 Groundwater dependent ecosystems (GDEs)

Groundwater dependent ecosystems (GDEs) are communities of plants, animals and other organisms whose extent and life processes are dependent on groundwater. GDEs were not observed within the development footprint and therefore a referral to NRAR with respect to GDEs is not required.

4.4.3 Watercourses

The proposed development will not impact on watercourses or drainage lines and therefore a referral to NRAR with respect to watercourse is not required.

5. IMPACT ASSESSMENT

5.1 BOS thresholds

The BOS includes three (3) elements to the threshold test – an area trigger, a Biodiversity Values Land Map trigger and the Test of Significance. If impacts exceed at least one of these triggers, the Biodiversity Offset Scheme applies to the proposed clearing.

5.1.1 Biodiversity Values Land

The study area is not located on lands mapped as Biodiversity Values Land (refer to Figure 5-1 – therefore an offset is not required as an outcome of this threshold test.

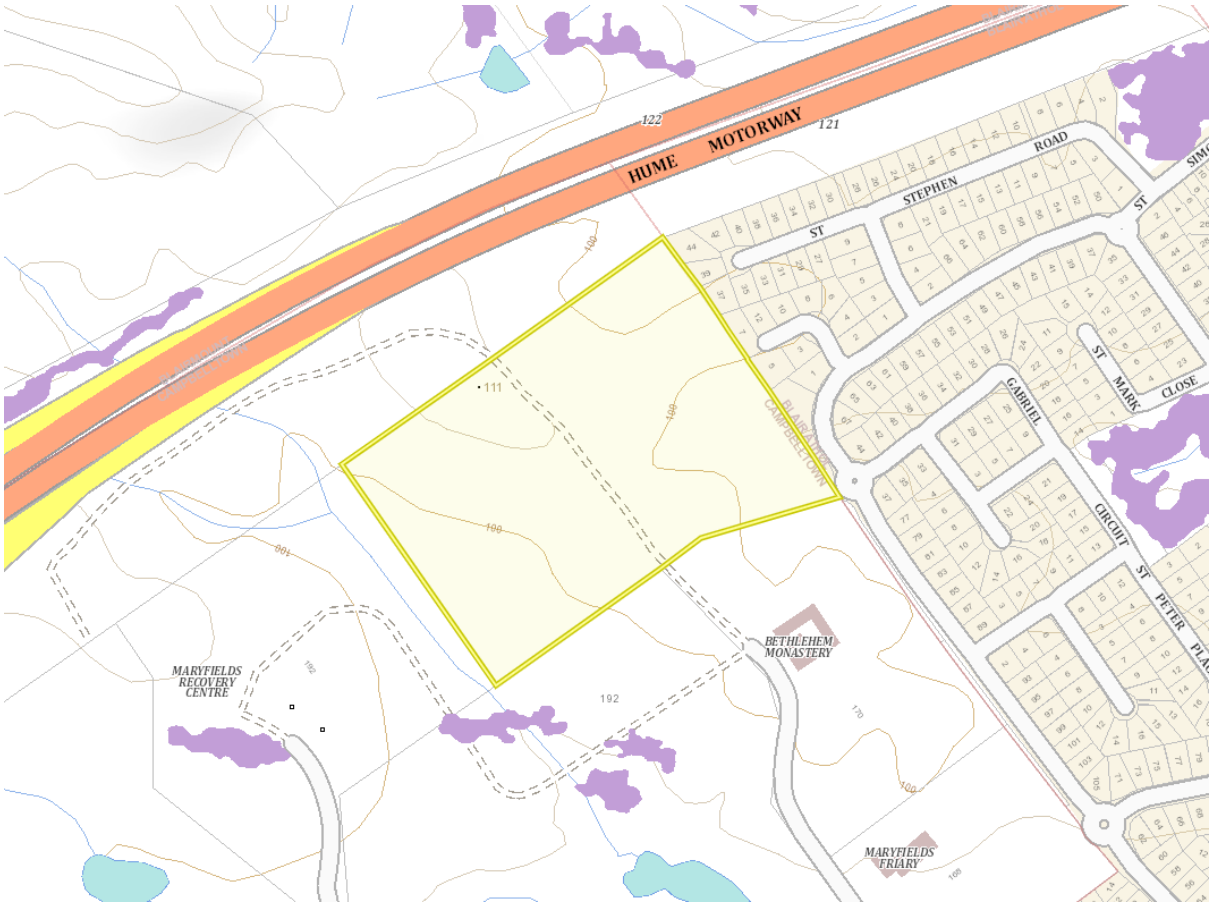

Figure 5-1 – Biodiversity Land Map (purple) relative to the study area (yellow)

(Source: https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BosetMap)

5.1.2 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 0.03 ha, and the clearing area threshold for which the BOS applies is 0.25 ha. Based on the preliminary concept plans (Figure 1-3) *Travers bushfire & ecology* concludes that the proposed development will remove less than 0.25 ha of of native vegetation therefore an offset is not required as an outcome of this threshold test.

Table 5-1 – BOS entry threshold report

Date of Calculation	15/06/2021 11:56 AM		**BDAR Required***
Total Digitised Area	2.31	ha	
Minimum Lot Size Method	LEP		
Minimum Lot Size	0.03	ha	
Area Clearing Threshold	0.25	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)?	no		no
Date of the 90 day Expiry	N/A		

Where the area of impact occurs on land with no vegetation mapping available, the tool cannot determine the area of native vegetation cleared and if this exceeds the Area Threshold. You will need to work out the area of native vegetation cleared - refer to the BOSET user guide for how to do this.

5.1.3 Test of Significance

A detailed test of significance has been applied to recorded Little Lorikeet, Dusky Woodswallow, Little Eagle, Grey-headed Flying-fox and Southern Myotis, as well as the CEEC Cumberland Plain Woodland within Appendix 2 in accordance with Section 7.2 of the *BC Act*. The test of significance has concluded a not significant impact, therefore an offset is not required as an outcome of this test.

5.1.4 Areas of Outstanding Biodiversity Value (AOBV)

Areas of Outstanding Biodiversity Value are special areas with irreplaceable biodiversity values that are important to the whole of New South Wales, Australia or globally.

The relevant legislative provisions for AOBV are Part 3, *BC Act* 2016 and Part 3, *BC reg.* 2017.

AOBV declarations in New South Wales include the following:

Gould's Petrel – critical habitat declaration

Little penguin population in Sydney's North Harbour – critical habitat declaration
Find out which areas around Manly have been declared an AOBV, what this means, and how you can help Sydney's little penguins.

Mitchell's Rainforest Snail in Stotts Island Nature Reserve – critical habitat declaration

Wollemi Pine – critical habitat declaration

None of the above occur within the development footprint or will be indirectly impacted.

5.2 Avoidance and minimisation actions

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

- Development has been located in the eastern extents of the subject lot to impact more on planted vegetation as opposed to remnant trees.
- Development will not impact on existing riparian habitat or habitat otherwise connecting to the riparian habits along the western fringes of the subject lot.
- The location of the development has been reduced to ensure impacts are under the key threshold limits for the BOS.
- The APZs go over predominately cleared lands that will not require the physical removal of trees or shrubs for compliance, only maintenance of the ground layer.

5.3 Potential ecological impacts

The direct, indirect and cumulative ecological impacts have been considered in respect to recorded biodiversity, threatening processes and extent of impact as a result of the proposed works are detailed below.

5.3.1 Direct impacts

The other direct impacts of the proposal within the development footprint are considered as:

- 0.2 ha of PCT 850 of various condition criteria, relative to the CEEC Cumberland Plain Woodland (*BC Act*).
- Removal of remnant and planted trees within the development footprint that may provide foraging value to local fauna.
- Subsequent removal of threatened fauna species foraging habitat including:

  (a) Seasonal flowering resources for foraging by the recorded Little Lorikeet and Grey-headed Flying-fox.
  (b) Potential perch and foraging habitat for Dusky Woodswallow.
  (c) Air space and prey species habitat for recorded Little Eagle.

- Removal of a single tree containing four (4) small hollows (0-10cm) and one (1) medium hollow (10-30cm) potentially suitable (but not expected) for recorded threatened Little Lorikeet and Southern Myotis.
- Removal of subsequent potential breeding (but not expected) habitat for these two species.
- Removal of dead trees for perching use by recorded Little Eagle and Dusky Woodswallow.

5.3.2 Indirect impacts

The potential indirect impacts of the proposal are considered as:

- Reduced cross-site movements by small bird species such as passerines.
- Increased presence of pets and subsequent impacts from domestic cat ownership.
- 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 and erosion into adjacent drainages.

5.3.3 Cumulative impacts

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

- Increased risk of weed invasion and fungal mobilisation or infections.
- Cumulative loss of Cumberland Plain Woodland in the locality.
- Very minor impacts of further fragmentation.
- 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.

5.4 Vegetation connectivity

The vegetation within the development footprint is highly fragmented from any localised habitat providing any connectivity values. They are generally single trees in an open landscape or a planted avenue that provide habitat only for highly mobile threatened birds and bats. Koalas may periodically traverse the local surrounds from the core habitat areas further east, however the subject site itself is not likely to offer any notable refuge or even short -term habitat values. The site is also subject to historical management of the understorey resulting in low potential use for threatened snails known in the locality.

In summary, the subject site area does not support habitat providing any local connectivity values.

6. CONCLUSION

Travers bushfire & ecology has been engaged to undertake an ecological impact assessment for a proposed 20 lot residential subdivision within Lot 4, DP 1213869, at 192 Narellan Road, Campbelltown within City of Campbelltown local government area (LGA). See Figure 1-3 for proposed subdivision layout.

6.1 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*, five (5) threatened fauna species including Little Lorikeet (*Glossopsitta pusilla*), Dusky Woodswallow (*Artamus cyanopterus*), Little Eagle (*Hieraaetus morphnoides*), Grey-headed Flying-fox (*Pteropus poliocephalus*) and Southern Myotis (*Myotis macropus*) were recorded within or beyond the study area. No threatened flora species, and one (1) threatened ecological community (TEC), Cumberland Plain Woodland, were recorded within the development footprint.

The state assessment of significance has concluded that the proposed subdivision development will not have a significant impact on any threatened species, populations or TECs. Therefore, a Species Impact Statement should not be required for the proposal.

Offsetting under the Biodiversity Offsets Scheme (BOS) is not required for the proposal as:

- The study area is not located on lands mapped as Biodiversity Values Land.
- The proposed clearing of 0.20 ha of native vegetation is less than the area clearing threshold of 0.25 ha.
- The test of significance concludes a not-significant impact on the relative entities being tested.

As a result of the Koala Habitat Assessment determined by the Campbelltown CKPoM, no compensation for loss of Koala habitat or consideration of design requirements are considered necessary for the proposed development.

In respect of matters required to be considered under the *EPBC Act*, one (1) threatened fauna species Grey-headed Flying-fox (*Pteropus poliocephalus*), no protected migratory bird species, no threatened flora species and one (1) TEC, Cumberland Plain Shale Woodland and Shale Gravel Transition Forest, listed under this Act were recorded within the development footprint.

The proposal was not considered to have a significant impact on matters of national environmental significance. As such a referral to Department of Agriculture, Water and the Environment is not required.

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

6.2 Mitigation measures

The following mitigation measures are recommended 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.

Table 6-1 – Measures to mitigate & manage impacts

Action / Technique	*Outcome*	*Timing / Frequency*	*Responsibility*
(a) 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.	Maintain integrity of nearby bushland habitat and natural topsoil soil by preventing deposition	Prior to any clearing works. Ongoing during all exposed soil stages until landscaping is completed	Project Ecologist / Contractors
(b) Temporary fencing - Where they adjoin the development areas, the boundaries of the conserved vegetation areas shall be clearly marked out on-site to ensure their protection. All areas of natural vegetation retention shall be protected by fencing, prior to construction, to ensure that these areas are not damaged during the construction phase.	Maintain integrity of remaining natural habitat	Prior to construction / habitat clearance	Project Ecologist / Contractors
(c) Prior to any habitat removal, a comprehensive search for fauna and habitat is to be undertaken to relocate any terrestrial individuals and identify any important nesting to be protected until fledging.	Reduce potential for impact on native species	Immediately prior to land clearance	Project Ecologist
(d) Management of hollows and hollow-dependent fauna: • The felling of hollow-bearing trees is to be conducted under the supervision of a fauna ecologist to ensure appropriate animal welfare procedures are taken, particularly for threatened species. Hollows of high quality or with fauna recorded residing within should be dismantled for relocation and all hollows should be inspected for occupation, signs of previous activity and potential for reuse.	Protection of hollow-dependent wildlife	At time of removal	Project Ecologist
• Subsequent hollows of retention value are to be relocated to nearby conserved habitat areas. If these are placed as on ground habitat and are not reattached to a new recipient tree then they are to be replaced with appropriately sized nest boxes affixed to a retained tree.	Maintain quality denning / hollow shelter opportunities	At time of removal	Project Ecologist

Action / Technique	*Outcome*	*Timing / Frequency*	*Responsibility*
• Constructed nest boxes should as priority target recorded hollow-dependent threatened species (and their prey species). Boxes should be constructed all of weatherproof timber (marine ply), fasteners and external paint and appropriately affixed to a recipient tree under the guidance of a fauna ecologist.	Protection of hollow-dependent wildlife	Prior to hollow removal	Project Ecologist
• If a threatened species is found to be occupying the hollow at the time of removal then this hollow section is to be reattached to a recipient tree within the nearby conservation areas as selected and directed by the fauna ecologist. The welfare and temporary holding of the residing animal(s) is at the discretion of the fauna ecologist.	Priority protection of hollow-dependent threatened species	At time of removal	Project Ecologist
• The relocated hollow section and nest boxes should be well secured in the recipient tree in a manner that will not compromise the current or future health of that tree.	Ensure hollow integrity is maintained	Time of installation	Project Ecologist
• Monitoring of nest boxes and relocated hollows	Ensure hollow integrity is maintained	Each year for 5 years	Project Ecologist
(e) Management of any other displaced fauna	Prevent direct impacts on nesting and terrestrial native fauna species	Prior to and during habitat removal / Adaptive management required	Project Ecologist
(f) If any fauna species, a nest or roost is located during development works, then works should cease until safe relocation can be advised by a contact fauna ecologist	Prevent direct impacts on nesting and terrestrial native fauna species	At time of removal / Adaptive management required	Project Ecologist / Contractors

7. BIBLIOGRAPHY

Auld, B. A. & Medd, R. W. (1996) *Weeds.* Inkata Press.

Barker, J., Grigg, G. C. & Tyler, M. J. (1995) *A Field Guide to Australian Frogs.* Surrey Beatty & Sons.

Bennett, A. F. (1990a) *Habitat Corridors: Their Role in Wildlife Management and Conservation*. Department of Conservation and Environment, Victoria).

Bishop, T. (1996) Field Guide to the Orchids of New South Wales and Victoria. UNSW Press.

Briggs, J. D. & Leigh, J. H. (1995) *Rare or Threatened Australian Plants.* CSIRO.

Churchill, S. (2008) *Australian Bats*, 2nd Ed., Jacana Books, Crows Nest, Sydney.

Cogger, H. G. (1996) *Reptiles and Amphibians of Australia*. Reed Books, Australia.

Cropper, S. (1993) *Management of endangered plants.* CSIRO Publications, Melbourne.

DAWE (2021) Environmental Protection and Biodiversity Conservation Act 1999 - Protected Matters Search Tool - http://www.environment.gov.au/webgis-framework/apps/pmst/pmst-coordinate.jsf

DEC (2004) Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft), New South Wales Department of Environment and Conservation, Hurstville, NSW.

DECC (2008) *Hygiene protocol for the control of disease in frogs*. Information Circular Number 6. DECC (NSW), Sydney South.

DECCW & Water NSW (2010). *NSW Wetlands Policy* – NSW Department of Environment, Climate Change.

DEWHA. 2010. *Survey guidelines for Australia's threatened bats*. Department of Environment Water Heritage and Arts.

DPIE (2019) *Biodiversity Assessment Method Operational Manual: Stage 2.* State of NSW and Department of Planning, Industry and Environment.

DPIE (2020) *Biodiversity Assessment Method.* State of NSW and Department of Planning, Industry and Environment.

DPIE (2020) Surveying Threatened Plants and their Habitats. NSW survey guide for the Biodiversity Assessment Method.

DPIE (2021) *Atlas of NSW Wildlife* (BioNet).

Ehmann, H. (1997) Threatened Frogs of New South Wales. FATS Group.

EPBC Listing Advice (2009) Advice to the Minister for the Environment, Heritage and the Arts from the Threatened Species Scientific Committee on an amendment to the List of Threatened Ecological Communities and the *EPBC Act* 1999 – Cumberland Plain Woodlands and Shale-Gravel Transition Forest.

Griffiths, K. (1997) *Frogs and Reptiles of the Sydney Region.* University NSW Press.

Harden, G. (1993) *Flora of New South Wales.* University NSW Press.

Hoser, R. (1989) *Australian Reptiles and Frogs.* Pierson & Co.

Klaphake, V. (2002) *Key to the grasses of Sydney.* Van Klaphake, Byabarra.

Klaphake, V. (2010) *Eucalypts of the Sydney Region. 2nd Ed.* Van Klaphake, Byabarra.

Lamp, C. & Collett, F. (1996) *A Field Guide to Weeds in Australia.* Inkata Press.

Lunney, D., Urquart, C. A. & Reed, P. (1988) *Koala Summit,* NPWS.

Marchant, S., & P. J. Higgins (Eds) (1990) *Handbook of Australian, New Zealand and Antarctic Birds.* Volumes 1-7 Oxford University Press, Melbourne.

Morrison, R. G. B. (1981) A Field Guide to the Tracks & Traces of Australian Animals. Rigby.

NSW National Parks and Wildlife Service (1997) *Urban Bushland Biodiversity Survey* NSW NPWS, Hurstville.

NSW National Parks and Wildlife Service (2002) *Vegetation Mapping of the Cumberland Plain.*

OEH (2016) The Native Vegetation of the Sydney Metropolitan Area. Version 3.0. NSW Office of Environment and Heritage, Sydney.

OEH (2018) 'Species credit' threatened bats and their habitats, NSW survey guide for the Biodiversity Assessment Method

OEH (2018) Biodiversity Assessment Method Operational Manual – Stage 1.

Parnaby, H. (1992) An interim guide to identification of insectivorous bats of south-eastern Australia. The Australian Museum, Sydney, Technical Report, No. 8.

Pennay, M., Law, B., Reinhold, L. (2004). Bat calls of New South Wales: Region based guide to the echolocation calls of Microchiropteran bats. NSW Department of Environment and Conservation, Hurstville.

Phillips, S. & Callaghan, J. (2008) The *Spot Assessment Technique*: a tool for determining levels of localised habitat use by Koalas *Phascolarctos cinereus*. Aust. Koala Foundation. Manuscript submitted to: Ecological management and Restoration

Phillott, A. D, Skerratt, L. F., McDonald, K. R., Speare, R., Hines, H. B., Meyer, E., Cashins, S. D, Mendez, D. & Berger, L. (2010) Minimising exposure of amphibians to pathogens during field studies. Inter-research. Diseases of Aquatic Organisms, *Contribution to DAO Special 4: 'Chytridiomycosis: an emerging disease'*

Pizzey, G. & Knight, F. (1997) *A Field Guide to the Birds of Australia.* Angus & Robertson.

Reader's Digest (1976) Complete Book of Australian Birds.

Richardson, F. J., Richardson, R. G. & Shepherd, R. C. H (2011) *Weeds of the South-East: an Identification Guide for Australia.* Everbest Printing Co. Pty. Ltd. China.

Robinson, L. (2003) Field Guide to the Native Plants of Sydney. 3rd ed. Simon & Shuster.

Robinson, M. (1996) A Field Guide to Frogs of Australia. Reed.

Schodde, R. and Tidemann, S. (Eds) (1986) *Readers Digest complete book of Australian Birds.* Second Edition. Reader's Digest Services Pty Ltd, Sydney.

Simpson & Day (1996) Field Guide to the Birds of Australia. Viking.

Specht, R. L., Specht, A., Whelan, M. B. & Hegarty, E. E. (1995) *Conservation Atlas of Plant Communities in Australia.* Southern Cross University Press, Lismore.

Tozer, M. (2003). The Native Vegetation of the Cumberland Plain, western Sydney: systematic classification and field identification of communities. Cunninghamia, 8(1):1-75.

Triggs, B. (1996) Tracks, Scats & Other Traces: A Field Guide to Australian Mammals. Oxford University Press, Melbourne.

Trounson, Donald & Molly (1998) *Australian Birds Simply Classified*. Murray David Publishing Pty Ltd, NSW.

Van Dyke, S. and Strahan, R. (Eds) (2008) *The Mammals of Australia* (3rd Edn). Reed New Holland. Sydney.

Wheeler, D. J. B., Jacobs, S. W. L. & Norton, B. E. (1994) *Grasses of New South Wales.* University of New England.

Wilson, K. W. and Knowles, D. G. (1988) Australia's Reptiles - A Photographic Reference to the Terrestrial Reptiles of Australia. Cornstalk Publishing.

APPENDIX 1. THREATENED SPECIES HABITAT ASSESSMENT

Table A 1-1 provides an assessment of potential habitat within the development footprint for state and nationally listed threatened fauna species recorded within 10 km on *BioNet* (DPIE) or indicated to have potential habitat present within 10 km on the *EPBC Act* Protected Matters Tool.

Table A 1-1 – Threatened flora habitat assessment

Scientific name DATABASE SOURCE	*BC Act*	*EPBC Act*	Growth form and habitat requirements Distribution limit	Recorded on site (✓)	If not recorded on site				Considered in assessment of significance test (✓) Refer to Appendix 2
					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	
Acacia bynoeana BIONET PMST	E1	V	Erect or spreading shrub to 0.3 m high growing in heath and dry sclerophyll open forest on sandy soils. Often associated with disturbed areas such as roadsides. *Distribution limits N-Newcastle S-Berrima.*	x	✓	15 – nearest is 10km away	✓	low	✓
Acacia pubescens BIONET PMST	V	V	Spreading shrub 1-4 m high open sclerophyll growing in open forest and woodlands on clay soils. *Distribution limits N-Bilpin S-Georges River.*	x	✓	4 – nearest is 5km away	✓	low	✓
Allocasuarina glareicola PMST	E1	E	Small shrub 1-2 m high growing in open sclerophyll forest on lateritic soils derived from tertiary alluviums. *Distribution limits Castlereagh NR region.*	x	x	-	-	x	x
Astrotricha crassifolia PMST	V	V	Shrub to 2.4 m high. Grows in dry sclerophyll woodland on sandstone. *Distribution limits N-Patonga S-Royal NP.*	x	x	-	-	x	x
Caladenia tessellata PMST	E1	V	Terrestrial orchid. Clay-loam or sandy soils. LHCCREMS guidelines suggest the species grows in Map Unit 34 – Coastal Sand Wallum Woodland - Heath. Flowers in September – November. *Distribution limits N-Swansea S-south of Eden.*	x	x	-	-	x	x

Scientific name DATABASE SOURCE	*BC Act*	*EPBC Act*	Growth form and habitat requirements Distribution limit	Recorded on site (✓)	If not recorded on site				Considered in assessment of significance test (✓) Refer to Appendix 2
					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	
Cryptostylis hunteriana PMST	V	V	Saprophytic orchid. Grows in swamp heath on sandy soils. *Distribution limits N-Gibraltar Range S-south of Eden.*	x	x	-	-	x	x
Cynanchum elegans PMST	E1	E	Climber or twiner to 1m. Grows in rainforest gullies, scrub & scree slopes. *Distribution limits N-Gloucester S-Wollongong.*	x	marginal	x	x	not likely	x
Eucalyptus benthamii BIONET PMST	V	V	Blue gum to 40 m high. Wet forest on sandy alluvial soils. *Distribution limits N-Yarramundi S-Bents Basin.*	x	x	-	-	x	x
Eucalyptus scoparia BIONET PMST	E1	V	Smooth-barked tree only known naturally from vicinity of Bald Rock in Northern NSW. Commonly planted as a street tree in the Sydney region.	x	x only as planted specimens	-	-	x	x
Genoplesium baueri BIONET PMST	E1	E	A terrestrial orchid that grows in sparse sclerophyll forest and moss gardens over sandstone. Flowers Feb–Mar. *Distribution limits N – Hunter Valley S – Nowra.*	x	x	-	-	x	x
Grevillea parviflora subsp. parviflora BIONET PMST	V	V	Open to erect shrub to 1m. Grows in woodland on light clayey soils. *Distribution limits N-Cessnock S-Appin.*	x	✓	164 – nearest is 5km away	✓	low	✓
Gyrostemon thesioides BIONET	E1	-	Multi-stemmed shrub to 70 cm. Grows on hillsides and riverbanks. *Confined to Georges and Nepean Rivers and believed extinct.*	x	x	-	-	x	x
Haloragis exalata subsp. exalata PMST	V	V	Shrub to 1.5 m high. Grows in damp places near watercourses. *Disjunctly distributed in the Central Coast, South Coast and North Western Slopes botanical subdivisions of NSW.*	x	x	-	-	x	x

Scientific name DATABASE SOURCE	*BC Act*	*EPBC Act*	Growth form and habitat requirements Distribution limit	Recorded on site (✓)	If not recorded on site				Considered in assessment of significance test (✓) Refer to Appendix 2
					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	
Hibbertia puberula BIONET	E1	-	Small shrub to 30cm. It extends from Wollemi NP to Morton NP / Nowra. It favours low heath on sandy soils or rarely in clay, with or without rocks underneath. Flowers predominately from Oct-Dec.	x	marginal	25 – nearest is 5km	✓	not likely	x
Leucopogon exolasius BIONET PMST	V	V	Erect shrub to 2 m high. Rocky hillsides and creek banks in Sydney Sandstone Gully Forest. Confined to Woronora and Georges Rivers and Stokes Creek.	x	x	-	-	x	x
Leucopogon fletcheri subsp. fletcheri BIONET	E1	-	Shrub to 1.8 m high growing in woodland on lateritic soils. Distribution limits N-St Albans S-Springwood.	x	x	-	-	x	x
Melaleuca deanei BIONET PMST	V	V	Shrub to 3 m high. Grows in heath on sandstone. *Distribution limits N-Gosford S-Nowra.*	x	x	-	-	x	x
Persicaria elatior PMST	V	V	Herb to 90 cm tall which grows in damp places especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance. *Varied distribution from SE NSW to QLD.*	x	x	-	-	x	x
Persoonia bargoensis PMST	E1	V	Erect shrub to 1 m high. Grows in woodland to Dry sclerophyll forest, on sandstone and laterite. *Restricted to the Bargo area.*	x	x	-	-	x	x
Persoonia hirsuta BIONET PMST	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
Pimelea curviflora var. curviflora PMST	V	V	Woody herb or sub-shrub to 0.2-1.2 m high. Grows on Hawkesbury Sandstone near shale outcrops. *Distribution Sydney.*	x	x	-	-	x	x

Scientific name DATABASE SOURCE	*BC Act*	*EPBC Act*	Growth form and habitat requirements Distribution limit	Recorded on site (✓)	If not recorded on site				Considered in assessment of significance test (✓) Refer to Appendix 2
					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	
Pimelea spicata BIONET PMST	E1	E	Decumbent or erect shrub to 0.5 m high. Occurs principally in woodland on soils derived from Wianamatta Shales. *Distribution limits N-Lansdowne S-Shellharbour.*	x	✓	825 – nearest is 2km away	✓	✓	✓
Pomaderris brunnea BIONET PMST	V	V	Shrub to 3 m high. Confined to Upper Nepean and Colo Rivers where it grows in open forest.	x	x	-	-	x	x
Pterostylis gibbosa PMST	E1	E	Terrestrial orchid which occurs near Wollongong and in Hunter Valley in sclerophyll forest, sometimes with paperbarks.	x	x	-	-	x	x
Pterostylis saxicola BIONET PMST	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
Pultenaea aristata BIONET PMST	V	V	A small shrub, mostly 20-40 cm tall. *Restricted to the Woronora Plateau, a small area between Helensburgh, south of Sydney, and Mt Kiera above Wollongong.* Occurs in either dry sclerophyll woodland or wet heath on sandstone. Flowers in winter and spring.	x	x	-	-	x	x
Pultenaea pedunculata BIONET	E1	-	Prostrate shrub. Grows in dry sclerophyll forest and disturbed sites. *Confined to Prestons and Villawood in NSW.*	x	marginal	13 – nearest is 9km away	✓	not likely	x
Rhizanthella slateri PMST	V	E	Underground orchid that is poorly known. Grows in sclerophyll forests. Usually only seen if the soil is disturbed. Flowers in Oct – Nov.	x	x	-	-	x	x

Scientific name DATABASE SOURCE	*BC Act*	*EPBC Act*	Growth form and habitat requirements Distribution limit	Recorded on site (✓)	If not recorded on site				Considered in assessment of significance test (✓) Refer to Appendix 2
					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	
Rhodamnia rubescens PMST	E4A	-	Shrub or small tree to 25 m high found in rainforest and riparian vegetation along the coast and up to 600 m 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
Syzygium paniculatum BIONET PMST	V	V	Small tree. Subtropical and littoral rainforest on sandy soil. *Distribution limits N-Forster S-Jervis Bay.*	x	x	-	-	x	x
Thelymitra sp. 'Kangaloon' *(Thelymitra kangaloonica)* PMST	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 *Temperate Highland Peat Swamps on Sandstone.*	x	x unless planted	-	-	x	x
Thesium australe BIONET PMST	V	V	Erect herb to 0.4 m high. Root parasite. Themeda grassland or woodland often damp. *Distribution limits N-Tweed Heads S-south of Eden.*	x	marginal	1 – 7km away. Accuracy is within 10km	Over 200 years	not likely	x

BIONET	- Denotes species listed within 10 km of the development footprint on the Atlas of NSW Wildlife
PMST	- Denotes species listed within 10 km of the development footprint in the EPBC Act 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

Scientific name DATABASE SOURCE	*BC Act*	*EPBC Act*	Growth form and habitat requirements Distribution limit	Recorded on site (✓)	If not recorded on site				Considered in assessment of significance test (✓) Refer to Appendix 2
					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	
NOTE:	This field is not considered if no suitable habitat is present within the development footprint 'records' refer to those provided by the Atlas of NSW Wildlife 'nearby' or 'recent' records are species specific accounting for home range, dispersal ability and life cycle								

Table A 1-2 provides an assessment of potential habitat within the development footprint for state and nationally listed threatened fauna species recorded within 10 km on *BioNet* (DPIE) or indicated to have potential habitat present within 10 km on the *EPBC Act* Protected Matters Tool.

Table A 1-2 –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				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 *Heleioporus australiacus* BIONET PMST	V	V	Inhabits open forests and riparian forests along non-perennial streams, digging burrows into sandy creek banks. Distribution limit: N-Near Singleton S-South of Eden.	x	x	-	-	x	x
Stuttering Frog *Mixophyes balbus* PMST	E	V	Terrestrial inhabitant of rainforest and wet sclerophyll forests. Distribution limit: N-near Tenterfield S-South of Bombala.	x	x	-	-	x	x
Red-crowned Toadlet *Pseudophryne australis* BIONET	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. Distribution limit: N-Pokolbin. S-near Wollongong.	x	x	-	-	x	x
Green and Golden Bell Frog *Litoria aurea* BIONET PMST	E	V	Prefers the edges of permanent water, streams, swamps, creeks, lagoons, farm dams and ornamental ponds. Often found under debris. Distribution limit: N-Byron Bay S-South of Eden.	x	marginal	✓	✓	unlikely	✓
Littlejohn's Tree Frog *Litoria littlejohnii* BIONET PMST	V	V	Found in wet and dry sclerophyll forest associated with sandstone outcrops at altitudes 280-1,000 m on eastern slopes of Great Dividing Range. Prefers flowing rocky streams. Distribution limit: N-Hunter River S-Eden.	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				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	
Southern Bell Frog *Litoria raniformis* PMST	E	V	Prefers the edges of permanent water, streams, swamps, creeks, lagoons, farm dams and ornamental ponds. Often found under debris. Distribution limit: N-ACT Bay. S-Albury.	x	x	-	-	x	x
Rosenberg's Goanna *Varanus rosenbergi* BIONET	V	-	Hawkesbury sandstone outcrop specialist. Inhabits woodlands, dry open forests and heathland sheltering in burrows, hollow logs, rock crevices and outcrops. Distribution limit: N-Nr Broke. S-Nowra Located in scattered patches near Sydney, Nowra and Goulburn.	x	x	-	-	x	x
Broad-headed Snake *Hoplocephalus bungaroides* BIONET PMST	E	V	Sandstone outcrops, exfoliated rock slabs and tree hollows in coastal and near coastal areas. Distribution limit: N-Mudgee Park. S-Nowra.	x	x	-	-	x	x
Blue-billed Duck *Oxyura australis* BIONET	V	-	A completely aquatic species occurring mainly throughout the Murray-Darling basin in cool to warm temperate deep permanent freshwater lakes, lagoons and swamps with extensive reed-beds. Distribution limit: N-Tenterfield. S-Albury.	x	x	-	-	x	x
Freckled Duck *Stictonetta naevosa* BIONET	V	-	Occurs mainly within the Murray-Darling basin and the channel country within large cool temperate to sub-tropical swamps, lakes and floodwaters with cumbungi, lignum or melaleucas. Distribution limit: N- Tenterfield. S-Albury.	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				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	
White-throated Needletail *Hirundapus caudacutus* BIONET PMST	-	V	Airspace over forests, woodlands, farmlands, plains, lakes, coasts, towns; companies often forage along favoured hilltops and timbered ranges. Breeds Siberia, Himalayas, east to Japan. Summer migrant to eastern Australia. Distribution limit: N-Tweed Heads. S-South of Eden.	x	✓	x	x	✓	n/a
Black-necked Stork *Ephippiorhynchus asiaticus* BIONET	E	-	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. Distribution limit: N-Tweed Heads. S-Nowra.	x	marginal	x	x	Not likely	x
Australasian Bittern *Botaurus poiciloptilus* PMST	E	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. Distribution limit: N-North of Lismore. S- Eden.	x	x	-	-	x	x
Spotted Harrier *Circus assimilis* BIONET	V	-	Utilises grassy plains, crops and stubblefields; saltbush, spinifex associations; scrublands, mallee, heathlands; open grassy woodlands. Distribution limit: N-Tweed Heads. S-South of Eden.	x	marginal	x	x	Not likely	x
White-bellied Sea Eagle *(Haliaeetus leucogaster)* BIONET	V	-	Occupies coasts, islands, estuaries, inlets, large rivers, inland lakes and reservoirs. Sedentary; dispersive. N-Tweed Heads. S-South of Eden.	x	marginal	x	✓	low	✓

Common name Scientific name Database source	*BC Act*	*EPBC Act*	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				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	
Little Eagle *Hieraaetus morphnoides* BIONET	V	-	Utilises plains, foothills, open forests, woodlands and scrublands; river red gums on watercourses and lakes. Distribution limit - N-Tweed Heads. S-South of Eden.	✓	-	-	-	-	✓
Square-tailed Kite *Lophoictinia isura* BIONET	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. Distribution limit: N-Goondiwindi. S-South of Eden.	x	marginal	x	✓	low	✓
Grey Falcon *Falco hypoleucos* PMST	V	-	Occurs over mainly inland drainage systems of open plains and lightly timbered country including the acacia scrub, spinifex and tussock grasslands. Distribution limit: N-Mullumbimby. S-Bega.	x	x	-	-	x	x
Bush Stone-curlew *Burhinus grallarius* BIONET	E	-	Utilises open forests and savannah woodlands, sometimes dune scrub, savannah and mangrove fringes. Distribution limit: N-Border Ranges National Park. S-Near Nowra.	x	marginal	x	x	Not likely	x
Red Knot *Calidris canutus* BIONET PMST	-	E	The red knot is a small to medium migratory shorebird. During the non-breeding season in Australasia, the red knot mainly inhabit intertidal mudflats, sandflats and sandy beaches of sheltered coasts and sometimes on sandy ocean beaches or shallow pools on exposed rock platforms. They are occasionally seen on terrestrial saline wetlands near the coast and on sewage ponds and saltworks	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				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	
Hooded Plover *Thinornis rubricollis* BIONET	E	-	Inhabits ocean beaches and coastal lakes. Forages on exposed flat sandy expanses on annelids, gastropods and crustaceans. Distribution limit: N-Jervis Bay. S-Eden.	x	x	-	-	x	x
Australian Painted Snipe *Rostratula australis* PMST	E	E	Most numerous within the Murray-Darling basin and inland Australia within marshes and freshwater wetlands with swampy vegetation. Distribution limit: N-Tweed Heads. S-South of Eden.	x	x	-	-	x	x
Curlew Sandpiper *Callidris ferruginea* BIONET	E	CE	Mainly coastal, but many inland feeding along tidal mudflats, salt marsh, salt fields, fresh, brackish or saline wetlands and sewerage ponds. Distribution limit: N-Tweed Heads. S-South of Eden.	x	x	-	-	x	x
Eastern Curlew *Numenius madagascariensis* PMST	-	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. Distribution limit: N-Tweed Heads. S-South of Eden.	x	x	-	-	x	x
Gang-gang Cockatoo *Callocephalon fimbriatum* BIONET	V	-	Prefers wetter forests and woodlands from sea level to > 2,000 m on the Great Dividing Range, timbered foothills and valleys, timbered watercourses, coastal scrubs, farmlands and suburban gardens. Distribution limit: mid north coast of NSW to western Victoria.	x	marginal	✓	✓	low	✓

Common name Scientific name Database source	*BC Act*	*EPBC Act*	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				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 *Calyptorhynchus lathami* BIONET	V	-	Open forests with Allocasuarina species and hollows for nesting. Distribution limit: N-Tweed Heads. S-South of Eden.	x	x	-	-	x	x
Little Lorikeet *Glossopsitta pusilla* BIONET	V	-	Inhabits forests, woodlands; large trees in open country; timbered watercourses, shelterbeds, and street trees. Distribution limit: N-Tweed Heads. S-South of Eden.	✓	-	-	-	-	✓
Swift Parrot *Lathamus discolour* BIONET PMST	E	E	Inhabits eucalypt forests and woodlands with winter flowering eucalypts. Distribution limit: N-Border Ranges National Park. S-South of Eden.	x	✓	✓	✓	✓	✓
Turquoise Parrot *Neophema pulchella* BIONET	V	-	Inhabits coastal scrubland, open forest and timbered grassland, especially ecotones between dry hardwood forests and grasslands. Distribution limit: N-Near Tenterfield. S-South of Eden.	x	Sub-optimal	x	x	unlikely	✓
Barking Owl *Ninox connivens* BIONET	V	-	Inhabits principally woodlands but also open forests and partially cleared land and utilises hollows for nesting. Distribution limit: N-Border Ranges National Park. S-Eden.	x	marginal	✓	✓	unlikely	✓
Powerful Owl *Ninox strenua* BIONET	V	-	Forests containing mature trees for shelter or breeding and densely vegetated gullies for roosting. Distribution limits: N-Border Ranges National Park. S-Eden.	x	marginal	✓	✓	low	✓
Masked Owl *Tyto novaehollandiae* BIONET	V	-	Open forest and woodlands with cleared areas for hunting and hollow trees or dense vegetation for roosting. Distribution limit: N-Border Ranges National Park. S-Eden.	-	marginal	✓	x	unlikely	✓

Common name Scientific name Database source	*BC Act*	*EPBC Act*	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				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	
Brown Treecreeper *Climacteris picumnus victoriae* BIONET	V	-	Occupies eucalypt woodlands, open woodland lacking a dense understorey with fallen dead timber. Distribution limit: (Sub species victoriae) Central NSW west of Great Div. Cumberland Plains, Hunter Valley, Richmond, Clarence, and Snowy River Valleys.	x	Sub-optimal	x	✓	unlikely	✓
Eastern Bristlebird *Dasyornis brachypterus* BIONET PMST	E	E	Coastal woodlands, dense scrubs and heathlands, especially where low heathland borders taller woodland or dense tall tea-tree. Distribution limit: N-Tweed Heads. S-South of Eden.	x	x	-	-	x	x
Speckled Warbler *Chthonicola sagittata* BIONET	V	-	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. Distribution limit: N-Urbanville. S-Eden.	x	marginal	x	✓	Not likely	x
Regent Honeyeater *Xanthomyza Phrygia* BIONET PMST	E4A	CE	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. Distribution limit: N-Urbanville. S-Eden.	x	Sub-optimal	x	✓	unlikely	✓
Painted Honeyeater *Grantiella picta* PMST	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. Distribution limit: N-Boggabilla. S-Albury with greatest occurrences on the inland slopes of the Great Dividing Range.	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				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-chinned Honeyeater *Melithreptus gularis gularis* BIONET	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. Distribution limit: N-Cape York Pen. Qld. S-Victor H. Mt Lofty Ra & Flinders Ra. SA.	x	Sub-optimal	x	x	unlikely	✓
Varied Sittella *Daphoenositta chrysoptera* BIONET	V	-	Open eucalypt woodlands / forests (except heavier rainforests); mallee, inland acacia, coastal tea-tree scrubs; golf courses, shelterbelts, orchards, parks, scrubby gardens. Distribution limit: N-Border Ranges National Park. S-South of Eden.	x	Sub-optimal	✓	x	low	✓
Dusky Woodswallow *Artamus cyanopterus cyanopterus* BIONET	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. Widespread in eastern, southern and south-western Australia.	✓	-	-	-	-	✓
Hooded Robin *Melanodryas cucullata cucullata* BIONET	V	-	Found in eucalypt woodlands, Acacia scrubland, open forest, and open areas adjoining large woodland blocks, with areas of dead timber. Distribution limit: N-Central Qld. S-Spencer Gulf SA.	x	marginal	x	x	Not likely	x
Scarlet Robin *Petroica boodang* BIONET	V	-	Found in foothill forests, woodlands, watercourses; in autumn-winter, more open habitats: river red gum woodlands, golf courses, parks, orchards, gardens. Distribution limit: N-Tweed Heads. S-South of Eden.	x	Sub-optimal	✓	x	low	✓

Common name Scientific name Database source	*BC Act*	*EPBC Act*	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				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 *Petroica phoenicea* BIONET	V	-	Summer: forests, woodlands, scrubs, from sea-level to c. 1800 m. Autumn-winter: open woodlands, plains, paddocks, golf courses, parks, orchards. Distribution limit: N northern NSW tablelands. S-South of Eden.	x	marginal	x	x	Not likely	x
Diamond Firetail *Stagonopleura guttata* BIONET	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. Distribution limit: N-Rockhampton Q. S-Eyre Pen Kangaroo Is. SA.	x	x	-	-	x	x
Spotted-tailed Quoll *Dasyurus maculatus* BIONET PMST	V	E	Dry and moist open forests containing rock caves, hollow logs or trees. Distribution limit: N-Mt Warning National Park. S-South of Eden.	x	x	-	-	x	x
Southern Brown Bandicoot *Isoodon obesulus* BIONET PMST	E	E	Utilises a range of habitats containing thick ground cover - open forest, woodland, heath, cleared land, urbanised areas and regenerating bushland. Distribution limit: N-Kempsey. S-South of Eden.	x	x	-	-	x	x
Koala *Phascolarctos cinereus* BIONET PMST	V	V	Inhabits both wet and dry eucalypt forest on high nutrient soils containing preferred feed trees. Distribution limit: N-Tweed Heads. S-South of Eden.	x	Sub-optimal	✓	✓	low	✓
Eastern Pygmy *Possum* *Cercatetus nanus* BIONET	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. Distribution limit: N-Tweed Heads. S-Eden.	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				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	
Yellow-bellied Glider *Petaurus australis* BIONET	V	-	Tall mature eucalypt forests with high nectar producing species and hollow bearing trees. Distribution limit: N-Border Ranges National Park. S-South of Eden.	x	x	-	-	x	x
Squirrel Glider *Petaurus norfolcensis* BIONET	V	-	Mixed aged stands of eucalypt forest & woodlands including gum barked & high nectar producing species & hollow bearing trees. Distribution limit: N-Tweed Heads. S-Albury.	x	marginal	x	x	Not likely	x
Greater Glider *Petauroides volans* PMST	-	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 Distribution limit: N-Border Ranges National Park. S- South of Eden.	x	x	-	-	x	x
Brush-tailed Rock-wallaby *Petrogale penicillata* PMST	E	V	Found in rocky gorges with a vegetation of rainforest or open forests to isolated rocky outcrops in semi-arid woodland country. Distribution limit: N-North of Tenterfield. S-Bombala.	x	x	-	-	x	x
Grey-headed Flying-fox *Pteropus poliocephalus* BIONET PMST	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. Distribution limit: N-Tweed Heads. S-Eden.	✓	-	-	-	-	✓

Common name Scientific name Database source	*BC Act*	*EPBC Act*	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				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	
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris* BIONET	V	-	Rainforests, sclerophyll forests and woodlands. Distribution limit: N-North of Walgett. S-Sydney.	x	✓	✓	✓	✓	✓
Eastern Coastal Free-tailed Bat *Micronomus norfolkensis* BIONET	V	-	Inhabits open forests and woodlands foraging above the canopy and along the edge of forests. Roosts in tree hollows, under bark and buildings. Distribution limit: N-Woodenbong. S-Pambula.	x	✓	✓	✓	✓	✓
Large-eared Pied Bat *Chalinolobus dwyeri* BIONET PMST	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. Distribution limit: N-Border Ranges National Park. S-Wollongong.	x	marginal	x	✓	unlikely	✓
Eastern False Pipistrelle *Falsistrellus tasmaniensis* BIONET	V	-	Recorded roosting in caves, old buildings and tree hollows. Distribution limit: N-Border Ranges National Park. S-Pambula.	x	✓	x	✓	low	✓
Golden-tipped Bat *Kerivoula papuensis* BIONET	V	-	Rainforest and adjoining moist open forest habitats, roosting in tree hollows and dense vegetation. Distribution limit: N-Border Ranges Nation Park. S-South of Eden.	x	x	-	-	x	x
Southern Myotis *Myotis macropus* BIONET	V	-	Roosts in caves, mines, tunnels, buildings, tree hollows and under bridges. Forages over open water. Distribution limit: N-Border Ranges National Park. S-South of Eden.	✓	-	-	-	-	✓

Common name Scientific name Database source	*BC Act*	*EPBC Act*	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				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 *Scoteanax rueppellii* BIONET	V	-	Inhabits areas containing moist river and creek systems, especially tree lined creeks. Distribution limit: N-Border Ranges National Park. S-Pambula.	x	✓	✓	✓	✓	✓
Little Bent-winged Bat *Miniopterus australis* BIONET	V	-	Roosts in caves, old buildings and structures in the higher rainfall forests along the south coast of Australia. Distribution limit: N-Border Ranges National Park. S-Sydney.	x	✓	x	✓	low	✓
Large Bent-winged Bat *Miniopterus orianae oceanensis* BIONET	V	-	Prefers areas where there are caves, old mines, old buildings, stormwater drains and well-timbered areas. Distribution limit: N-Border Ranges National Park. S-South of Eden.	x	✓	✓	✓	✓	✓
New Holland Mouse *Pseudomys novaehollandiae* PMST	-	V	Occurs in heathlands, woodlands, open forest and paperbark swamps and on sandy, loamy or rocky soils. Coastal populations have a marked preference for sandy substrates, a heathy understorey of leguminous shrubs less than 1m high and sparse ground litter. Recolonise of regenerating burnt areas. Distribution limit: N-Border Ranges National Park. S-South of Eden.	x	x	-	-	x	x
Cumberland Plain Land Snail *Meridolum corneovirens* BIONET	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. Distribution limit: Cumberland Plain of Sydney Basin Bioregion.	x	marginal	✓	✓	low	x

Common name Scientific name Database source	*BC Act*	*EPBC Act*	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				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	
Dural Land Snail *Pommerhelix duralensis* PMST	E	E	Occurs on shale-sandstone transitional forest landscapes within the Blue Mountains, Penrith, The Hills, Wollondilly, Hornsby and Parramatta LGA's. Occurs in low abundance and shelters under rocks or inside curled-up bark, beneath leaves and light woody debris. Distribution limit: St Albans to Mulgoa with most records from The Hills LGA.	x	x	-	-	x	x
Macquarie Perch *Macquaria australasica* PMST	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 *Prototroctes maraena* PMST	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 1,000 m). Typically found in gravel bottom pools. Often forming aggregations below barriers to upstream movement (e.g. weirs, waterfalls).	x	x	-	-	x	x

BIONET	Denotes species listed within 10 km of the development footprint on the BioNet search (Atlas of NSW Wildlife) managed by BIONET
PMST	-Denotes species listed within 10 km of the development footprint in the Protected Matters Search Tool managed by DAWE
TBE	Denotes additional species considered by Travers bushfire & ecology to have potential habitat based on regional knowledge and other records

Common name Scientific name Database source	*BC Act*	*EPBC Act*	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				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	

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 development footprint 2. 'records' refer to those provided by the Atlas of NSW Wildlife 3. 'nearby' or 'recent' records are species specific accounting for home range, dispersal ability and life cycle
Unlikely	Represents such a low margin but not enough to 100% rule it one. A test of significance is required.
Not likely	Means 0% change of occurring, despite there being potential habitat. A test of significance is not applied to these species.

Table A 1-3 provides an assessment of potential habitat within the development footprint for nationally *protected* migratory fauna species recorded within 10 km on the *EPBC Act* Protected Matters Tool. Nationally *threatened* migratory species are considered in Table A 1-2.

Table A 1-3 – Migratory fauna habitat assessment

Common name Scientific name	Preferred habitat Migratory breeding	Suitable habitat present (✓)	Recorded on site (✓)	Comments
Oriental Cuckoo *(Cuculus optatus)*	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	-	-
Osprey *(Pandion haliaetus)*	Occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia. They require extensive areas of open fresh, brackish or saline water for foraging. They frequent a variety of wetland habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterholes. They exhibit a preference for coastal cliffs and elevated islands in some parts of their range, but may also occur on low sandy, muddy or rocky shores and over coral cays. They may occur over atypical habitats such as heath, woodland or forest when travelling to and from foraging sites. Eastern Ospreys occur sympatrically and sometimes interact with White-bellied Sea-Eagles.	x	-	-
White-throated Needletail *(Hirundapus caudacutus)*	Airspace over forests, woodlands, farmlands, plains, lakes, coasts, towns; companies often forage along favoured hilltops and timbered ranges. *Breeds Siberia, Himalayas, east to Japan. Summer migrant to eastern Australia.*	✓	x	Not likely impacted
Fork-tailed Swift *(Apus pacificus)*	Aerial: over open country, from semi-arid deserts to coasts, islands; sometimes over forests, cities. 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.	✓	x	Not likely impacted
Black-faced Monarch *(Monarcha melanopsis)*	Rainforests, eucalypt woodlands; coastal scrubs; damp gullies in rainforest, eucalypt forest; more open woodland when migrating. *Summer breeding migrant to coastal south east Australia, otherwise uncommon*.	x	-	-
Spectacled Monarch *(Monarcha trivirgatus)*	Understorey of mountain / lowland rainforest, thickly wooded gullies, waterside vegetation, mostly well below canopy. 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.	x	-	-
Satin Flycatcher *(Myiagra cyanoleuca)*	Heavily vegetated gullies in forests, taller woodlands, usually above shrub-layer; during migration, coastal forests, woodlands, mangroves, trees in open country, gardens. *Breeds mostly south-east Australia and Tasmania over warmer months, winters in north east Qld.*	x	-	-
Rufous Fantail *(Rhipidura rufifrons)*	Undergrowth of rainforests / wetter eucalypt forests / gullies; monsoon forests, paperbarks, sub-inland and coastal scrubs; mangroves, watercourses; parks, gardens. On migration, farms, streets buildings. *Breeding migrant to south-east Australia over warmer months. Altitudinal migrant in north-east NSW in mountain forests during warmer months.*	x	-	-

Common name Scientific name	Preferred habitat Migratory breeding	Suitable habitat present (✓)	Recorded on site (✓)	Comments
Yellow Wagtail *(Motacilla flava)*	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	-	-
Latham's Snipe *(Gallinago hardwickii)*	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. *Breeds Japan. Regular summer migrant to Australia. Some overwinter.*	x	-	-
Common Greenshank *(Tringa nebularia)*	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. *Breeds in Eurasia, the northern British Isles, Scandanavia, east Estonia and north-east Belarus, through Russia and east.*	x	-	-
Curlew Sandpiper *(Calidris ferruginea)*	Mainly coastal, but many inland feeding along tidal mudflats, salt marsh, salt fields, fresh, brackish or saline wetlands and sewerage ponds. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	x	-	-
Common Sandpiper *(Actitis hypoleucos)*	The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats. The Common Sandpiper has been recorded in estuaries and deltas of streams, as well as on banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. The muddy margins utilised by the species are often narrow, and may be steep. The species is often associated with mangroves, and sometimes found in areas of mud littered with rocks or snags.	x	-	-
Sharp-tailed Sandpiper *(Calidris acuminata)*	Prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline salt lakes inland. They also occur in saltworks and sewage farms. They use flooded paddocks, sedgelands and other ephemeral wetlands, but leave when they dry. They use intertidal mudflats in sheltered bays, inlets, estuaries or seashores, and also swamps and creeks lined with mangroves.	x	-	-

Common name Scientific name	Preferred habitat Migratory breeding	Suitable habitat present (✓)	Recorded on site (✓)	Comments
Pectoral Sandpiper *(Calidris acuminata)*	Prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. The species is usually found in coastal or near coastal habitat but occasionally found further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire. The species has also been recorded in swamp overgrown with lignum. They forage in shallow water or soft mud at the edge of wetlands	x	-	-
Eastern Curlew *(Numenius madagascariensis)*	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. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	✓	x	-

APPENDIX 2. TEST OF SIGNIFICANCE

Section 7.2 of the *BC Act* requires a determination as to whether a development or activity is likely to significantly affect threatened species or ecological communities, or their habitats. Henceforth this is referred to as the 'test of significance'.

For the purposes of this part, development or an activity is likely to significantly affect threatened species if:

(a) it is likely to significantly affect threatened species or ecological communities, or their habitats, according to the test in Section 7.3, or
(b) the development exceeds the biodiversity offsets scheme threshold if the biodiversity offsets scheme applies to the impacts of the development on biodiversity values, or
(c) it is carried out in a declared area of outstanding biodiversity value.

Section 7.3 of the *BC Act* provides the terms of the test for determining whether proposed development or activity likely to significantly affect threatened species or ecological communities, or their habitats.

The following test of significance relies on the biodiversity assessment provided in this report and should be read making reference to the relevant discussion on each threatened species or their habitats, endangered population and ecological community.

Flora investigations and fauna habitat assessments of the study area have resulted in the identification of suitable habitat for the following threatened species and populations with varying potential to occur. Species recorded or with a considered potential to occur have been noted. The potential for any direct or indirect impacts on these species has also been considered and noted.

Threatened flora

Scientific name	*BC Act*	Potential to occur	Potential impact
Acacia bynoeana	E1	low	Removal of 0.2 ha of potential vegetated habitat
Acacia pubescens	V	low	Removal of 0.2 ha of potential vegetated habitat
Grevillea parviflora subsp. *parviflora*	V	low	Removal of 0.2 ha of potential vegetated habitat
Pimelea spicata	E1	✓	Removal of 0.2 ha of potential vegetated habitat

Threatened ecological communities

Cumberland Plain Woodland – critically endangered

Threatened fauna

Common name	BC Act	Potential to occur	Potential habitat impact
Little Eagle	V	recorded	Indirect – on potential foraging
Little Lorikeet	V	recorded	Direct – on potential roosting, breeding and foraging
Dusky Woodswallow	V	recorded	Direct – on marginal roosting and foraging
Grey-headed Flying-fox	V	recorded	Direct – on likely seasonal foraging
Southern Myotis	V	recorded	Direct – on low potential roosting, breeding and foraging
Swift Parrot	E	✓	Direct – on potential winter foraging

Common name	BC Act	Potential to occur	Potential habitat impact
Yellow-bellied Sheathtail-bat	V	✓	Direct – on low potential roosting, breeding and foraging
Eastern Coastal Free-tailed Bat	V	✓	Direct – on potential roosting, breeding and foraging
Greater Broad-nosed Bat	V	✓	Direct – on low potential roosting, breeding and foraging
Large Bent-winged Bat	V	✓	Direct – on potential foraging
White-bellied Sea Eagle	V	low	Direct – on low potential foraging
Square-tailed Kite	V	low	Direct – on low potential foraging
Gang-gang Cockatoo	V	low	Direct – on low potential foraging
Powerful Owl	V	low	Direct – on low potential foraging
Varied Sittella	V	low	Direct – on low potential foraging
Scarlet Robin	V	low	Direct – on low potential foraging
Koala	V	low	Direct – on low potential dispersal
Eastern False Pipistrelle	V	low	Direct – on low potential roosting, breeding and foraging
Little Bent-winged Bat	V	low	Direct – on low potential foraging
Cumberland Plain Land Snail	E	low	Direct – on low potential shelter and use
Green and Golden Bell Frog	E	unlikely	Indirect - on unlikely potential dispersal and overwintering
Turquoise Parrot	V	unlikely	Direct – on unlikely potential foraging
Barking Owl	V	unlikely	Direct – on unlikely potential foraging
Masked Owl	V	unlikely	Direct – on unlikely potential foraging
Brown Treecreeper	V	unlikely	Direct – on unlikely potential foraging
Regent Honeyeater	E4A	unlikely	Direct – on unlikely potential winter foraging
Black-chinned Honeyeater	V	unlikely	Direct – on unlikely potential foraging
Large-eared Pied Bat	V	unlikely	Direct – on unlikely potential foraging

Endangered populations

- There are local flora populations but are unlikely to occur given that the vegetation type is not the most ideal, there are no nearby records and the disturbance history. Those with potential are listed in Section 4.2.1 of the report.
- None for fauna

BC ACT 2016 - SECTION 7.3 – TEST OF SIGNIFICANCE

Test for determining whether proposed development or activity likely to significantly affect threatened species or ecological communities, or their habitats. The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:

(a) **In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction**,

The direct and indirect impacts of the proposal are considered within Section 5.3.

With consideration to the relative direct and indirect impacts on all threatened species with varying potential to occur, it is considered that the proposal is unlikely to disrupt the life cycle for any of these listed species such that a viable local population would be placed at risk of extinction. Species recorded present during survey, previously recorded nearby or with high potential to occur and requiring further discussion given potential impacts are further discussed in detail below. For threatened flora, the likelihood of threatened species is limited

due to the previous disturbance and fragmented nature of the vegetation that would be difficult to maintain a population. The proposal will impact on 0.2 ha of remnant native vegetation that may have potential habitat for *Acacia bynoeana, Acacia pubescens, Grevillea parviflora* subsp. *parviflora* and *Pimelea spicata.* Surveys to date have failed to locate any remnant specimens. As such, it is considered that the impacts of the proposal on these species will be minimal.

Summary of threatened species recorded

***Little Eagle* (*Hieraaetus morpnoides*)**

The Little Eagle occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. For nest site it requires a tall living tree within a remnant patch. It eats birds, reptiles and mammals and occasionally large insects and carrion. It was formerly heavily dependent on rabbits before *calicivirus* disease reduced rabbit numbers in arid zones (Scientific Committee, 2009). Most of its former native mammalian prey (terrestrial mammals of rabbit size or smaller, e.g. large rodents, bandicoots, bettongs, juvenile hare-wallabies and nailtail wallabies) are extinct (Van Dyke and Strahan 2008). It occurs as a single population throughout NSW (Scientific Committee, 2009).

A Little Eagle was observed high in flight to the west of the study area during the diurnal survey on 9/3/21. The individual was not observed over the study area at any time.

It is considered that the study area provides suitable foraging and perching habitat for the Little Eagle. Searches along the outer fringes of the study area and the adjacent riparian habitats to the immediate west did not locate any nest consistent with this species from the previous breeding season. The potential prey rabbit was recorded present to the north of the subject site area. The study area however is not demonstrated of likely importance, use or likely containing any unique foraging habitat not otherwise well represent in the remaining locality.

Therefore, it is considered that there will be no significant impact on the Little Eagle as a result of the proposal.

Little Lorikeet (*Glossopsitta pusilla*)

Little Lorikeets mostly occur in dry, open eucalypt forests and woodlands. Little Lorikeets are gregarious, usually foraging in small flocks, often with other species of lorikeet. They feed primarily on nectar and pollen in the tree canopy, particularly on profusely-flowering eucalypts, but also on a variety of other species including Melaleucas and mistletoes.

There is no evidence of regular migration, but Little Lorikeets are generally considered to be nomadic (Higgins 1999), with irregular large or small influxes of individuals occurring at any time of year, apparently related to food availability. Long term investigations indicate that breeding birds are resident from April to December, and even during their non-resident period, they may return to the nest area for short periods if there is some tree-flowering in the vicinity (Courtney & Debus 2006).

Approximately 3 cm diameter nest hollows are located mostly in living, smooth-barked eucalypts, and are kept open by the activities of the occupants, which use their beaks to bite away living bark from around the opening. When nest hollows are deserted, e.g. after storm-damage to trees, hollows can close over within 14 months (Courtney & Debus 2006). Nest hollows are occasionally located in dead trees, but birds generally desert hollows within two years of tree death. Nest-hollows are used “traditionally”, with the same hollow (not necessarily by the same individuals) (Courtney & Debus 2006).

Little Lorikeet was not observed but was recorded by call in flight to the nearby east of the study area during diurnal survey on the 9/3/21. Based on the calls it is expected that the bird(s) took flight from foraging within the adjacent property. Refer to Figure 2-1 for approximate recorded location.

The study area provides likely seasonal foraging habitat for Little Lorikeet. There is one hollow-bearing tree located within the subject site which is proposed for removal. Whilst this tree did contain small hollows, these were not typical knolls or small openings into larger chambers. Therefore, the subject site is not expected to be utilised for shelter roosting or breeding.

Given the extent of suitable seasonal foraging habitat for this species in the locality and the number of recent local records, particularly within the extensive habitats of the Holsworthy military area to the east, the proposal is unlikely to significantly impact on a local population. It is recommended that the removal of hollows is under a strict process to ensure the effective recovery of resident fauna, particularly threatened species.

Dusky Woodswallow (*Artamus cyanopterus cyanopterus*)

The Dusky Woodswallow is often reported 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 (Higgins and Peter 2002).

At sites where Dusky Woodswallows are recorded the understorey is typically open with sparse eucalypt saplings, acacias and other shrubs, including heath (Higgins and Peter 2002). The ground cover may consist of grasses, sedges or open ground, often with coarse woody debris (Higgins and Peter 2002). Birds are also often observed in farm land, usually at the edges of forest or woodland or in roadside remnants or wind breaks with dead timber (Higgins and Peter 2002; M. Schulz *in litt.* November 2014).

Fledglings appear to disperse with the flock but return to the birth site in subsequent years (Higgins and Peter 2002). Nesting is usually solitary but occasionally occurs in loose colonies of up to 20 nests (Higgins and Peter 2002). The Dusky Woodswallow is monogamous and nests in pairs although cooperative breeding sometimes occurs (Higgins and Peter 2002). Although Dusky Woodswallows have large home ranges, individuals may spend most of their time in about a 2 ha range and defend an area about 50 m around the nest (Higgins and Peter 2002).

Depending on location and local climatic conditions (temperature and rainfall) the Dusky Woodswallow can be resident year-round or migratory (Higgins and Peter 2002; M. Schulz *in litt.* November 2014). In New South Wales birds migrate after breeding to the north of the state and to southeast Queensland, Migrants generally depart March–May moving north, along the coast or inland slopes of the Great Dividing Range (Higgins and Peter 2002). Migrants generally move south in spring (September–November) to breed (Higgins and Peter 2002).

A party of approximately seven (7) Dusky Woodswallows were observed perching and foraging around two trees located on the adjacent property to the south during diurnal survey on 9/3/21.

The habitat of observed use provides varying yet somewhat extensive woodland structure connectivity typical for use by the species. This utilised habitat runs along the large dams and also has a high edge to width association with the surrounding cleared and managed landscapes. This area of recorded habitat is located over 250 m from the subject site area. The subject site itself has potential for periodic use for foraging but unlikely nesting given the more highly fragmented and managed hilltop setting.

It is expected that the habitats to the south may be utilised for nesting. Given the extent of localised habitat surrounding the recorded location as well as remaining in the immediate locality, and also given that the species was not recorded in the study area itself, it is considered that the proposal is not likely to significantly impact on the local population.

Grey-headed Flying-fox (*Pteropus poliocephalus*)

Grey-Headed Flying-foxes are canopy feeding frugivores and nectarivores, inhabiting a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas. This species roosts in camps, which may contain tens of thousands of individuals.

Camps are commonly formed in gullies, typically not far from water and usually in vegetation with a dense canopy (Tidemann 1998). Camps can be found in riparian rainforest patches, Melaleuca stands, mangroves, riparian woodland or modified vegetation in urban areas. Loyalty to a site is high and some camps in NSW have been used for over a century (NSW NPWS 2001). Some camps are used at the same time every year by hundreds of thousands of flying-foxes while others are used sporadically by a few hundred individuals (Strahan 1995). Generally foraging is within 20 km of camps but individuals are known to commute up to 50 km to a productive food source.

Grey-headed Flying-fox were recorded in numbers during survey flying over the study area during nocturnal survey on the 9/3/21. Two individuals were also recorded within or close to the study area foraging on flowering Grey Box (within the study area) and Acacia (to the north). Refer to Figure 2-1 for recorded locations.

The development footprint provides seasonal foraging habitat for the Grey-headed Flying-fox as no suitable roosting or subsequent breeding habitat is present. Foraging habitat is otherwise well represented in the surrounding locality such that removal of this habitat will not significantly impact on a local population. It is recommended that foraging habitat is replaced by locally native flowering eucalypts within landscaping areas.

Southern Myotis (*Myotis macropus*)

The Southern Myotis inhabits rainforests and open forests containing creeks and lakes over which it feeds and roosts in tree hollows, caves, mines, under bridges, in tunnels and occasionally buildings (Richards 1995). The Southern Myotis predominantly forages along creek lines and over waterbodies where it takes insects and small fish from on and just below the water surface (Richards 1995).

This species has a strong association with streams and permanent waterways, most frequently at low elevations and in flat or undulating country and usually in areas that are vegetated rather than cleared. They will live in most habitat types as long as it is near water (Churchill 2008).

The Southern Myotis was recorded foraging over the large open water areas on the adjacent property to the south during active-monitoring nocturnal survey on 9/3/21.

The study area itself does not contain any open water habitat suitable for foraging, nor does the riparian channel located close to the west. Therefore, the study area offers mainly roosting and subsequent breeding potential within the few recorded hollows, however these are considered of low potential use due to their distant proximity to preferred foraging areas. Other localised roosting opportunities supporting the local population are expected and known.

Therefore, the proposed development will not likely significantly impact on a local population of Southern Myotis.

Careful habitat removal measures, relocation of suitable hollows and provision of supplementary habitat measures for this species have been considered and incorporated into the mitigation and amelioration of impacts outlined in Section 6.2.

(b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Cumberland Plain Woodland is a critically endangered ecological community under the *BC Act.*

The development proposal will impact 0.12 ha of moderate_good quality vegetation, 0.04 ha of canopy_only vegetation, and 0.04 ha of planted_native_vegetation which had a light cover of native groundcovers underneath the trees (which don't occur locally).

Overall, the vegetation is quite poor because of its structural integrity. There is very little if any natural regeneration occurring because the understorey is regularly slashed.

Each remnant of vegetation is fragmented, and although it may be still considered part of a larger patch because the distance between the fragments is less than 100 m, each fragment is generally very small. Small fragments of vegetation, mostly less than 0.1 ha have high edge-width ratios and subject to edge effects. If remnants were continued to be managed under the same regime as current, they would gradually die out as the seedbank is not being replenished and the understorey continues to be slashed, not allowing regrowth trees to mature.

DPIE would have considered the vegetation too highly degraded as they did not include any of the fragments in the 2016 vegetation mapping of the Sydney Metropolitan area.

Connectivity of vegetation in the local area is poor and degraded with limited usability more focussed on highly mobile species. Cumberland Plain Woodland within these connected links is highly degraded with low species diversity due to previous management regimes, either from slashing or grazing which has made them fragmented. The encroachment of newer residential areas in Blair Athol are squeezing the available lands for conservation and the Hume Highway and Narellan Road provide barriers to movement.

Vegetation on site is of low value and is not mapped by DPIE on the biodiversity values map.

The remnant vegetation is not part of a priority conservation land that has been identified by OEH in 2011.

The impact of 0.12 ha of Cumberland Plain Woodland will have minimal impacts on the extent of the community, and is not considered that its local occurrence will be placed at risk of local extinction.

(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Modification of the composition will often occur when a particular stratum needs to be removed or requires ongoing management. The application of an APZ is an example whereby the mid-storey is quite heavily impacted, canopy is thinned if tree canopies are touching, and the ground layer of vegetation is regularly slashed.

The vegetation in the development footprint does not have a continuous canopy cover and the mid-storey is virtually absent except for a handful or shrubs.

The ground layer is already managed and regularly mown. The application of an APZ would have no greater impact that the current level of management.

(c) In relation to the habitat of threatened species or ecological community:

It is considered that the habitat attributes of the development footprint provide known or potential habitat for *Acacia bynoeana, Acacia pubescens, Grevillea parviflora* subsp. *parviflora, Pimelea spicata,* Cumberland Plain Woodland*,* Little Eagle, Little Lorikeet, Dusky Woodswallow, Grey-headed Flying-fox, Southern Myotis, Swift Parrot, Yellow-bellied Sheathtail-bat, Eastern Coastal Free-tailed Bat, Greater Broad-nosed Bat, Large Bent-winged Bat, White-bellied Sea Eagle, Square-tailed Kite, Gang-gang Cockatoo, Powerful Owl, Varied Sittella, Scarlet Robin, Koala, Eastern False Pipistrelle, Little Bent-winged Bat, Cumberland Plain Land Snail, Green and Golden Bell Frog, Turquoise Parrot, Barking Owl, Masked Owl, Brown Treecreeper, Regent Honeyeater, Black-chinned Honeyeater and Large-eared Pied Bat.

(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

The development footprint will have an impact of 0.2 ha on native vegetation that is direct on known habitat, or may just be on potential habitat that was likely to be too degraded to support threatened species.

(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

The vegetation within the development footprint is already highly fragmented from any localised habitat providing any connectivity values. They are generally single trees in an open landscape or a planted avenue that provide habitat only for highly mobile threatened birds and bats. This habitat is also at the edge of existing urban development and thus at the outer extent of the local fragmented vegetated landscapes.

Therefore, it is considered that known habitat for a threatened species, population or ecological community within the local area and region is unlikely to become isolated or fragmented as a result of the proposal.

(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

In respect to threatened fauna species recorded or with potential to occur the proposed area of impact is not likely of high quality, of any breeding importance or central to the home range requirements of any species such that behaviour or ecology of these species will be significantly altered in any way.

No threatened flora species have been detected, and the value or the small fragments for threatened flora potential is highly limited due to previous vegetation management and ongoing slashing regimes.

Whilst EEC vegetation occurs within the development footprint, it is fragmented and low in native species diversity. Its long-term viability is considered low and has limited contribution to local connectivity.

The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population and ecological communities in the locality is considered to be minimal.

(d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The development footprint is not within any declared area of outstanding biodiversity value or nearby. Therefore, the proposal will not have any adverse effects on any declared area of outstanding biodiversity value (either directly or indirectly).

(e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

A key threatening process is defined as a process that threatens, or could threaten, the survival or evolutionary development of species, populations or ecological communities.

The current list of key threatening processes, and whether the proposed activity is recognised as a threatening process, is shown below.

Listed key threatening process (as described in the final determination of the Scientific Committee to list the threatening process)	**Is the development or activity proposed of a class of development or activity that is recognised as a threatening process?**		
	Likely	Possible	Unlikely
Aggressive exclusion of birds by Noisy Miners (*Manorina melanocephala*)		✓	
Alteration of habitat following subsidence due to longwall mining			✓
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands			✓
Anthropogenic Climate Change			✓
Bushrock removal			✓
Clearing of native vegetation	✓		
Competition and habitat degradation by feral goats			✓
Competition and grazing by the feral European Rabbit (*Oryctolagus cuniculus*)		✓	✓
Competition from feral honeybees			✓
Death or injury to marine species following capture in shark control programs on ocean beaches			✓
Entanglement in, or ingestion of anthropogenic debris in marine and estuarine environments			✓
Forest Eucalypt dieback associated with over-abundant psyllids and bell miners			✓
High frequency fire resulting in the disruption of life-cycle processes in plants and animals and loss of vegetation structure and composition			✓
Herbivory and environmental degradation caused by feral deer			✓
Importation of red imported fire ants into NSW			✓
Infection by *Psittacine circoviral* (beak and feather) disease affecting endangered psittacine species and populations			✓
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis			✓
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae		✓	
Infection of native plants by *Phytophthora cinnamomi*		✓	
Introduction of the large earth bumblebee (*Bombus terrestris*)			✓
Invasion and establishment of exotic vines and scramblers			✓
Invasion and establishment of Scotch Broom (*Cytisus scoparius*)			✓
Invasion and establishment of the Cane Toad (*Bufo marinus*)			✓

Listed key threatening process (as described in the final determination of the Scientific Committee to list the threatening process)	Is the development or activity proposed of a class of development or activity that is recognised as a threatening process?		
Invasion, establishment and spread of *Lantana camara*			✓
Invasion of native plant communities by bitou bush & boneseed *Chrysanthemoides monilifera*			✓
Invasion of native plant communities by exotic perennial grasses	✓		
Invasion of native plant communities by African Olive (*Olea europaea* subsp. *cuspidata*)	✓		
Invasion of the Yellow Crazy Ant (*Anoplolepis gracilipes*)			✓
Loss of Hollow-bearing trees	✓		
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants			✓
Loss and/or degradation of sites used for hill-topping by butterflies			✓
Predation and hybridisation by feral dogs (*Canis lupus* familiaris)			✓
Predation by the European Red Fox (*Vulpes vulpes*)		✓	
Predation by the Feral Cat (*Felis catus*)		✓	
Predation by Gambusia holbrooki Girard, 1859 (plague minnow or mosquito fish)			✓
Predation by the Ship Rat (*Rattus rattus*) on Lord Howe Island			✓
Predation, habitat degradation, competition & disease transmission from Feral pigs (*Sus scofa*)			✓
Removal of dead wood and dead trees	✓		

The above key threatening processes have been considered in reference to the proposal. It was considered that the proposal may contribute to a small degree to a number these processes as described below. It was not considered that the proposal will have a large or significant impact on any of the following key threatening processes. Some mitigation measures have been listed under each process to minimise or reduce such impacts upon those processes.

Summary of "likely" or "possible" Key Threatening Processes

This section identifies what mitigation measures can be implemented to address threatening processes.

Aggressive exclusion of birds by Noisy Miners (*Manorina melanocephala*)

Noisy Miners have been recorded present within the study area. It is likely that Noisy Miners from within the study area may be slightly displaced as a result of habitat removal for the development, resulting in increased impacts from this species on other native birds in the nearby surrounds. Given the high degree of disturbance in the local surrounds it is expected that the Noisy Miner is already at impacting numbers in these areas.

Clearing of native vegetation

The proposal is of a class of development recognised as a threatening process. It is generally recommended that all sites should aim to achieve a maintain or improve outcome on the quality and quantity of native vegetation cover through protection and restoration measures. 0.2 ha of native vegetation will be impacted by the proposed development. Whilst a full 0.2 ha restoration is unlikely, utilising locally occurring native species as street trees or shrubs may be a small compensatory measure. The removal of native vegetation within the development footprint is not likely to significantly affect the biodiversity of the local area due to its fragmentation, low species diversity and size.

Competition and grazing by the feral European rabbit

It is expected that the proposed development will increase or decrease the potential for rabbit invasion. Rabbit management and control such as through exclusion fencing, destruction of warrens and target “Pindone” baiting is recommended as a standard protocol.

Infection of native plants by Phytophthora cinnamomi

The proposal may temporarily increase the risk of fungal infection on site as it may be spread via vehicular movement and relocation of soil and vegetation. Consequently, standard *Phytophthora cinnamomi* protocol applies to the cleaning of all plant, equipment, hand tools and work boots prior to delivery onsite to ensure that there is no loose soil or vegetation material caught under or on the equipment and within the tread of vehicle tyres or tracks. Any equipment found to contain soil or vegetation material from offsite is to be cleaned in a quarantined work area or wash station and treated with anti-fungal pesticides prior to commencing work.

Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae

‘Myrtle Rust’ may be spread via machinery, animals and humans as well as by environmental factors such as wind. The presence of machinery and construction works is likely to slightly increase the potential for spread of this key threatening process. Similar protocols as to *Phytophthora cinnamomi* should be applied.

Invasion of native plant communities by African Olive (Olea europaea subsp. cuspidata)

This species is present within or adjacent to the development footprint. The proposed development may provide an opportunity to ameliorate the effect of this key threatening process by the application of suitable weed control measures.

Invasion of native plant communities by exotic perennial grasses

Exotic perennial grasses such as Kikuyu ares present within the development footprint. The proposed development may provide an opportunity to ameliorate the effect of this key threatening process by the application of suitable weed control measures.

Loss of hollow-bearing trees

Hollow-bearing tree surveys identified one hollow-bearing trees containing medium (10-30cm) and small (0-10cm) sized hollows within the development footprint. The proposal will require the removal of five observed hollows within this tree and as such is of a class of development recognised as a threatening process. Threatened species with suitable habitat within the site and dependant on hollows of this nature include Little Lorikeet, Eastern False Pipistrelle, East-coast Freetail Bat, Greater Broad-nosed Bat, Southern Myotis and Yellow-bellied Sheathtail-bat. The Little Lorikeet and Southern Myotis were recorded during surveys undertaken, however are not expected to utilised the recorded hollows. The relocation or replacement of hollows within remaining trees within the study area is recommended to reduce the impacts from the loss of natural hollows.

Predation by the European red fox

It is expected that the proposed development will provide an opportunity to manage the area with regard to European red fox invasion. European red fox management is encouraged for the retained vegetated areas of the development footprint.

Predation by feral cat (*Felis catus*)

The proposed development may alter impacts on adjoining lands by increasing the numbers of domestic cat ownership and as such the action proposed may increase the impact of this threatening process.

Removal of dead wood and dead trees

The proposal will require the removal of deadwood and dead trees and as such is of a class of development recognised as a threatening process. Threatened fauna species with potential habitat within the development footprint and likely dependent on dead wood or dead trees include Varied Sittella, Green and Golden Bell Frog, Scarlet Robin, Brown Treecreeper and Cumberland Plain Land Snail. These species have not been recorded to date within the study area; the Dusky Woodswallow was however recorded nearby to the south.

Given the low-quality habitat associated with deadwood and dead trees present within the development areas, the removal of dead wood and dead trees within the subject site is not considered likely to impact on threatened species or the biodiversity of the local area. It is recommended that deadwood habitat within the proposed development areas is relocated to the adjacent riparian habitats under the direction of a project ecologist during clearing works.

APPENDIX 3. EPBC IMPACT CRITERIA

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 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.

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.

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:

(b) 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

(c) b) Habitat that is of critical importance to the species at particular life-cycle stages; and/or

(d) c) Habitat utilised by a migratory species which is at the limit of the species range; and/or

(e) 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.

APPENDIX 4. STAFF QUALIFICATIONS AND EXPERIENCE

Team member (role)	Accreditations and qualifications	Experience	Employment history	Skills and expertise
Lindsay Holmes (Manager of Ecology)	• Bachelor of Science – Biology, James Cook University, Qld • Bush Regeneration II Certificate, Ourimbah TAFE • NSW WorkCover OHS Construction Induction • Senior First Aid Certificate • BioBanking Assessor (No. 199) • Biodiversity Assessment Method (BAM) Assessor (BAAS17032)	Lindsay has 21 years of experience as a flora ecologist and bushland regeneration supervisor and has expertise in botanical survey, ecological analysis, maintain and improve analysis, biometric analysis and geo-plotting of ecological data.	• 2007-Current: Senior Botanist, Travers bushfire & ecology • 2006-2007: Ecologist, Conacher Travers Pty Ltd • 1999-2006: Field Operations Manager, Microclimate	• Highly experienced in botanical survey and ecological analysis • Vegetation management planning • Flora and fauna assessment • Species impact statement • Threatened species, ecological communities and endangered population surveys and analysis • Preparation of BioBanking and Biodiversity Development Assessment Reports • Riparian, bushland and wetland restoration • Habitat tree analysis and assessment • Noxious weed identification and control • SULE assessment

Team member (role)	Accreditations and qualifications	Experience	Employment history	Skills and expertise
Corey Mead (Contract fauna ecologist)	• Southern Cross University – B. App. Sc. • BAM Accredited Assessor (BAAS.19050) • Accredited BioBanking Assessor (No.231) • Scientific License (SI102477) • Animal Ethics Permit (TRIM V20/32969) • Bionet Sensitive Species Data License (No. 1589) • Licence to Harm Protected Animals (MWL000103525) • Possum Catch & Release Licence (MWL000103525) • Reptile Catch & Release Licence (MWL000103525) • Tre climbing techniques (AHCARB312) • Chainsaw operation • NSW NPWS – Intro to ArcView GIS • First Aid Certificate (HLTAID003) • Class C vehicle, Boat & Divers Licences • OHS General Induction (CGI00761144SEQ1) • Risk Assessment Training (Taronga Zoo) • NSW RFS – Firefighters Certificate • Report Writing – Pollack Learning Alliance • Frog, Reptile & Bat Survey, ID & Mgt Training – NSW Forestry • Anabat Techniques Training – Titley Scientific – Smiths Lake • Cert III – Building & Carpentry (assist in construction of nest boxes)	Corey has developed extensive specialist knowledge over 20 years in fauna survey techniques, threatened species target surveys, data analysis and visual and call identification of vertebrate fauna within coastal habitats of NSW. Corey has also worked alongside a number of industry recognised fauna specialists including Dr Steve Phillips (Koala), John Young (owls), Gerry Swan (Rosenberg's Goanna), Prof Michael Mahony (Giant Burrowing Frog), Dr Ross Goldingay (Yellow-bellied Glider and Eastern Pygmy Possum), Dr Brad Law (microbats), Ross Wellington (Green-thighed Frog, Giant Barred Frog & Stuttering Frog) and Dr Richard Noske (Varied Sittella). Corey has also worked with industry personalities including Malcolm Douglas (crocodiles), Steve Irwin (Rattlesnakes) and has presented on Totally Wild and in schools across Australia providing wildlife education. As a wildlife scout for Discovery Channel in 2002 Corey provided the only known then capture of the *Pseudechis weigeli* brown snake in the remote Kimberleys WA, as well as the only person to have captured more than one Rough-scaled Python through working out the species otherwise unknown ecology. Corey assisted John Young in the re-discovery of the Night Parrot in 2013.	• Nov 20 – Present – Contract Fauna Ecologist (*TreeHouse Ecology*) • Oct 07 – Nov 20 – Senior Fauna Ecologist (*Travers Bushfire & Ecology*) • Jan 06 – Oct 07 – Field Tech / Fauna Ecologist (*Conacher Travers Environmental Consultants*) • Feb 03 – Jan 06 – Head Reptile Keeper (*Australian Reptile Park*) • Jan 03 – Sept 05 – Visitor Services Officer (*National Parks & Wildlife Service*) • Dec 02 – Jan 03 – Marine Turtle Project Officer (*National Park & Wildlife Service*) • Aug 00 – Feb 03 – Venom Room Attendant (*Australian Reptile Park*) • Nov 99 – Feb 00 – Waste Minimisation Education Officer (*Manly Council*) • Apr 97 – Sept 00 – Environmental Education Officer (*Australian Reptile Park*)	• BAM-C fauna data and credit assessment • Remote and independent terrestrial vertebrate surveys • Threatened fauna target surveys & assessment • Large hollow relocation methods • Microbat Call Identification & active monitoring • AnalookW, Anapocket, Insight & CFC Read bat analysis software • Kaleidoscope Pro song-meter clustering & classifier analysis • Advanced song classifiers for threatened owls, frogs & gliders • Owl breeding ecology • Squirrel Glider radio-tracking surveys • Project Ecologist during habitat clearance • Habitat tree assessment / audits • Advanced reptile captive management • Fire trail audits & bushfire risk analysis • Advanced venomous snake handling & training • Education/training program development • GPS data transfer and management

Team member (role)	Accreditations and qualifications	Experience	Employment history	Skills and expertise
Michael Sheather-Reid (Managing Director)	• Bachelor of Natural Resources (Hons), University of New England • BioBanking Assessor • Engineering Assistant – CAD Drafting • MUSIC Modelling – Stormwater quality and quantity modelling (RMIT) • Bush Regeneration II Certificate, Ryde TAFE • NSW WorkCover OHS Construction Induction • Chemical Handling Certificate, Ryde TAFE	Michael has a wealth of experience in environmental consulting and on ground management of bushland, wetland and riparian habitats having undertaken environmental assessment, ecological consultancy and restoration in both the private and public sectors for over 22 years.	• 2007- Current: Senior Ecologist, Travers bushfire & ecology • 2004 -2007: Senior Ecologist, Conacher Travers Pty Ltd • 2002-2004: Project Manager, Urban Bushland Management Projects Pty Ltd • 1999-2002: Project Manager Sustainable Vegetation Management Pty Ltd • 1995-1999: Managing Director Sheather-Reid & Associates Pty Ltd • 1996-1997: NSW Landcare Liaison Officer, Australian Conservation Foundation • 1992-1995: Environmental Officer, Dept. Land & Water Conservation • 1990-1992: Scientific Officer Dept. of Water Resources	• Ecological assessment • Rezoning studies • Biodiversity offset planning • Restoration management and coordination • Biotic and soil translocation • Watercourse assessment • Project ecologist services • EPBC Act referrals • Controlled Activity Approvals • Vegetation management plans
Sandy Cardow (GIS officer)	• Bachelor of Science (Biological Sciences) (Macquarie University)	Sandy has over twenty years of experience in Spatial Information (Geographic Information Systems (GIS)), which includes preparation of mapping in local government roles and has completed a Bachelor of Science (Biological Sciences).	• 2017 – Current: GIS Officer, Travers bushfire & ecology • 2014 – 2017: GIS Consultant, Forestry Corp. NSW • 2005 – 2011: GIS Analyst, Forests NSW • 2002 – 2005: GIS Data Librarian, Forests NSW • 2000 – 2002: GIS Operator, Forests NSW • 2000 – 2002: GIS Data Import / Export Officer, Forests NSW • 1999 2000: GIS Project Officer DECC • 1998 – 1999: GIS Support Officer DECC • 1998 – 1999: Wildlife Atlas Data Entry Officer DECC	• Geographic Information Systems • Data management and analysis • Spatial databases and database administration • GPS • Cartography • Natural resource management • Client liaison

Team member (role)	Accreditations and qualifications	Experience	Employment history	Skills and expertise
Bronte Talbot (GIS officer / ecologist)	• Bachelor of Environmental Science and Management (University of Newcastle) (2016 -2018) • Currently studying - Master of Environmental Science specialising in Water Resource (Charles Sturt University) (2020-present)	Bronte has experience in Geographic Information Systems (GIS), Watercourse Assessments, Report Writing and Field Work procedures. She aims to specialise in Water Resources and assist communities adopt sustainable practices and help create water security.	• 2019 to present Travers Bushfire and Ecology • 2018 volunteer at Verico Group	• Geographical Information Systems (GIS) • GPS • Report Writing • Watercourse Assessments • Flora and Fauna Field Assessments • Vegetation Management Plans • Environmental Monitoring (Air quality – Ambient Gaseous, Ambient Particulate and water sampling)

APPENDIX 5. FLORA DATA SHEETS

BAM Site – Field Survey Form

Site Sheet no: 1 of

Survey Name	Zone ID	Recorders
18IND04 Narellan Rd Campbelltown		LH

Date	8/3/21			Plot dimensions	20x20 50x20m	Photo #	
Zone	Datum	Plot ID	Q1				
56	GDA CA						
Easting	Northing	IBRA region	Sydney Basin In m	Midline bearing from 0 m	° Magnetic °		

Vegetation Class	Coastal Valley Grassy Woodland		Confidence: (H) M L
Plant Community Type	PCT 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 m² plot)		Sum values
Count of Native Richness	Trees	2
	Shrubs	1
	Grasses etc.	6
	Forbs	6
	Ferns	0
	Other	2
Sum of Cover of native vascular plants by growth form group	Trees	25
	Shrubs	1
	Grasses etc.	30.8
	Forbs	0.7
	Ferns	0
	Other	0.2
High Threat Weed cover		24.1

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	0	x
50 – 79 cm	3	
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	0

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)	15	75	50	40	75	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	51																			

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			

400m² plot Sheet of	Survey Name	Plot Identifier	Recorders
Date 8/3/21	Narellan Rd, Campbelltown	Q1	LH

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	Stratum	voucher
T	Eucalyptus moluccana		7	4		
T	Eucalyptus crebra		18	8		
	Chloris gayana	HTE	20	3000		
F	Veronica plebeia		0.2	60		
G	Themeda triandra		20	5000		
	Sida rhombifolia	E	1	250		
	Olea europaea	HTE	2	11		
	Gomphocarpus fruticosus	E	0.3	15		
	Verbena bonariensis	E	0.3	70		
G	Cynodon dactylon		D	400		
S	Acacia falcata		1	2		
G	Bytidosperma tenuis		7	2000		
	Phytolacca octandra	E	0.1	1		
	Solanum nigrum	E	0.1	1		
G	Cyperus gracilis		0.1	20		
	Paspalum dilatatum	HTE	2	500		
	Senecio madagascariensis	HTE	0.1	15		
G	Panicum effusum		1	200		
	Glycine clandestina		0.1	3		
	Plantago lanceolata	E	0.1	15		
	Aristida ramosa		1.5	250		
D	Glycine tabacina		0.1	10		
	Arthraxanthum odoratum	E	1	250		
G	Cymbopogon refractus		7	1500		
D	Polymeria calycina		0.1	2		
F	Hahnenbergia gracilis		0.1	5		
	Phyllanthus tenellus	E	0.1	5		
F	Euchiton sphaericus		0.1	5		
F	Brunoniella australis		0.1	10		
	Setaria parviflora	E	0.1	20		
F	x forb		0.1	6		
F	Portulaca oleracea		0.1	2		
	Lysimachia arvensis	E	0.1	1		
G	Dichelachne micrata		0.7	120		

GF Code: see growth form definitions in Appendix 1 N: native, E: exotic, HTE: high threat exotic GE = circle code of '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 10m
Abundance: 1, 2, 3 ... 10, 20, 30 ... 100, 200 ... 1000 ...

BAM Site – Field Survey Form

Site Sheet no: 1 of

		Survey Name	Zone ID	Recorders			
Date	8 / 3 / 21	18IND04 Narellan Rd Campbelltown					
Zone 56	Datum GDA 94	Plot ID	Q2	Plot dimensions	20x20 50x20m	Photo #	
Easting	Northing	IBRA region	Syd Basin	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 m² plot)		Sum values
Count of Native Richness	Trees	2
	Shrubs	0
	Grasses etc.	5
	Forbs	6
	Ferns	0
	Other	2
Sum of Cover of native vascular plants by growth form group	Trees	18.5
	Shrubs	0
	Grasses etc.	13.6
	Forbs	7.7
	Ferns	0
	Other	0.2
High Threat Weed cover		53.8

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	3	x
50 – 79 cm	2	
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	0

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)	90	95	20	40	40	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	53																			

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			

400m² plot: Sheet of	Survey Name	Plot Identifier	Recorders
Date 8/8/21	Narellan Rd Campbelltown	Q2	LH

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	Stratum	voucher
T	Eucalyptus moluccana		8	2		
T	Eucalyptus tereticornis		10	2		
	Olea europaea	HTE	25	125		
G	Chloris truncata		1.5	300		
	Sida rhombifolia	E	3	600		
F	Einadia nutans		2	250		
	Setaria parviflora	E	1	100		
	Conyza bonariensis	E	0.2	40		
	Solanum sisymbriifolium	E	1	12		
G	Microlaena stipoides		10	2500		
	Sporobolus africanus	E	1	200		
	Euphorbia peplus	E	0.3	70		
	Ehrharta erecta	HTE	5	1000		
F	Commelina cyanea		3	200		
F	Dichondra repens		1.5	200		
T	Melia azedarach		0.5	1		
	Asparagus asparagoides	HTE	0.2	8		
	Aptenia cordifolia	E	0.5	30		
G	Cyperus gracilis		0.5	120		
	Lycium ferocissimum	HTE	3	20		
	Senecio madagascariensis	HTE	0.1	10		
F	Einadia trigonos		1	50		
	Verbena bonariensis	E	0.3	40		
	Cyperus eragrostis	HTE	0.3	60		
	Cirsium vulgare	E	0.2	40		
	Pyracantha sp.	HTE	0.3	1		
	Rubus fruticosus	HTE	1.5	20		
	Cenchrus clandestinus	HTE	18	4000		
G	Juncus usitatus		0.1	2		
	Modiola caroliniana	E	0.2	40		
	Paspalum dilatatum	HTE	3	500		
	Ricinus communis	HTE	0.2	1		
	Holcus lanatus	E	1	150		
	Plantago lanceolata	E	0.1	10		
G	Cynodon dactylon		1.5	200		
	Solanum nigrum	E	1	30		
	Phytolacca octandra	E	2.5	15		
	Sonchus asper	E	0.1	5		
	Rumex crispus	E	0.1	1		
O	Glycine clandestina		0.1	10		
	~~[illegible]~~ Urochloa panicoides	E	0.8	100		
	Lantana camara	HTE	0.2	2		
F	Alternanthera denticulata		0.1	3		
F	Verbena [illegible]		0.1	3		
O	Clematis glycinoides		0.1	1		

GF Code: see growth form definitions in Appendix 1. N: native, E: exotic, HTE: high threat exotic. GF = circle code of '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