

A photograph of a possum climbing a tree trunk, positioned vertically on the left side of the cover. The possum is grey with a white face and chest, and its tail is visible at the bottom. The tree bark is rough and textured.

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bushfire & ecology

Flora & fauna assessment

Proposed redevelopment of
Katoomba Christian
Convention Centre (KCC)
at Lot 5 DP 222736
119 Cliff Drive, Katoomba

February 2018
(REF: A16026F)



Flora & Fauna Assessment

119 Cliff Drive, Katoomba (Lot 5 DP 222736) Katoomba

February 2018

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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 undertake a flora and fauna assessment for a proposed redevelopment of Katoomba Christian Convention (KCC) within Lot 5 DP 222736 at 119 Cliff Drive, Katoomba. The entire area of this lot as well as the adjacent Lot 1 DP 1121828 (41 Violet Street Katoomba) has been subject to varying survey effort over a number of years, the combined area will hereafter be referred to as the 'study area'.

The proposed development area incorporating the development footprints and asset protection zones (APZs) which are subject to direct impacts on habitat removal will be referred to as the 'subject site'.

Proposed Development

The proposed works include the demolition and construction of a new 3,500 seat auditorium (increase of 1,200 people compared to the existing facility), new bookshop, meeting rooms, reception, dining hall and café. The proposal also includes the construction of six eco lodges and three chalets to provide a total of 390 beds (a net increase of 170 beds).

Recorded threatened flora, fauna & EECs

Ecological survey and assessment has been undertaken in accordance with relevant legislation including the *Environmental Planning and Assessment Act 1979 (EP&A Act)*, the *Threatened Species Conservation Act 1995 (TSC 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 *TSC Act*, five (5) threatened fauna species including Eastern Pygmy Possum (*Cercartetus nanus*), Gang-Gang Cockatoo (*Callocephalon fimbriatum*), Little Lorikeet (*Glossopsitta pusilla*), Grey-headed Flying-fox (*Pteropus poliocephalus*) and Eastern Falsistrelle (*Falsistrellus tasmaniensis*) and no threatened flora species, or populations were recorded in the study area.

There are two (2) Threatened Ecological Communities (TECs) occurring on site. One community is the Hanging Swamp vegetation community which is commensurate with '*Blue Mountains Swamps of the Sydney Basin Bioregion*' which is listed as a Vulnerable Ecological Community (VEC) under the NSW *TSC Act*. This same community is a component of the '*Temperate Highland Peat Swamp on Sandstone*' which is listed as an Endangered Ecological Community (EEC) within the Commonwealth *EPBC Act*. The second community is the Fernland vegetation which also forms a component of the '*Blue Mountains Swamps in the Sydney Basin Bioregion*' which is a Vulnerable Ecological Community (VEC) as listed within the NSW *TSC Act*.

In accordance with Section 5A of the *EP&A Act*, the 7 part test of significance concluded that the proposed development will not have a likely significant impact on any threatened species, populations or EECs. Therefore, a Species Impact Statement is not required for the proposal.

The proposed development is not likely to have a significant impact on any remaining state listed threatened species with potential to occur, nor any populations or EECs.

In respect of matters required to be considered under the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*, one (1) threatened fauna species Grey-headed Flying-fox (*Pteropus poliocephalus*), two (2) protected migratory bird species Black-faced Monarch (*Monarcha melanopsis*) and Rufous Fantail (*Rhipidura rufifrons*), no threatened flora species, and one EEC (Hanging Swamp) listed under this Act were recorded within the study area.

The proposed development was considered to have a not significant impact on matters of national environmental significance. As such a referral to Department of Environment should not be required.

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

Conclusion

The direct, indirect and cumulative impacts of the proposal have been carefully considered in Section 5.3 of this report.

Recommended mitigation and amelioration measures to the abovementioned impacts are, where applicable, addressed within Section 5.4 of this report.

It is concluded that the proposed development of the subject site within Lot 5 DP 222736, Number 119, Cliff Drive, Katoomba, is unlikely to result in a significant impact on any threatened species, populations or EECs or their habitats.

As such no further assessments are considered to be required under the *EP&A Act*, the *EPBC Act* or the *FM Act*.

List of abbreviations

APZ	asset protection zone
BPA	bushfire protection assessment
CLUMP	conservation land use management plan
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 OEHS from April 2011)
DEWHA	Commonwealth Department of Environment, Water, Heritage & the Arts (superseded by SEWPAC)
DOE	Commonwealth Department of Environment
EEC	endangered ecological community
EPA	Environmental Protection Agency
EP&A Act	<i>Environmental Planning and Assessment Act</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act</i>
ESMP	ecological site management plan
FF	flora and fauna assessment
FM Act	<i>Fisheries Management Act</i>
FMP	fuel management plan
HTA	habitat tree assessment
IPA	inner protection area
LEP	Local Environment Plan
LGA	local government area
NES	national environmental significance
NPWS	NSW National Parks and Wildlife Service
NSW DPI	NSW Department of Primary Industries
OEHS	Office of Environment and Heritage (Part of the NSW Department of Premier and Cabinet)
OPA	outer protection area
PBP	<i>Planning for bushfire protection 2006</i>
POM	plan of management
RF Act	<i>Rural Fires Act</i>
RFS	NSW Rural Fire Service
ROTAP	rare or threatened Australian plants
SEPP 44	<i>State Environmental Protection Policy No 44 – Koala Habitat Protection</i>
SEWPAC	Commonwealth Dept. of Sustainability, Environment, Water, Population & Communities (superseded by DOE)
SIS	species impact statement
SULE	safe useful life expectancy
TPO	tree preservation order
TPZ	tree preservation zone
TRRP	tree retention and removal plan
TSC Act	<i>Threatened Species Conservation Act</i>
VMP	vegetation management plan

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Introduction

1

Travers bushfire & ecology has been engaged to undertake a flora and fauna assessment for a proposed development within Lot 5 DP 222736, Number 119, Cliff Drive, Katoomba. The entire area of this lot as well as the adjacent Lot 1 DP 1121828 have been subject to varying survey effort and the combined area will be referred to as the 'study area'. In some circumstances survey has however extended slightly beyond this boundary particularly for Eastern Pygmy Possum (EPP) target surveys across Cliff Drive to the south, this area thus referred to as the 'extended EPP study area'.

The proposed development area incorporating the development footprints and asset protection zones (APZs) which will cause direct impacts such as habitat removal or modification will be referred to as the 'subject site'.

Two (2) previous ecological surveys were undertaken within the study area by *Conacher Travers* in 2006 and 2007, while a further two (2) were undertaken by *Travers bushfire and ecology* in 2011. The combined survey effort and results for these previous surveys have been incorporated into this report.

1.1 Aims of the assessment

The aims of the flora and fauna assessment are to:

- Carry out a botanical survey to describe the vegetation communities and their conditions
- Carry out a fauna survey for the detection and assessment of fauna and their habitats
- Complete targeted surveys for threatened species, populations and ecological communities
- Prepare a flora and fauna impact assessment in accordance with the requirements of the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*, the *Threatened Species Conservation Act 1995 (TSC Act)*, the *Fisheries Management Act 1994 (FM Act)* and Threatened species assessment guidelines, the assessment of significance (DECC 2007)

1.2 Statutory requirements

1.2.1 Legislation – TSC vs BC Acts

Local developments in the following western Sydney local government areas will have 12 months from 25 August 2017 to submit an application under the previous legislation: the local government areas of Camden, City of Campbelltown, City of Fairfield, City of Hawkesbury, City of Liverpool, City of Penrith and Wollondilly. The NSW Government may identify (by 25 February 2018) additional areas where this transitional period until 25 August 2018 applies.

Local developments in all other areas will have six months from 25 August 2017 to submit a development application under the previous legislation.

For local developments where a Species Impact Statement is required to be submitted, and the requirements for the preparation of the statement were issued before 25 August 2017, the application must be submitted by 25 August 2018.

The study area is located in The Hills and may be lodged under the TSC Act under the savings and transitional provisions until the 24th of February 2017 as this is a local development and not a major project. The amount of impact is considered low and not warranting a Species Impact Statement.

The Biodiversity Conservation Act (BC Act 2016) and the Regulations (2017) came into effect on the 25th of August, 2017 subject to the saving and transitional provisions. To assist the consent authority, the guidance document on determining Serious and Irreversible Impacts (SAIL's) includes a list of threatened species and threatened ecological communities that may be potential SAIL's. These are often candidates which are listed under the BC Act as critically endangered. OEH has not yet published key threshold criteria for determining SAIL's however this may be available from February 25th 2018.

As the proposal has been finalised and is ready for lodgement by February 24th 2018, the proposal will utilise the savings and transitional provisions for assessment under the TSC Act.

1.2.2 Threatened Species Conservation Act 1995 (TSC Act)

The specific requirements of the *TSC Act* must be addressed in the assessment of impacts on threatened flora and fauna, populations and ecological communities. The factors to be taken into account in deciding whether there is a significant effect are set out in Section 5A of the *EP&A Act* and are based on a 7 part test of significance. 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, a Species Impact Statement (SIS) is required to be prepared.

1.2.3 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.

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

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

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

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

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

A threshold criterion apply to specific NES matters which may determine whether a referral is or is not required, such as for the EPBC listed ecological communities Cumberland Plain Woodland and Shale-Gravel transition Forest. Consultation with DOE 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 1999 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>.

1.3 Transitional provisions – TSC vs BC Acts

1.3.1 Commencement of the Biodiversity Offset Scheme

From 25th February 2018 in most local government areas, any new application for development consent or modification to an approved development under Part 4 of the *Environmental Planning & Assessment Act 1979* (EP&A Act) (not including State Significant Development) will be subject to the biodiversity assessment requirements of the Biodiversity Conservation Act 2016.

Transitional arrangements will continue to apply to activities under Part 5 of the EP&A Act, major projects and mining projects as outlined in the *Biodiversity Conservation (Savings & Transitional) Regulation 2017* (BC (S&T) Regulation).

1.3.2 Additional Interim Designated Areas declared

The Minister for Environment has made an amendment to the BC (S&T) Regulation to declare seven additional local government areas as Interim Designated Areas: Cessnock, Newcastle, Port Stephens, Lake Macquarie, Maitland, Central Coast and Coffs Harbour. In addition, the West Dapto Urban Release Area in the Wollongong local government area has been declared as an Interim Designated Area.

Former planning provisions continue to apply within Interim Designated Areas. Applications for development consent, or modification to an approved development, under Part 4 of the EP&A Act (not including State Significant Development) will continue to be assessed under former planning provisions until the 24 November 2018. This has been extended for an additional three months from 24 August 2018.

'Opt in' by agreement provisions, set out in clause 28(2) of the BC (S&T) Regulation, only apply to Part 4 development in limited circumstances. These include when an Environmental Impact Statement is to be submitted in connection with the application and either assessment requirements have been received or the Secretary of the Department of Planning and Environment determines in writing that the proponent has undertaken substantial environmental assessment. Applicants and consent authorities can also agree to 'opt in' if a Species Impact Statement is to be prepared in connection with the application and assessment requirements have been issued.

Time limits for the submission of the application apply.

1.3.3 Biodiversity certification

Strategic biodiversity certification, a new biodiversity assessment and approval pathway under the *Biodiversity Conservation Act 2016*, is already underway in Western Sydney. It is intended to deliver upfront conservation outcomes when planning for future development. Biodiversity certification will now also be pursued in the Lower Hunter, Central Coast, Coffs Harbour and West Dapto. To provide a simpler transition for these areas, local development will continue to be assessed under the former planning provisions until 24 November 2018.

As the proposal has been finalised and is ready for lodgement by February 24th 2018, the proposal will utilise the savings and transitional provisions for assessment under the TSC Act.

1.4 Proposed works

The proposal is for a five stage development of the existing Katoomba Christian Centre. The development specific to the DA-1 area in the southern half of the study area and subject to this assessment includes the following:

- Demolition of the existing auditorium and construction of a new 3,500 seat auditorium to be used as a place of public worship (an increase of 1,200 people compared the existing facility).
- A new bookshop building to replace the existing bookshop building.
- Seven new breakout spaces/meeting rooms.
- A new reception building with store rooms.
- Demolition of the existing 200 seat dining hall and construction of a new dining hall with 500 seat capacity, kitchen; laundry, storage, reception and administration space;
- A new café fronting Violet Street.
- Demolition of the existing accommodation buildings and construction of new accommodation buildings including six ecolodges and three chalets to provide a total of 390 beds (a net increase of 170 beds); and
- New internal access roads and car parking area.

The concept development layout for the study area is shown in Figure 1.

The proposal includes the implementation of vegetation management for bushfire protection purposes in accordance with the Bushfire Protection Assessment that has been prepared for the site. Fuel management will be required on an ongoing basis to comply with the

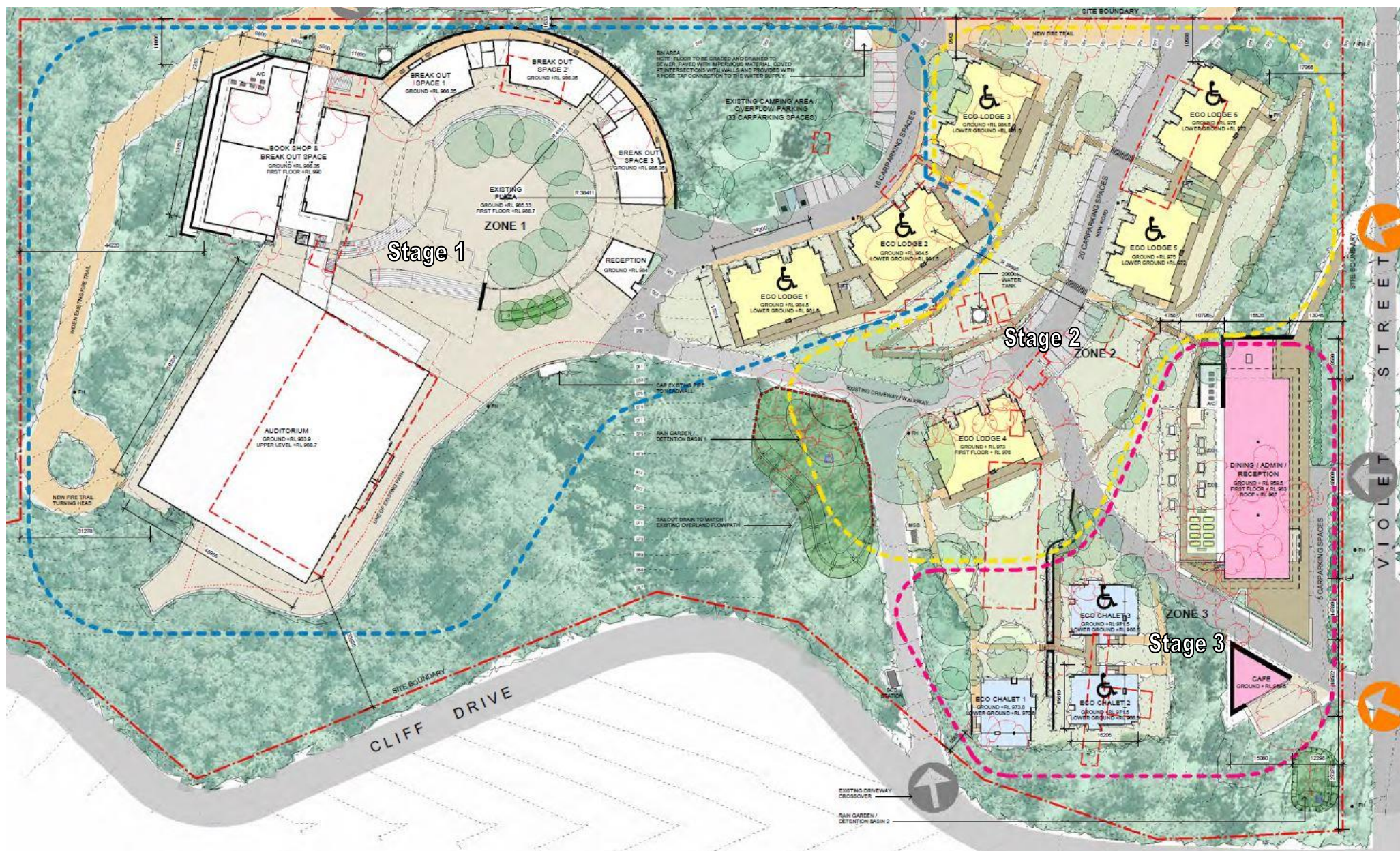
requirements of the *Rural Fires Act (RF Act)*. The entire area of the DA-1 site will be managed as an APZ with the exception of the most southern portions providing Dry Open Forest. The proposed APZs are indicated on the Flora survey effort and results Figure 2.

1.5 Site description

Table 1.1 provides a summary of the planning, cadastral, topographical, and disturbance details of the subject site.

Table 1.1 – Site features

Location	Lot 5 DP 222736 , 119 Cliff Drive, Katoomba
Local government area	Blue Mountains
Grid reference	249550E and 6264450N
Elevation	950-980m AHD
Topography	Situated on the Katoomba plateau close to the steep southern escarpment. Graduating gentle to steep slopes towards plateau drainage lines.
Geology and soils	The geology is characterised by undifferentiated Sandstones of the Triassic Period. Soils are mapped as Medlow Bath (Katoomba 1:100,000 Soil Landscape map sheet (King, 1994)). The landscape is narrow crests and moderately inclined slopes on Narrabeen Group sandstones. Soils are moderately deep, well drained lithosols / siliceous sands.
Catchment and drainage	Overland flow via northern and eastern aspects into Kedumba River which flows into Warragamba River and then into the Nepean River and then the Hawkesbury River.
Vegetation	The majority of the site is dominated by Dry Open Forest (<i>E. piperita</i> , <i>E sieberi</i>), while a small area of Wet Open Forest (<i>E. piperita</i> , <i>E oreades</i>) near the eastern drainage line. The majority of the site's habitat forms an area of patchy remnant vegetation with disjunct connectivity to urban remnant habitats to the west, north and east. The southern portion of the subject site contains relatively undisturbed vegetation connected to the northern boundary (cliff line) of Blue Mountains NP.
Existing land use	Place of public worship and tourist and visitor accommodation
Clearing	Clearing has occurred within portions of the site. Some areas of bushland are represented by canopy only. Approximately 20% of the Study Area contains relatively undisturbed native vegetation.





Survey Methodology

2

2.1 Information collation, technical resources, desktop assessments, specialist identification and licences

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

Client documents reviewed include:

- Development Application drawings prepared by *NBRS Architecture*

Standard technical resources utilised:

- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities 2004* (working draft), Department of Environment and Conservation (DEC)
- Aerial photographs (Google Earth Pro / Nearmap / Spatial Information Exchange)
- Topographical maps (scale 1:25,000)
- *Threatened Species Conservation Act 1995* (TSC Act)
- *Fisheries Management Act 1994* (FM Act)
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- Rare or Threatened Australian Plants (ROTAP)
- Vegetation mapping (Blue Mountains City Council – web based Interactive Maps June 2016)

Desktop assessment:

To determine the likely and actual occurrence of flora and fauna species and plant communities within the study area, desktop assessments were undertaken including:

- **A literature review** – A review of readily available literature for the area was undertaken to obtain reference material and background information for this survey. This includes two previous ecological surveys undertaken within the study area by *Conacher Travers* in 2006 and 2007 and a further two by *Travers bushfire and ecology* in 2011. The combined survey effort and results for these previous surveys have been incorporated into this report.
- **A data search** – A search of the *Atlas of NSW Wildlife* (OEH 2016) was undertaken to identify records of threatened flora and fauna species located within a 10km radius of the site. Searches were also undertaken on the DOE – ‘protected matters search tool’ website to generate a report that will help determine whether matters of national environmental significance or other matters protected by the EPBC Act are likely to occur in the area of interest. The search was broadened to a 10km radius like the Atlas search. These two searches combined, enabled the preparation of a list of threatened flora and fauna species that could potentially occur within the habitats found on the site (Tables A2.1, A2.2 and A2.3).

Accuracy of identification:

Specimens of plants not readily discernible in the field were collected for identification. Structural descriptions of the vegetation were made according to Specht *et al* (1995).

Scats collected during survey were sent to Barbara Triggs for analysis.

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 Department of Agriculture. 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.

2.2 Flora survey methodology

Two surveys within the study area were undertaken by *Conacher Travers* in 2006, 2007 and a further two by *Travers bushfire and ecology* in 2011. The combined survey effort and results for these previous surveys have been incorporated into this report.

Site flora survey effort and the location of techniques employed are outlined in Table 2.2 and depicted on Figure 2.

A review of the Atlas of NSW Wildlife (OEH 2016) and also the Protected Matters Search Tool on the DoE website were undertaken prior to the botanical survey to identify threatened species previously recorded within 10km of the subject site and to determine habitats where targeted searches were required.

In addition, a site inspection was undertaken on between 09:45hrs and 15:30hrs on 2 June, 2016. A random meander search was undertaken in accordance with Cropper (1993) throughout the entire Study Area to search for threatened species known in the locality or with potential habitat within the site. All species within 3m either side of the meander were noted. This meander was also used to create a broad species list, map current vegetation boundaries, note vegetation condition and to verify previous vegetation mapping and descriptions.

Whilst some exotic landscaping species were noted and identified during the random meander searches, no specific survey was undertaken for these species (most of which will not appear on the species list in section 3).

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 3a.

Current standard fauna survey techniques employed by *Travers bushfire & ecology* in line with relevant survey guidelines as well as current survey knowledge are provided in Appendix 1. Fauna survey techniques that have been tailored to the site are provided in Section 2.6.

2.4 Field survey effort

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

Table 2.1 – Fauna survey effort

Fauna group	Date	Weather conditions	Survey technique(s)	Survey effort / time (24hr)
Diurnal birds	5/2/07	0/8 cloud, no wind, no rain, temp 30°C	Diurnal Opportunistic	2hrs 30min 16.30 - 19.00
	6/2/07	0/8 cloud, no wind, no rain, heavy fog, temp 18°C	Diurnal Opportunistic	2hrs 7.30 - 9.30
	6/2/07	7/8 cloud, light SW wind, no rain, temp 27°C	Diurnal Opportunistic	2hrs 16.30 - 18.30
	7/2/07	8/8 cloud, light SW wind, no rain, temp 17°C	Diurnal Opportunistic	1hr 30min 6.30 - 8.00
	7/2/07	6/8 cloud, no wind, no rain, temp 24°C	Diurnal Opportunistic	1hr 9.00 - 10.00
	7/2/07	7/8 cloud, no wind, no rain, temp 25°C	Diurnal Opportunistic	2hrs 14.00 - 16.00
	8/2/07	0/8 cloud, no wind, no rain, temp 20°C	Diurnal Opportunistic	1hr 30min 7.00 - 8.30
	25/5/16	0/8 cloud, no wind, no rain, temp 14-11°C	Diurnal census / opportunistic	6hrs 11.30 - 17.30
	26/5/16	8/8 cloud, mod SW wind, no rain, temp 8°C	Diurnal census	1hr 9.00 - 10.00
	5/10-10/11/16	8/8 cloud, mod SW wind, light showers, temp 9°C	Diurnal census / opportunistic	2hrs 15min 10.30 - 12.45
		Various	Surveillance cameras x20	720 camera day/nights
Nocturnal birds	5/2/07	0/8 cloud, no wind, no rain, temp 25°C	Owl call playback	45min 20.30 - 21.15
	6/2/07	8/8 cloud, light SW wind, no rain, temp 19°C	Spotlighting	1hr 10min 20.30 - 21.40
			Owl call playback	45min 20.30 - 21.15
	25/5/16	Fine 7/8 cloud, mod W wind, no rain, temp 11-8°C	Spotlighting	1hr 20.30 - 21.30
			Spotlighting	3hr 10min 17.50 - 21.00
			Call playback (Section 2.5 species)	Commenced @ 18.20
Arboreal mammals	5/2/07	0/8 cloud, light NW wind, no rain, temp 25°C	Spotlighting	1hr 10min 20.30 - 21.40
	5/2/07	0/8 cloud, light NW wind, no rain, heavy fog, temp 20°C	5 x type A & B Elliott trap (5 transects)	25 trap nights
	6/2/07	8/8 cloud, light SW wind, no rain, temp 19°C	Spotlighting	1hr 20.30 - 21.30
	6/2/07	8/8 cloud, light SW wind, no rain, temp 15°C	5 x type A & B Elliott trap (5 transects)	25 trap nights
	7/2/07	8-0/8 cloud, light NW wind, early storm, temp 15°C	5 x type A & B Elliott trap (5 transects)	25 trap nights
	25/5/16	Fine 7/8 cloud, mod W wind, no rain, temp 11-8°C	Spotlighting	3hr 10min 17.50 - 21.00
	25/5-21/6/16	Various (survey effort counted only for first 5 nights)	Surveillance cameras x4	20 camera day/nights
	5/10-10/11/16	Various	Surveillance cameras x20	720 camera day/nights
	7/6/17	8/8 cloud, S winds, showers, temp 3-8°C	Eastern Pygmy Possum habitat assessment	5hrs

Fauna group	Date	Weather conditions	Survey technique(s)	Survey effort / time (24hr)
Terrestrial mammals	5/2/07	0/8 cloud, no wind, no rain, temp 25°C	Spotlighting	1hr 10min 20.30 - 21.40
	5/2/07	8/8 cloud, light NW wind, no rain, temp 20°C	5 x type A & B Elliott trap (5 transects)	25 trap nights
	5/2/07		5 x Cage traps (2 transects)	10 cage trap nights
	6/2/07	8/8 cloud, light SW wind, no rain, temp 19°C	Spotlighting	1hr 20.30 - 21.30
	6/2/07	8/8 cloud, light SW wind, no rain, temp 15°C	5 x type A & B Elliott trap (5 transects)	25 trap nights
	6/2/07		5 x Cage traps (2 transects)	10 cage trap nights
	7/2/07	8-0/8 cloud, light NW wind, early storm, temp 15°C	5 x type A & B Elliott trap (5 transects)	25 trap nights
	7/2/07		5 x Cage traps (2 transects)	10 cage trap nights
	25/5/16	Fine 7/8 cloud, mod W wind, no rain, temp 11-8°C	Spotlighting	3hr 10min 17.50 - 21.00
	25/5-21/6/16	Various (survey effort counted only for first 5 nights)	Surveillance cameras x4	20 camera day/nights
	5/10-10/11/16	Various	Surveillance cameras x20	720 camera day/nights
Bats	5/2/07	0/8 cloud, light NE wind, no rain, temp 23°C	Anabat II x2	1hr 20min 20.10 - 21.40
	6/2/07	8/8 cloud, light SW wind, no rain, temp 19°C	Anabat II x2	1hr 20.30 - 21.30
	25/5/16	Fine 7/8 cloud, mod W wind, no rain, temp 11-8°C	Spotlighting Anabat SD-1 (Passive monitoring) x1 SM4BAT (Passive monitoring) x2	3hr 10min 17.50 - 21.00 Overnight from 17.40 Overnight from 17.40
Reptiles	5/2/07	0/8 cloud, no wind, no rain, temp 30°C	Diurnal Opportunistic	2hrs 30min 16.30 - 19.00
	5/2/07	0/8 cloud, no wind, no rain, temp 25°C	Spotlighting	1hr 10min 20.30 - 21.40
	6/2/07	0/8 cloud, no wind, no rain, heavy fog, temp 18°C	Diurnal Opportunistic	2hrs 7.30 - 9.30
	6/2/07	7/8 cloud, light SW wind, no rain, temp 27°C	Diurnal Opportunistic	2hrs 16.30 - 18.30
	6/2/07	8/8 cloud, light SW wind, no rain, temp 19°C	Spotlighting	1hr 20.30 - 21.30
	7/2/07	8/8 cloud, light SW wind, no rain, temp 17°C	Diurnal Opportunistic	1hr 30min 6.30 - 8.00
	7/2/07	6/8 cloud, no wind, no rain, temp 24°C	Diurnal Opportunistic	1hr 09.00 - 10.00
	7/2/07	7/8 cloud, no wind, no rain, temp 25°C	Diurnal Opportunistic	2hrs 14.00 - 16.00
	8/2/07	0/8 cloud, no wind, no rain, temp 20°C	Diurnal Opportunistic	1hr 30min 7.00 - 8.30
	25/5/16	0/8 cloud, no wind, no rain, temp 14-11°C	Habitat search, opportunistic	6hrs 11.30 - 17.30
	5/10-10/11/16	Various	Surveillance cameras x20	720 camera day/nights
Amphibians	5/2/07	0/8 cloud, no wind, no rain, temp 25°C	Spotlighting & call identification	1hr 10min 20.30 - 21.40
	6/2/07	8/8 cloud, light SW wind, no rain, temp 19°C	Spotlighting & call identification	1hr 20.30 - 21.30
	25/5/16	Fine 7/8 cloud, mod W wind, no rain, temp 11-8°C	Spotlighting & call identification	6hrs 11.30 - 17.30

Table 2.2 – Flora survey effort

Flora survey	Survey technique(s)	Dates
Vegetation communities	Survey of the boundaries of all communities – field verification and aerial photographic interpretation	??/05/2006 05/02/2007 20/08/2011 02/06/2016
	Vegetation condition assessment	02/06/2016
Stratified sampling	20x20m quadrats in all existing bushland or remnant areas	??/05/2006 05/02/2007 20/08/2011 22/06/2016
Target searches	Targeted searches in potential habitats	??/05/2006 05/02/2007 20/08/2011 02/06/2016

2.5 Site specific survey techniques

Diurnal birds

Nine (9) diurnal bird census points were undertaken within the study area. A minimum of 15 minutes of survey was undertaken at each census point in an area radiating out to between 30-50m. Bird census points were selected to give an even spread and representation across the site and its communities (see Figure 3a). 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.

Seeding *Allocasuarina* trees were opportunistically searched for chewed cones indicating foraging activity by Glossy Black-Cockatoo.

Recent surveillance camera surveys across Cliff Drive recorded allot of diurnal bird activity and therefore has been incorporated into the diurnal bird effort.

Nocturnal birds

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

Arboreal and terrestrial mammals

Survey undertaken by *Conacher Travers* in 2007 incorporated the use of trapping effort as outlined below:

Elliott trapping

Elliott type A and B traps were used for trapping arboreal and terrestrial mammals amounting to 75 arboreal trap nights and 70 terrestrial trap nights.

Arboreal trap-lines using 10-20 metre separations were placed in the most suitable trees along approximately 80 metre transects. Elliott type A traps were placed onto platforms that

were attached to the trunks of trees 2-3 metres above the ground at an incline of 10 degrees to facilitate drainage during inclement weather. A mixture of honey and water was then sprayed onto the trunk 3-5 metres above the trap and around the platform as a lure.

Terrestrial trap-lines of type A and B Elliott traps using 10-20 metre separations were placed along the same line as the arboreal traps in the most suitable terrestrial habitats.

The traps were baited with a mixture of rolled oats, honey and peanut butter.

Five (5) trap-lines were set on the nights of February 5, 6, and 7, 2007. The location of the trap-lines is shown in Figure 3a. Each trap-line consisted of a mixture of 5 type A and B arboreal traps and a mixture of 5 type A and B terrestrial traps.

Cage trapping

Cage trapping was conducted to target the threatened species, Southern Brown Bandicoot (*Isodon obesulus*) and Spotted-tailed Quoll (*Dasyurus maculatus*). Two cage trap lines consisting of 5 traps each were set in suitable areas of dense shrub and ground cover. The standard cage traps used were 18cm x 18cm x 45cm long. The location of the trap-lines is shown in Figure 3a. The cage traps were baited with a mix of honey, oats, peanut butter and sardines. Cage trapping consisted of a total of 30 trap nights.

Surveillance cameras

Four (4) surveillance cameras were placed as part of May 2016 surveys to target presence of Spotted-tailed Quoll. Bait placed in front of cameras included raw chicken and sardines. Nearby trees were also smeared with jelly meat cat food as a lure. Following the recording of Eastern Pygmy Possum at one of the camera stations further surveillance camera surveys were undertaken.

Target Eastern Pygmy Possum surveillance camera surveys included the deployment of twenty (20) cameras across Cliff Drive to the south and above the cliff line in October-November 2016. These cameras were placed as a grid at a density of ten (10) cameras per hectare which is the suggested amount indicated by the *Survey guidelines for Australia's threatened mammals - EPBC Act 1999*. Each of these camera sites were baited with rolled oats, peanut butter and honey in a bait canister pegged to the ground. A high concentration of honey was in the mix as well as poured on surrounding trees to target EPP. Four camera sites were also baited with chicken and Sardines to target the Spotted-tailed Quoll. Camera locations are shown on Figure 3b.

Given that no EPP were recorded on surveillance cameras deployed in connective habitat to the south of Cliff Drive a conclusion on EPP was to be based on further habitat assessment. The habitat assessment area was applied to the entire Lot 5 study area as well as connective natural habitat extending to the south and bound within Cliff Drive (adjacent to the EPP recorded location). Figure 3c shows the EPP habitat study area.

Areas of *low*, *moderate*, *high* and *very high* areas of EPP habitat within the EPP habitat study area was fundamentally determined based on the presence of a eucalypt overstorey, the diversity and extent of flowering understorey shrub species for foraging (particularly banksias), the density of available hollows and the degree of fragmentation. These classes were considered as a reflection also of potential to occur.

Therefore any vegetation within the EPP habitat study area not containing a natural understorey or containing predominantly exotic trees were not included in the mapped habitat. Nine (9) 20x20m habitat assessment quadrats were undertaken within each of the

resultant patches of potential habitat providing an even spread between. Two areas of vegetation were narrow and therefore a 10x40m quadrat was applied.

Within each quadrat the percentage presence of each flowering overstorey tree (*Eucalypt*) and understorey vegetation (*Banksia* and *Acacia*) were estimated. These calculations are provided in table format on Figure 3c. A vegetation quality rating of low, moderate or high was identified from these combined values.

The number of available hollows per quadrat was also estimated and these results also are added to the Figure 3c table to achieve the final adjusted vegetation rating of *low*, *moderate*, *high* or *very high*. *Very high* quality habitat generally contained both Sydney peppermint and Silvertop Ash in the overstorey, a high representation of different banksia species and more than four hollows per quadrat area (400m²). This rating also considered the fragmented nature of the patch from the consolidated habitat to the south where the individual EPP was initially recorded. In this case quality diminished to the north.

All hollows were surveyed by GPS within the subject site area where an understorey is present except for the patch adjacent to Violet Street. The hollow study area is indicated on Figure 3c.

Significant Habitat Trees

Significant habitat trees were identified by GPS during the field survey. Significant habitat trees are defined as trees containing large (30+cm) sized hollows, more than one good quality medium (10-30cm) sized hollow, or otherwise found to be of unique habitat benefit (eg. glider sap feed tree, raptor nest, or owl roost). Given the recording of Gang-gang Cockatoo, significant habitat trees were specifically identified where considered to have potential use by this species for nesting.

Data such as the number of hollows present in each size category (or other reason for selection), tree species, diameter at breast height, canopy spread and overall height were collected. A summary of significant habitat tree results is provided in Table 4.3 and locations are indicated on Figure 3a.

2.6 Survey limitations

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

Flora survey limitations

The species list does not include all household garden / exotic 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 identifiable when flowering.

It is not expected that there are any limitations to threatened flora species survey which could change the outcomes of significance assessment as survey has been undertaken at a time when most are readily flowering or can be observed.

Fauna survey limitations

Several years have lapsed since initial fauna trapping effort was undertaken in 2007. Given this, updated technology has allowed the additional use of surveillance cameras during the 2016 surveys to target Spotted-tailed Quoll and Eastern Pygmy Possum. This survey initially included placement of three (3) surveillance cameras around the southern extent of the study area. One of these recorded Eastern Pygmy Possum thus prompting a higher concentration of surveillance camera survey on the other side of Cliff Drive to the south. This concentrated effort has not been undertaken within the southern study area remnants that may also provide habitat for EPP (refer to Figure 3c). A detailed EPP habitat assessment was undertaken immediately surrounding the proposed auditorium to identify hollows and suitable refuges (see Sections 2.5 and 4.3.4). Full inspection of hollows was not able to be completed by available habitat resources were mapped.

The EPP habitat assessment incorporated a habitat tree survey within the area indicated on Figure 3c. Remaining portions of the subject site that have not been subject to habitat tree survey include the northern patch of vegetation adjacent to Violet Street indicated on Figure 3c as well as all remaining areas unshaded on this map (areas with a managed understorey).

The late May 2016 survey within the study area was undertaken during a cold and windy late afternoon and night period. These conditions likely had an effect on the detectability and/or presence of diurnal birds, reptiles and microbat species. With respect to microbats, it is expected that greater activity and higher species diversity would be recorded during a complete night's recording over warmer months.

The threatened Gang-gang Cockatoo and Little Lorikeet have both been recorded during surveys however there has been no recent surveys undertaken during the nesting period for these species (October and January) to effectively rule out nesting activity. Given that Little Lorikeet has not been recorded in recent years and the sub-optimal nature of hollows for Gang-gang Cockatoo within the existing landscaped areas of the site, both species are not expected to utilise the subject site for important nesting habitat.



Survey Results

3

3.1 Flora results

3.1.1 Flora species

The plants observed within the vegetation communities of the study area are listed in Table 3.1 below.

Table 3.1 – Flora observations for the study area

Family	Scientific Name	Common Name
TREES		
Mimosoideae	<i>Acacia dealbata</i>	Silver Wattle
Mimosoideae	<i>Acacia elata</i>	Mountain Cedar Wattle
Mimosoideae	<i>Acacia melanoxylon</i>	Blackwood
Proteaceae	<i>Banksia serrata</i>	Old Man Banksia
Cunoniaceae	<i>Callicoma serratifolia</i>	Black Wattle
Cunoniaceae	<i>Ceratopetalum gummiferum</i>	NSW Christmas Bush
Cyatheaceae	<i>Cyathea australis</i>	Rough Tree-fern
Eleocarpaceae	<i>Elaeocarpus reticulatus</i>	Blueberry Ash
Myrtaceae	<i>Eucalyptus blaxlandii</i>	Blaxland's Stringybark
Myrtaceae	<i>Eucalyptus dalrympleana</i>	Mountain Gum
Myrtaceae	<i>Eucalyptus mannifera</i> subsp. <i>gullickii</i>	-
Myrtaceae	<i>Eucalyptus oreades</i>	Blue Mountains Ash
Myrtaceae	<i>Eucalyptus piperita</i>	Sydney Peppermint
Myrtaceae	<i>Eucalyptus radiata</i>	Narrow-leaved Peppermint
Myrtaceae	<i>Eucalyptus sclerophylla</i>	Scribbly Gum
Myrtaceae	<i>Eucalyptus sieberi</i>	Silvertop Ash
Myrtaceae	<i>Eucalyptus sparsifolia</i>	Narrow-leaved Stringybark
Phyllanthaceae	<i>Glochidion ferdinandi</i> var. <i>ferdinandi</i>	Cheese Tree
Oleaceae	<i>Notelaea longifolia</i>	Mock Olive, Large Mock-olive
Pinaceae	<i>Pinus elliotti</i> *	Slash Pine
Pittosporaceae	<i>Pittosporum undulatum</i>	Sweet Pittosporum
SHRUBS		
Mimosoideae	<i>Acacia floribunda</i>	White Sally
Mimosoideae	<i>Acacia longifolia</i> var. <i>longifolia</i>	Sydney Golden Wattle
Mimosoideae	<i>Acacia obtusifolia</i>	Blunt-leaf Wattle
Mimosoideae	<i>Acacia suaveolens</i>	Sweet Scented Wattle
Mimosoideae	<i>Acacia terminalis</i> subsp. <i>angustifolia</i>	-
Mimosoideae	<i>Acacia ulicifolia</i>	Prickly Moses
Casuarinaceae	<i>Allocasuarina distyla</i>	-
Myrtaceae	<i>Baeckea linifolia</i>	Weeping Baeckea
Proteaceae	<i>Banksia cunninghamii</i> subsp. <i>cunninghamii</i>	-
Proteaceae	<i>Banksia ericifolia</i> subsp. <i>ericifolia</i>	Heath-leaved Banksia
Proteaceae	<i>Banksia spinulosa</i> var. <i>collina</i>	Hairpin Banksia
Rutaceae	<i>Boronia microphylla</i>	Small-leaved Boronia
Faboideae	<i>Bossiaea heterophylla</i>	Variable Bossiaea

Family	Scientific Name	Common Name
Epacridaceae	<i>Brachyloma daphnoides</i>	Daphne Heath
Loganiaceae	<i>Buddleja davidii</i> *	Butterfly Bush, Buddleja
Myrtaceae	<i>Callistemon citrinus</i>	Crimson Bottlebrush
Asteraceae	<i>Cassinia aculeata</i>	Dolly Bush
Polygalaceae	<i>Comesperma ericinum</i>	Pyramid Flower
Proteaceae	<i>Conospermum ericifolium</i>	-
Proteaceae	<i>Conospermum taxifolium</i>	Coneseed
Faboideae	<i>Cytisus scoparius</i> subsp. <i>scoparius</i> *	Scotch or English Broom
Faboideae	<i>Daviesia ulicifolia</i>	Gorse Bitter Pea
Faboideae	<i>Dillwynia retorta</i>	Eggs and Bacon
Epacridaceae	<i>Dracophyllum secundum</i>	-
Epacridaceae	<i>Epacris microphylla</i>	Coral Heath
Epacridaceae	<i>Epacris obtusifolia</i>	Blunt-leaf Heath
Epacridaceae	<i>Epacris pulchella</i>	Wallum Heath
Proteaceae	<i>Grevillea acanthifolia</i> subsp. <i>acanthifolia</i>	Bog Grevillea
Proteaceae	<i>Grevillea sericea</i>	Pink Spider Flower
Proteaceae	<i>Grevillea</i> sp. (cultivar)	-
Proteaceae	<i>Hakea dactyloides</i>	Broad-leaved Hakea
Proteaceae	<i>Hakea laevipes</i>	-
Proteaceae	<i>Hakea salicifolia</i>	Willow Hakea
Proteaceae	<i>Hakea teretifolia</i>	Dagger Hakea
Monimiaceae	<i>Hedycarya angustifolia</i>	Native Mulberry
Dilleniaceae	<i>Hibbertia acicularis</i>	Prickly Guinea Flower
Dilleniaceae	<i>Hibbertia serpyllifolia</i>	Hairy Guinea Flower
Faboideae	<i>Hovea linearis</i>	-
Aquifoliaceae	<i>Ilex aquifolium</i> *	English Holly
Proteaceae	<i>Isopogon anemonifolius</i>	Flat-leaved Drumsticks
Myrtaceae	<i>Kunzea ambigua</i>	Tick Bush
Myrtaceae	<i>Kunzea capitata</i>	Pink Buttons
Proteaceae	<i>Lambertia formosa</i>	Mountain Devil
Santalaceae	<i>Leptomeria acida</i>	Native Currant
Myrtaceae	<i>Leptospermum continentale</i>	Prickly Tea-tree
Myrtaceae	<i>Leptospermum grandifolium</i>	Woolly Tea-tree
Myrtaceae	<i>Leptospermum juniperinum</i>	Prickly Tea-tree
Myrtaceae	<i>Leptospermum polygalifolium</i> subsp. <i>polygalifolium</i>	Tantoon
Myrtaceae	<i>Leptospermum squarrosum</i>	-
Myrtaceae	<i>Leptospermum trinervium</i>	Slender Tea-tree
Epacridaceae	<i>Leucopogon ericoides</i>	Pink Beard-heath
Epacridaceae	<i>Leucopogon lanceolatus</i>	Lance-leaf Beard-heath
Oleaceae	<i>Ligustrum sinense</i> *	Small-leaved Privet
Proteaceae	<i>Lomatia myricoides</i>	River Lomatia
Proteaceae	<i>Lomatia silaifolia</i>	Crinkle Bush
Faboideae	<i>Mirbelia platylobioides</i>	-
Asteraceae	<i>Olearia elliptica</i> subsp. <i>elliptica</i>	Sticky Daisy-bush
Asteraceae	<i>Olearia erubescens</i>	Silky Daisy Bush
Asteraceae	<i>Olearia quercifolia</i>	Oak-leaved Olearia
Asteraceae	<i>Ozothamnus diosmifolius</i>	Ball Everlasting
Proteaceae	<i>Persoonia chamaepitys</i>	Mountain Geebung
Proteaceae	<i>Persoonia lanceolata</i>	Lance-leaved Geebung
Proteaceae	<i>Persoonia laurina</i>	Laurel Geebung
Proteaceae	<i>Persoonia levis</i>	Broad-leaved Geebung
Proteaceae	<i>Persoonia mollis</i> subsp. <i>nectens</i>	-
Proteaceae	<i>Persoonia myrtilloides</i>	-
Proteaceae	<i>Persoonia myrtilloides</i> subsp. <i>myrtilloides</i>	Myrtle Geebung
Proteaceae	<i>Petrophile pedunculata</i>	Conesticks

Family	Scientific Name	Common Name
Proteaceae	<i>Petrophile pulchella</i>	Conesticks
Euphorbiaceae	<i>Phyllanthus hirtellus</i>	Thyme Spurge
Faboideae	<i>Phyllota phyllicoides</i>	Heath Phyllota
Pittosporaceae	<i>Pittosporum spinescens</i>	Orange Thorn
Faboideae	<i>Platylobium formosum</i> subsp. <i>formosum</i>	Handsome Flat-pea
Apiaceae	<i>Platysace lanceolata</i>	Lance-leaf Platysace
Apiaceae	<i>Platysace linearifolia</i>	Narrow-leafed Platysace
Faboideae	<i>Podolobium ilicifolium</i>	Prickly Shaggy Pea
Araliaceae	<i>Polyscias sambucifolia</i>	Elderberry Panax
Amygdalaceae	<i>Prunus laurocerasus</i> *	Cherry Laurel
Faboideae	<i>Pultenaea scabra</i>	-
Faboideae	<i>Pultenaea tuberculata</i>	-
Rosaceae	<i>Rubus anglocandicans</i> *	Blackberry
Epacridaceae	<i>Styphelia tubiflora</i>	Red Five-corner
Proteaceae	<i>Symphionema montanum</i>	-
Proteaceae	<i>Telopea speciosissima</i>	Waratah
GROUNDCOVERS		
Rosaceae	<i>Acaena novae-zelandiae</i>	Biddy Biddy
Asteraceae	<i>Actinotus minor</i>	Lesser Flannel Flower
Alliaceae	<i>Agapanthus praecox</i> subsp. <i>orientalis</i> *	-
Euphorbiaceae	<i>Amperea xiphoclada</i>	-
Poaceae	<i>Anthoxanthum avenaceus</i>	Oat Speargrass
Poaceae	<i>Anthoxanthum odoratum</i> *	Sweet Vernal Grass
Asteraceae	<i>Arrhenechthites mixta</i>	Purple Fireweed
Aspleniaceae	<i>Asplenium flabellifolium</i>	Necklace Fern
Poaceae	<i>Austrodanthonia</i> spp.	A Wallaby Grass
Poaceae	<i>Austrostipa pubescens</i>	Tall Speargrass
Poaceae	<i>Austrostipa rudis</i>	Bamboo Grass
Blechnaceae	<i>Blechnum nudum</i>	Fishbone Water Fern
Cyperaceae	<i>Caustis flexuosa</i>	Curly Wig
Apiaceae	<i>Centella asiatica</i>	Swamp Pennywort
Sinopteridaceae	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	Poison Rock Fern
Asteraceae	<i>Cirsium vulgare</i> *	Spear Thistle
Asteraceae	<i>Conyza bonariensis</i> *	Flax-leaf Fleabane
Asteraceae	<i>Coronidium scorpioides</i>	Button Everlasting
Iridaceae	<i>Crocasmia X crocosmiiflora</i> *	Montbretia
Orchidaceae	<i>Cryptostylis leptochila</i>	Small Tongue Orchid
Cyperaceae	<i>Cyathochaeta diandra</i>	-
Poaceae	<i>Cynodon dactylon</i>	Common Couch
Cyperaceae	<i>Cyperus eragrostis</i> *	Umbrella Sedge
Cyperaceae	<i>Cyperus gracilis</i>	Slender Flat Sedge
Cyperaceae	<i>Cyperus tenellus</i> *	-
Goodeniaceae	<i>Dampiera stricta</i>	Blue Dampiera
Faboideae	<i>Daviesia alata</i>	-
Poaceae	<i>Deyeuxia parviseta</i>	-
Phormiaceae	<i>Dianella caerulea</i> var. <i>caerulea</i>	Flax Lily
Phormiaceae	<i>Dianella caerulea</i> var. <i>producta</i>	Blue Flax Lily
Phormiaceae	<i>Dianella prunina</i>	-
Phormiaceae	<i>Dianella tasmanica</i>	-
Poaceae	<i>Echinopogon caespitosus</i> var. <i>caespitosus</i>	Tufted Hedgehog Grass
Poaceae	<i>Ehrharta erecta</i> *	Panic Veldtgrass
Poaceae	<i>Entolasia marginata</i>	Bordered Panic
Poaceae	<i>Entolasia stricta</i>	Wiry Panic
Poaceae	<i>Eragrostis brownii</i>	Brown's Lovegrass
Poaceae	<i>Eragrostis leptostachya</i>	Paddock Lovegrass
Cyperaceae	<i>Gahnia microstachya</i>	-

Family	Scientific Name	Common Name
Cyperaceae	<i>Gahnia sieberiana</i>	Red-fruited Saw-sedge
Geraniaceae	<i>Geranium solanderi</i>	Cutleaf Cranesbill
Gleicheniaceae	<i>Gleichenia dicarpa</i>	Pouched Coral Fern
Gleicheniaceae	<i>Gleichenia rupestris</i>	Coral Fern
Haloragaceae	<i>Gonocarpus tetragynus</i>	Poverty Raspwort
Haloragaceae	<i>Gonocarpus teuroides</i>	Raspwort
Goodeniaceae	<i>Goodenia bellidifolia</i>	Daisy-leaved Goodenia
Goodeniaceae	<i>Goodenia heterophylla</i> subsp. <i>heterophylla</i>	Variable Leaved Goodenia
Cyperaceae	<i>Gymnoschoenus sphaerocephalus</i>	Button Grass
Dilleniaceae	<i>Hibbertia aspera</i>	Rough Guinea Flower
Dennstaedtiaceae	<i>Histiopteris incisa</i>	Bat's Wing Fern
Poaceae	<i>Holcus lanatus</i> *	Yorkshire Fog
Violaceae	<i>Hybanthus monopetalus</i>	Slender Violet
Apiaceae	<i>Hydrocotyle laxiflora</i>	Stinking Pennywort
Asteraceae	<i>Hypochaeris radicata</i> *	Flatweed
Juncaceae	<i>Juncus continuus</i>	-
Juncaceae	<i>Juncus prismatocarpus</i>	Branching Rush
Juncaceae	<i>Juncus usitatus</i>	Common Rush
Anthericaceae	<i>Laxmannia gracilis</i>	Slender Wire Lily
Cyperaceae	<i>Lepidosperma filiforme</i>	-
Cyperaceae	<i>Lepidosperma laterale</i>	Variable Sword-sedge
Cyperaceae	<i>Lepidosperma limicola</i>	-
Restionaceae	<i>Lepyrodia scariosa</i>	Scale Rush
Lindsaeaceae	<i>Lindsaea microphylla</i>	Lacy Wedge-fern
Lomandraceae	<i>Lomandra cylindrica</i>	-
Lomandraceae	<i>Lomandra filiformis</i>	Wattle Matt-rush
Lomandraceae	<i>Lomandra glauca</i>	Pale Mat-rush
Lomandraceae	<i>Lomandra gracilis</i>	-
Lomandraceae	<i>Lomandra longifolia</i>	Spiky-headed Mat-rush
Lomandraceae	<i>Lomandra multiflora</i> subsp. <i>multiflora</i>	Many-flowered Mat-rush
Lomandraceae	<i>Lomandra obliqua</i>	Twisted Mat-rush
Lycopodiaceae	<i>Lycopodium deuterodensum</i>	Bushy Clubmoss
Poaceae	<i>Microlaena stipoides</i>	Weeping Grass
Iridaceae	<i>Patersonia glabrata</i>	Leafy Purple-flag
Iridaceae	<i>Patersonia sericea</i>	Wild Iris
Poaceae	<i>Pennisetum clandestinum</i> *	Kikuyu, Kikuyu Grass
Thymelaeaceae	<i>Pimelea linifolia</i>	Slender Rice Flower
Poaceae	<i>Poa sieberiana</i>	Tussock Grass
Rubiaceae	<i>Pomax umbellata</i>	Pomax
Phyllanthaceae	<i>Poranthera corymbosa</i>	-
Euphorbiaceae	<i>Poranthera microphylla</i>	Small Poranthera
Dennstaedtiaceae	<i>Pteridium esculentum</i>	Bracken
Cyperaceae	<i>Ptilothrix deusta</i>	-
Poaceae	<i>Rhytidospermum pallidum</i>	Silvertop Wallaby Grass
Cyperaceae	<i>Schoenus melanostachys</i>	Black Bog Rush
Cyperaceae	<i>Schoenus villosus</i>	-
Selaginallaceae	<i>Selaginella uliginosa</i>	Swamp Selaginella
Asteraceae	<i>Senecio lautus</i> ssp. <i>dissectifolius</i>	Variable Groundsel
Gleicheniaceae	<i>Sticherus flabellatus</i> var. <i>flabellatus</i>	Umbrella Fern
Stylidiaceae	<i>Stylidium graminifolium</i>	Grass Trigger Plant
Poaceae	<i>Tetrarrhena turfosa</i>	-
Osmundaceae	<i>Todea barbara</i>	King Fern
Scrophulariaceae	<i>Veronica plebeia</i>	Creeping Speedwell
Violaceae	<i>Viola hederacea</i>	Ivy-leaved Violet
Campanulaceae	<i>Wahlenbergia</i> spp.	Bluebell
Xanthorrhoeaceae	<i>Xanthorrhoea</i> spp.	-

Family	Scientific Name	Common Name
Apiaceae	<i>Xanthosia pilosa</i>	Woolly Xanthosia
WATERPLANTS		
Cyperaceae	<i>Baumea rubiginosa</i>	Twig Rush
Restionaceae	<i>Empodisma minus</i>	-
CLIMBERS		
Pittosporaceae	<i>Billardiera scandens</i>	Hairy Appleberry
Lauraceae	<i>Cassytha glabella</i>	-
Lauraceae	<i>Cassytha pubescens</i>	Common Devil's Twine
Vitaceae	<i>Cissus hypoglauca</i>	Water Vine
Luzuriagaceae	<i>Eustrephus latifolius</i>	Wombat Berry
Luzuriagaceae	<i>Geitonoplesium cymosum</i>	Scrambling Lily
Faboideae	<i>Hardenbergia violacea</i>	False Sarsparilla
Araliaceae	<i>Hedera spp.*</i>	-
Dilleniaceae	<i>Hibbertia dentata</i>	Twining Guinea Flower
Caprifoliaceae	<i>Lonicera japonica*</i>	Japanese Honeysuckle
Asclepiadaceae	<i>Marsdenia rostrata</i>	Common Milk Vine
Bignoniaceae	<i>Pandorea pandorana</i>	Wonga Vine
Apocynaceae	<i>Parsonsia straminea</i>	Common Silkpod
Smilacaceae	<i>Smilax australis</i>	Lawyer Vine
Smilacaceae	<i>Smilax glycyphylla</i>	Sarsaparilla
* Denotes Exotic Species		
TS Denotes Threatened Species		

3.1.2 Vegetation communities

Seven (7) vegetation communities were identified within the study area using aerial photographic interpretation and extensive ground truthing:

1. Dry Open Forest (*Eucalyptus piperita* & *E. sieberi*)
2. Moist Gully Forest (*E. dalrympleana*, *E. piperita*, *E. sieberi*, *E. oreades*)
3. Moist Open Forest (*E. blaxlandii*, *E. piperita*, *E. sieberi*)
4. Fernland
5. Hanging Swamp
6. Moist Open Forest (*E. mannifera*, *E. radiata*)
7. Disturbed Land with Scattered Trees and Garden Beds

The extent and location of vegetation communities are shown in Figure 2.

1. Dry Open Forest (*Eucalyptus piperita* & *E. sieberi*)

Occurrence - This is the dominant vegetation community throughout the study area and covers approximately 2.34 ha within the site boundary of land subject to this development application.

Structure - Open Forest with a canopy cover of approximately 25 to 45 % and height of up to 25 metres. The understorey consists of a moderate shrub layer to 3 metres high and sparse to moderate groundcover of herbs, ferns and grasses.

Disturbances - The majority of this vegetation community has been highly disturbed by continued underscrubbing of the understorey vegetation, construction of numerous tracks and infrastructure associated with the existing development and moderate incursions by exotic weed species.

Variations - This community contains a number of minor variations throughout the site. Within the south-western portion of the site associated with the slightly higher elevation, the canopy is dominated by *Eucalyptus sieberi* (Silvertop Ash) with scattered occurrences of *Eucalyptus sclerophylla* (Scribbly Gum) rather than *Eucalyptus piperita* (Sydney Peppermint). Within the eastern extent of this community there is a gradual transition within the Moist Riparian Forest situated along the ephemeral drainage lines, resulting in a predominately ferny understorey and presence of a slightly higher proportion of moisture tolerant understorey species. There is also a relatively undisturbed variation of this community within the far southeast of the subject site.

Classification - This vegetation community corresponds to Map Unit 11A - *Eucalyptus sieberi* – *E. piperita* Open-forest/Woodland as described within the Blue Mountains City Council's "Native Vegetation Mapping in the Blue Mountains 1999-2002". This vegetation type is not classified as a Scheduled Vegetation Community within the Blue Mountains LGA.

This vegetation community is not commensurate with any Endangered Ecological Community as listed within the NSW TSC Act (1995) or the Commonwealth EPBC Act (1999).



Photo 1 - Dry Open Forest (*Eucalyptus piperita* & *E. sieberi*)

Common Species

Canopy: *Banksia serrata* (Old Man Banksia), *Eucalyptus piperita* (Sydney Peppermint), *Eucalyptus sieberi* (Silvertop Ash) and *Eucalyptus sparsifolia* (Narrow-leaved Stringybark).

Understorey (Shrubs): *Acacia longifolia* (Sydney Golden Wattle), *Baeckea linifolia*, *Banksia spinulosa* (Hairpin Banksia), *Dillwynia retorta* (Eggs and Bacon), *Epacris pulchella*, *Isopogon Hibbertia aspera* (Rough Guinea Flower), *Hakea dactyloides* (Broad-leaved Hakea), *Lambertia formosa* (Mountain Devil), *Leptospermum polygalifolium* (Yellow Tea Tree), *Leptospermum trinervium* (Flaky-barked Tea Tree), *Persoonia levis* (Broad-leaved Geebung), *Persoonia mollis*, *Petrophile pulchella* (Conesticks), *Phyllanthus hirtellus* (Thyme Spurge), *Pittosporum undulatum* (Sweet Pittosporum), *Platysace linearifolia* (Narrow-leaved Platysace), *Polyscias sambucifolia* (Elderberry Panax) and *Podolobium ilicifolium* (Native Holly).

Understorey (Groundcovers): *Austrostipa pubescens* (Tall Spear Grass), *Dianella caerulea* (Flax Lily), *Dianella prunina*, *Entolasia marginata* (Bordered Panic), *Gahnia microstachya*, *Goodenia bellidifolia*, *Goodenia heterophylla*, *Lepidosperma laterale* (Variable Sword-sedge), *Lomandra longifolia* (Spiky-headed Mat-rush), *Lomandra obliqua* (Twisted Mat-rush), *Pomax umbellata*, *Pteridium esculentum* (Bracken Fern), *Smilax glycyphylla* (Sarsparilla), *Stylidium graminifolium* (Trigger Plant) and *Xanthosia pilosa*.

2. Moist Gully Forest (*E. dalrympleana*, *E. piperita*, *E. sieberi*, *E. oreades*)

Occurrence - This vegetation community occurs along the central part of the eastern boundary of the subject site associated with two minor drainage lines and covers approximately 0.24 ha within the site boundary of land subject to this development application.

Structure - Open Forest to Closed Forest with a canopy cover of approximately 30% and height of approximately 15-25 metres, a sub-canopy – shrub layer with a canopy cover of up to 75% and height of approximately 5-10metres and a dense groundcover of ferns and herbs and climbers.

Disturbances - This vegetation community has been moderately disturbed by erosion resulting from considerable runoff, past clearing and high levels of exotic weed invasion.

Classification - This vegetation community corresponds to Map Unit 2G - *Eucalyptus oreades* Open-forest/Tall Open-forest as described within the Blue Mountains City Council's "Native Vegetation Mapping in the Blue Mountains 1999-2002". This vegetation type is classified as a Scheduled Vegetation Community within the Blue Mountains LGA.

This vegetation community is not commensurate with any Endangered Ecological Community as listed within the NSW TSC Act (1995) or the Commonwealth EPBC Act (1999).



Photo 2 - Moist Gully Forest (*E. dalrympleana*, *E. piperita*, *E. sieberi*, *E. oreades*)

Common Species

Canopy: *Eucalyptus piperita* (Sydney Peppermint) and *Eucalyptus oreades* (Blue Mountains Ash).

Sub-canopy: *Acacia elata* (Cedar Wattle), *Callicoma serratifolia* (Black Wattle), *Cyathea australis* (Tree Fern), *Elaeocarpus reticulatus* (Blueberry Ash), *Hedycarya angustifolia* (Native Mulberry) and *Pittosporum undulatum* (Sweet Pittosporum).

Understorey (Shrubs): *Banksia ericifolia* (Heath-leaved Banksia), *Epacris pulchella*, *Leptospermum polygalifolium* (Yellow Tea Tree), *Leptospermum squarrosum*, *Prunus laurocerasus* (Cherry Laurel) and *Persoonia mollis*.

Understorey (Groundcovers): *Blechnum nudum*, *Cissus hypoglauca* (Water Vine), *Empodisma minus*, *Gahnia sieberiana* (Red-fruited Saw-sedge), *Gleichenia* spp., *Histiopteris incisa* (Bat's Wing Fern), *Lomandra longifolia* (Spiky-headed Mat-rush), *Smilax glycyphylla* (Sarsparilla) and *Tetrastigma nitens* (Three-leaved Water Vine).

3. Moist Open Forest (*E. blaxlandii*, *E. piperita*, *E. sieberi*)

Occurrence - This vegetation community occurs on the lower slope and flat areas around the existing playing field in the north-eastern parts of the study area. This vegetation type does not occur within the site boundary of land subject to this development application.

Structure - Open Forest with a canopy cover of approximately 30-35% and height of approximately 22 to 25 metres, a sub-canopy – shrub layer with a canopy cover of 30 to 60% and height of approximately 3 to 7 metres and a dense 90% groundcover layer comprising of ferns and herbs.

Disturbances - This vegetation community has been moderately disturbed by exotics or weed invasion in the western most portions of this community resulting from escaped or planted landscape species.

Classification - This vegetation community corresponds to an ecotone between Map Units 11A - *Eucalyptus sieberi* – *E. piperita* Open-forest/Woodland and Map Unit 2M - *Eucalyptus radiata* ssp. *radiata* – *E. piperita* Open Forest as described within the Blue Mountains City Council's "Native Vegetation Mapping in the Blue Mountains 1999-2002". The 11A vegetation type is not classified as a Scheduled Vegetation Community within the Blue Mountains LGA, while the 2M community is classified as a Scheduled Vegetation Community.

This vegetation community is not commensurate with any Endangered Ecological Community as listed within the NSW TSC Act (1995) or the Commonwealth EPBC Act (1999).



Photo 3 - Moist Open Forest (*E. blaxlandii*, *E. mannifera*, *E. piperita*, *E. sieberi*)

Common Species

Canopy: *Eucalyptus mannifera* subsp. *gullickii* (Brittle Gum), *Eucalyptus blaxlandii* (Blaxland's Stringybark), *E. piperita* (Sydney Peppermint), *E. radiata* (Narrow-leaved Peppermint) and *E. sieberi* (Silvertop Ash).

Sub-canopy: *Acacia dealbata* (Silver Wattle), *Callicoma serratifolia* (Black Wattle), *Banksia cunninghamii* and *Pittosporum undulatum* (Sweet Pittosporum).

Understorey (Shrubs): *Olearia erubescens* (Silky Daisy Bush), *Banksia spinulosa* (Heath-leaved Banksia), *Epacris pulchella* (Wallum Heath), *Leptospermum grandifolium* (Woolly Tea Tree), *Leptospermum continentale* (Prickly Tea-tree) and *Boronia microphylla* (Small-leaved Boronia).

Understorey (Groundcovers): *Gleichenia dicarpa* (Pouched Coral Fern), *Blechnum nudum* (Fishbone Water Fern), *Lepyrodia scariosa* (Scale Rush), *Caustis flexuosa* (Curly Wig), *Gahnia sieberiana* (Red-fruited Saw-sedge).

4. Fernland

Occurrence - This vegetation community occurs in the north-eastern corner of the study area and encompasses the Hanging Swamp vegetation community described below. This vegetation type does not occur within the site boundary of land subject to this development application.

Structure - Sparsely scattered small trees 8 to 14 metres high with a sparse cover of less than 5%. The shrub layer is between 4 and 6 metres high with a variable cover of between 5 and 40%. There is a dense groundcover dominated by ferns with occasional herbs and small climbers.

Disturbances - This vegetation community is mostly undisturbed, however, encroachment is occurring along the northern edge of this community by land management practices such as regular mowing. There is evidence that this community is also recovering from areas that were previously managed as lawns also located along the northern edge.

Classification - This vegetation community corresponds to Map Unit 5A - Blue Mountains Heath/Scrub/Sedgeland/Fernland as described within the Blue Mountains City Council's "Native Vegetation Mapping in the Blue Mountains 1999-2002". This vegetation type is classified as a Scheduled Vegetation Community within the Blue Mountains LGA.

This vegetation community is also commensurate with 'Blue Mountains Swamps in the Sydney Basin Bioregion' which is a Vulnerable Ecological Community (VEC) as listed within the NSW TSC Act (1995).



Photo 4 - Fernland

Common Species

Canopy: One specimen of *Eucalyptus sclerophylla* (Scribbly Gum) and one specimen of *Pinus elliotti* (Slash Pine) were observed within this vegetation community.

Sub-canopy: *Glochidion ferdinandii* (Cheese Tree), *Callicoma serratifolia* (Black Wattle) and *Pittosporum undulatum* (Sweet Pittosporum) were present in low numbers.

Understorey (Shrubs): *Acacia obtusifolia* (Blunt-leaf Wattle), *Banksia ericifolia* (Heath-leaved Banksia), *Epacris pulchella* (Wallum Heath), *Hakea teretifolia* (Dagger Hakea), *Leptospermum continentale* (Prickly Tea-tree), *Leptospermum polygalifolium* (Yellow Tea Tree), *Kunzea capitata* (Pink Buttons), *Leptospermum trinervium* (Slender Tea-tree).

Understorey (Groundcovers): *Blechnum nudum* (Fishbone Water Fern), *Gahnia sieberiana* (Red-fruited Saw-sedge), *Gleichenia dicarpa* (Pouched Coral Fern), *Todea barbara* (King Fern), *Lomandra longifolia* (Spiky-headed Mat-rush), *Pteridium esculentum* (Bracken) and *Rubus anglocandicans* (Blackberries).

5. Hanging Swamp

Occurrence - This vegetation community occurs within the north-eastern most corner of the study area. This vegetation type does not occur within the site boundary of land subject to this development application.

Structure - Canopy trees are absent, sparse shrubs with a 10% cover to a height of 3 metres and a dense ground layer dominated by sedges to 1.5 metres high with a 95% cover with some smaller herbs and forbs.

Disturbances - This vegetation community is mostly undisturbed by anthropomorphic influences and has low levels of exotic weed invasion that are limited to the outer margins along the interface with the Cliff Drive roadside.

Classification - This vegetation community corresponds to Map Unit 5B - Blue Mountains Swamps as described within the Blue Mountains City Council's "*Native Vegetation Mapping in the Blue Mountains 1999-2002*". This vegetation type is classified as a Scheduled Vegetation Community within the Blue Mountains LGA.

This vegetation community is commensurate with the vegetation community known as '*Blue Mountains Swamps in the Sydney Basin Bioregion*' which is listed as a Vulnerable Ecological Community (VEC) within the NSW Threatened Species Conservation Act (1995). The Blue Mountains Swamps community also corresponds to a component of '*Temperate Highland Peat Swamps on Sandstone*', which is listed as an Endangered Ecological Community (EEC) under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999.



Photo 5 – Hanging Swamp

Common Species

Canopy: Absent.

Sub-canopy: Absent.

Understorey (Shrubs): *Baeckea linifolia* (Weeping Baeckea), *Callistemon citrinus* (Crimson Bottlebrush), *Banksia ericifolia* (Heath-leaved Banksia), *Leptospermum polygalifolium* (Yellow Tea Tree), *Leptospermum grandifolium* (Woolly Tea-tree) and *Leptospermum juniperinum* (Prickly Tea-tree).

Understorey (Groundcovers): *Gymnoschoenus sphaerocephalus* (Button Grass), *Lepidosperma limicola*, *Empodisma minus* with occasional *Blechnum nudum* (Fishbone Water Fern) and *Gleichenia dicarpa* (Pouched Coral Fern).

6. Moist Open Forest (*E. mannifera*, *E. radiata*)

Occurrence - This vegetation community occurs on the lower slope and flat areas to the south and west of the existing playing field in the north-eastern parts of the study area. This vegetation type does not occur within the site boundary of land subject to this development application.

Structure - Open Forest with a canopy cover of approximately 30% and height of approximately 22 to 25 metres, a shrub layer with a variable cover of 5 to 30% and height of approximately 2 to 4 metres and a moderate 50 to 60% ground cover comprising of grasses, ferns and herbs common within moist habitat.

Disturbances - This vegetation community has been moderately disturbed by land management practices such as planting or invasion of exotic or weed species in the shrub and ground layers. Some parts of this vegetation community exist as canopy only over lawns.

Classification - This vegetation community corresponds to Map Unit 4A - *Eucalyptus mannifera* subsp. *gullickii* Alluvial Woodland as described within the Blue Mountains City Council's "Native Vegetation Mapping in the Blue Mountains 1999-2002". This Map Unit 4A vegetation type is classified as a Scheduled Vegetation Community within the Blue Mountains LGA.

This vegetation community is not commensurate with any Endangered Ecological Community as listed within the NSW TSC Act (1995) or the Commonwealth EPBC Act (1999).



Photo 6 - Moist Open Forest (*E. mannifera*, *E. radiata*)

Common Species

Canopy: *Eucalyptus mannifera* subsp. *gullickii* (Brittle Gum), *E. radiata* (Narrow-leaved Peppermint) and *E. blaxlandii* (Blaxland's Stringybark).

Sub-canopy: *Acacia dealbata* (Silver Wattle), *Acacia melanoxylon* (Blackwood) and *Banksia cunninghamii*.

Understorey (Shrubs): *Dampiera stricta* (Blue Dampiera), *Dillwynia retorta* (Eggs and Bacon), *Hakea dactyloides* (Broad-leaved Hakea), *Leptospermum juniperinum* (Prickly Tea-tree), *Leptospermum continentale* (Prickly Tea-tree), *Banksia spinulosa* (Heath-leaved Banksia) and *Leptospermum grandifolium* (Woolly Tea Tree).

Understorey (Groundcovers): *Poa seiberiana* (Tussock Grass), *Blechnum nudum* (Fishbone Water Fern), *Entolasia stricta* (Wiry Panic), *Lepidosperma laterale* (Variable Sword-sedge), *Microlaena stipoides* (Weeping Grass), and *Pteridium esculentum* (Bracken).

7. Disturbed Land with Scattered Trees and Garden Beds:

Occurrence - This highly disturbed vegetation community occurs throughout the land subject to this development application and covers approximately 2.85 ha.

Structure - Open Woodland to Woodland with a canopy cover of approximately <5% to 20 % and height of up to 25 metres. The understorey consists of a sparse shrub layer to 2 metres high and a highly variable groundcover of herbs, ferns and grasses.

Disturbances - The majority of this vegetation community has been highly disturbed by artificially created garden beds and lawn; continued underscrubbing of the understorey vegetation; planting of a wide variety of exotic trees, shrubs and ground species; construction of buildings and infrastructure associated with the existing development and high levels of incursions by exotic weed species.

Variations - This community varies considerably in floristic assemblages and structure depending on the particular disturbances and position within the site.



Photo 7 – Disturbed land with scattered trees and garden beds

Common Species

Canopy: *Eucalyptus piperita* (Sydney Peppermint), *Eucalyptus mannifera* (Brittle Gum), *Eucalyptus sieberi* (Silvertop Ash) and *Pinus elliotti* (Slash Pine).

Understorey (Shrubs): *Acacia longifolia* (Sydney Golden Wattle), *Grevillea* spp. (cultivar) *Leptospermum polygalifolium* (Yellow Tea Tree), *Leptospermum trinervium* (Flaky-barked Tea Tree), *Persoonia levis* (Broad-leaved Geebung), *Petrophile pulchella* (Conesticks), *Phyllanthus hirtellus* (Thyme Spurge), *Pittosporum undulatum* (Sweet Pittosporum), *Platysace linearifolia* (Narrow-leaved Platysace) and *Rubus anglocandicans* (Blackberries).

Understorey (Groundcovers): *Pennisetum clandestinum* (Kikuyu Grass), *Agapanthus praecox* (Agapanthus), *Austrodanthonia* sp. (Wallaby Grass), *Austrostipa pubescens* (Tall Spear Grass), *Conyza bonariensis* (Flax-leaf Fleabane), *Cynodon dactylon* (Common Couch), *Crocasmia X crocosmiiflora* (Montbretia), *Dianella caerulea* (Flax Lily), *Entolasia marginata* (Bordered Panic), *Holcus lanatus* (Yorkshire Fog), *Hypochaeris radicata* (Flatweed), *Lomandra longifolia* (Spiky-headed Mat-rush), *Lomandra obliqua* (Twisted Mat-rush), *Pomax umbellata* (Pomax) and *Pteridium esculentum* (Bracken Fern).

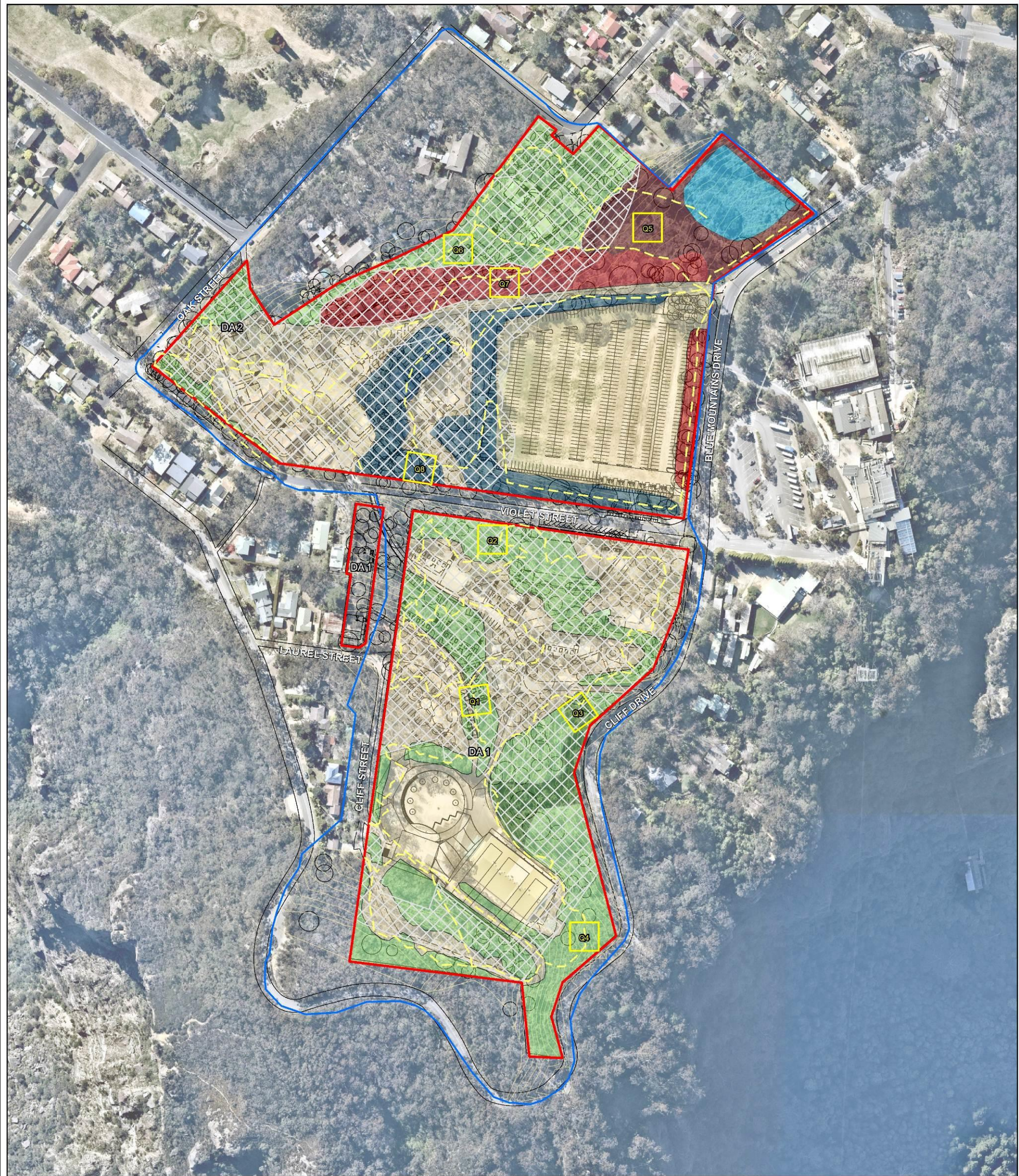
3.2 Fauna results

Fauna species observed throughout the duration of fauna surveys within the study area and the extended EPP study area to the south are listed in Table 3.2 below.

Table 3.2 – Fauna observations for the study area

Common name	Scientific name	Method observed	
Birds		2007	2016
Australian King Parrot	<i>Alisterus scapularis</i>	O W	O W
Australian Magpie	<i>Cracticus tibicen</i>	O W	O W
Australian Wood Duck	<i>Chenonetta jubata</i>		W
Black-faced Monarch	<i>Monarcha melanopsis</i>		W ^{PR}
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	O W	O
Brown Cuckoo-Dove	<i>Macropygia amboinensis</i>		W
Brown Gerygone	<i>Gerygone mouki</i>	O	
Brown Thornbill	<i>Acanthiza pusilla</i>	O W	O W
Common Myna *	<i>Sturnus tristis</i>	O W	
Crimson Rosella	<i>Platycercus elegans</i>	O W	O W
Eastern Spinebill	<i>Acanthorhynchus tenuirostris</i>	O W	O W
Eastern Whipbird	<i>Psophodes olivaceus</i>	O W	O
Eastern Yellow Robin	<i>Eopsaltria australis</i>	O W	O W
Fan-tailed Cuckoo	<i>Cacomantis flabelliformis</i>		W
Galah	<i>Cacatua roseicapilla</i>	O W	O
Gang-gang Cockatoo ^{TS}	<i>Callocephalon fimbriatum</i>	O W	O W
Golden Whistler	<i>Pachycephala pectoralis</i>	O	W
Grey Butcherbird	<i>Cracticus torquatus</i>	O W	W
Grey Fantail	<i>Rhipidura albiscapa</i>	O W	
Grey Shrike-thrush	<i>Colluricincla harmonica</i>	O W	
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	O W	O
Lewin's Honeyeater	<i>Meliphaga lewinii</i>	O W	O W
Little Lorikeet ^{TS}	<i>Glossopsitta pusilla</i>	O W	
New Holland Honeyeater	<i>Phylidonyris novaehollandiae</i>	O W	W
Noisy Friarbird	<i>Philemon corniculatus</i>	O W	
Noisy Miner	<i>Manorina melanocephala</i>		O W
Olive-backed Oriole	<i>Oriolus sagittatus</i>	O W	
Pied Currawong	<i>Strepera graculina</i>	O W	O W
Pilotbird	<i>Pycnoptilus floccosus</i>		Q O W
Rainbow Lorikeet	<i>Trichoglossus haematodus</i>	O W	O W
Red Wattlebird	<i>Anthochaera carunculata</i>	O W	O W
Red-whiskered Bulbul *	<i>Pycnonotus jocosus</i>	O W	

Common name	Scientific name	Method observed	
Rose Robin	<i>Petroica rosea</i>		O W
Rufous Fantail	<i>Rhipidura rufifrons</i>	O	
Satin Bowerbird	<i>Ptilonorhynchus violaceus</i>	O W	O W
Silvereye	<i>Zosterops lateralis</i>	O W	
Spotted Pardalote	<i>Pardalotus punctatus</i>		O W
Spotted Quail-thrush	<i>Cinclosoma punctatum</i>		W ^{PR}
Striated Thornbill	<i>Acanthiza lineata</i>	O W	O W
Sulphur Crested Cockatoo	<i>Cacatua galerita</i>	O W	W
Superb Fairy-wren	<i>Malurus cyaneus</i>		O W
Superb Lyrebird	<i>Menura novaehollandiae</i>	O W	O Q
Tawny Frogmouth	<i>Podargus strigoides</i>	O	
Welcome Swallow	<i>Hirundo neoxena</i>		O
White-browed Scrubwren	<i>Sericornis frontalis</i>	O W	O W Q
Yellow-tailed Black-Cockatoo	<i>Calyptorhynchus funereus</i>	O W	W
Mammals			
Black Rat *	<i>Rattus rattus</i>		Q
Brown Antechinus	<i>Antechinus stuartii</i>	T	
Bush Rat	<i>Rattus fuscipes</i>		Q
Cat *	<i>Felis catus</i>		Q
Common Brushtail Possum	<i>Trichosurus vulpecula</i>	O	Q
Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>	O	O
Domesticated Cat *	<i>Felis catus</i>		O
Dusky Antechinus	<i>Antechinus swainsonii</i>		Q ^{PO}
Eastern Broad-nosed Bat	<i>Scotorepens orion</i>	U ^{PR}	
Eastern Falsistrelle ^{TS}	<i>Falsistrellus tasmaniensis</i>		U ^{PR}
Eastern Pygmy Possum ^{TS}	<i>Cercartetus nanus</i>		Q
European Red Fox *	<i>Vulpes vulpes</i>		Q
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>	U	
Grey-headed Flying-fox ^{TS}	<i>Pteropus poliocephalus</i>	O W	
Large Forest Bat	<i>Vespadelus darlingtoni</i>	U	U
Little Forest Bat	<i>Vespadelus vulturinus</i>	U	
Macropod Sp.	<i>Macropod Sp.</i>	P	P
Rabbit *	<i>Oryctolagus cuniculus</i>	O	O
Short-beaked Echidna	<i>Tachyglossus aculeatus</i>		Q
Sugar Glider	<i>Petaurus breviceps</i>	T	W ^{PR}
Swamp Wallaby	<i>Wallabia bicolor</i>		Q
Reptiles			
Blotched Blue-tongued Lizard	<i>Tiliqua nigrolutea</i>		Q
Delicate Skink	<i>Lampropholis delicata</i>	O	
Southern Grass Skink	<i>Pseudemoia entrecasteauxii</i>		O ^{PO}
Amphibians			
Toadlet	<i>Uperoleia sp</i>	W	
Note: * indicates introduced species ^{TS} indicates threatened species All species listed are identified to a high level of certainty unless otherwise noted as: ^{PR} indicates species identified to a 'probable' level of certainty – more likely than not ^{PO} indicates species identified to a 'possible' level of certainty – recorded to a moderate to high level of uncertainty usually applied to a threatened species of note. E - Nest/roost 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			



Legend

Site Boundary

Study Area

Contours

Asset Protection Zone (APZ)

Flora Survey Effort

Flora quadrat (20x20m)

Flora survey meander

Vegetation Communities

1. Dry open forest (*E. piperita*, *E. sieberi*)

2. Moist gully forest (*E. dalrympleana*, *E. piperita*, *E. sieberi*, *E. oreades*)

3. Moist open forest (*E. blaxlandii*, *E. piperita*, *E. sieberi*)

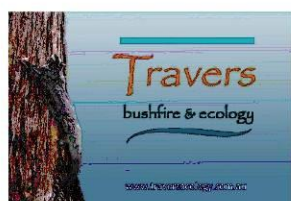
4. Heath

5. Hanging swamp

6. Moist open forest (*E. mannifera*, *E. radiata*)

7. Disturbed land (with scattered trees and garden beds)

Aerial source: Nearmap



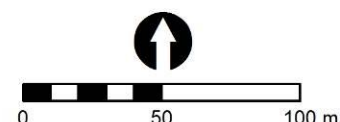
PROJECT & MXD REFERENCE
Cliff Drive, Katoomba
A16026_FL001

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SCALE & COORDINATE SYSTEM
1:2,500 @ A3
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Flora Survey Effort & Results

Document Path: N:\GIS STORAGE\N Drive\A16026 Cliff Drive, Katoomba\MXD\A16026 FL001.mxd



Disclaimer: 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.

Figure 2 – Flora survey effort and results

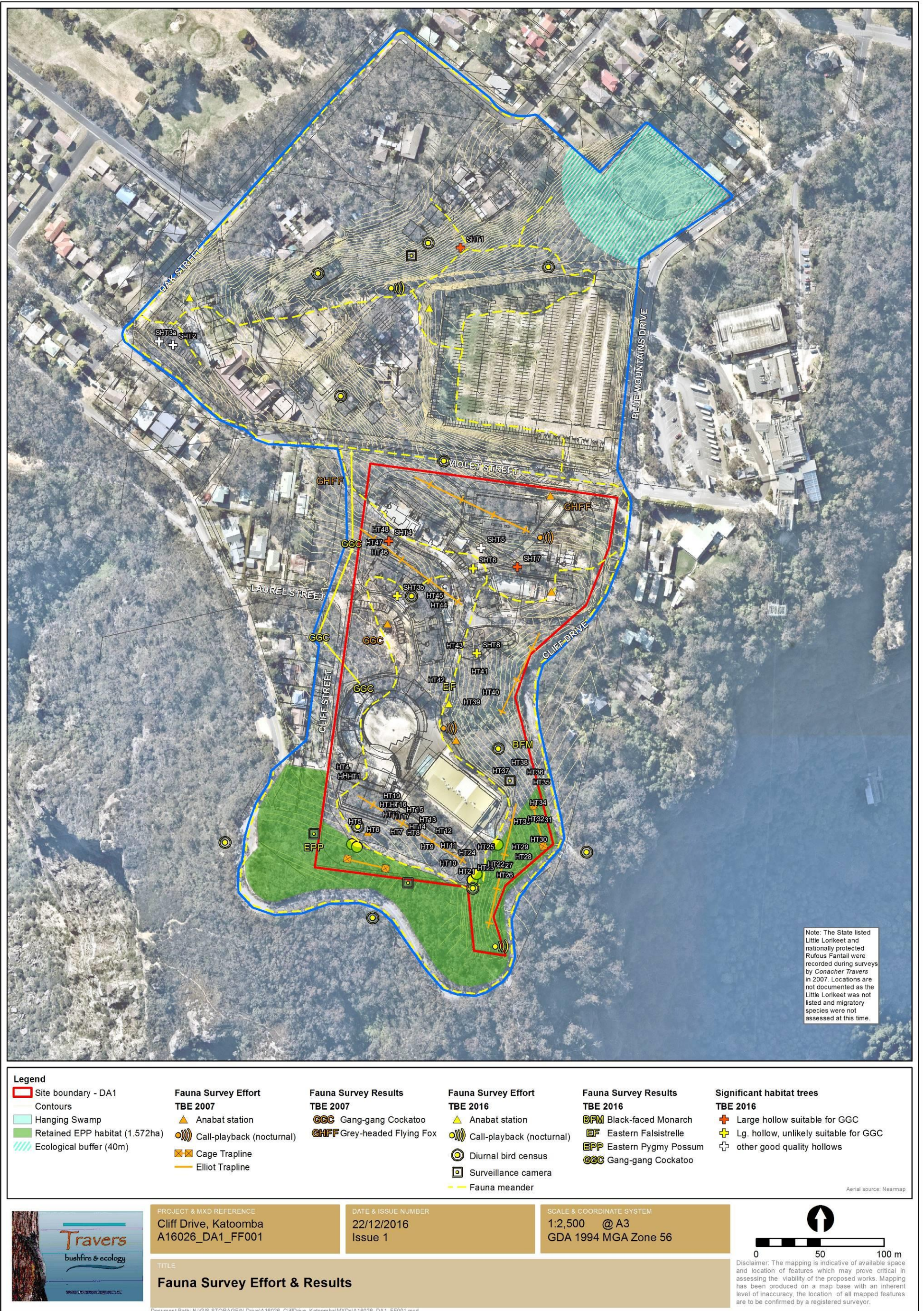
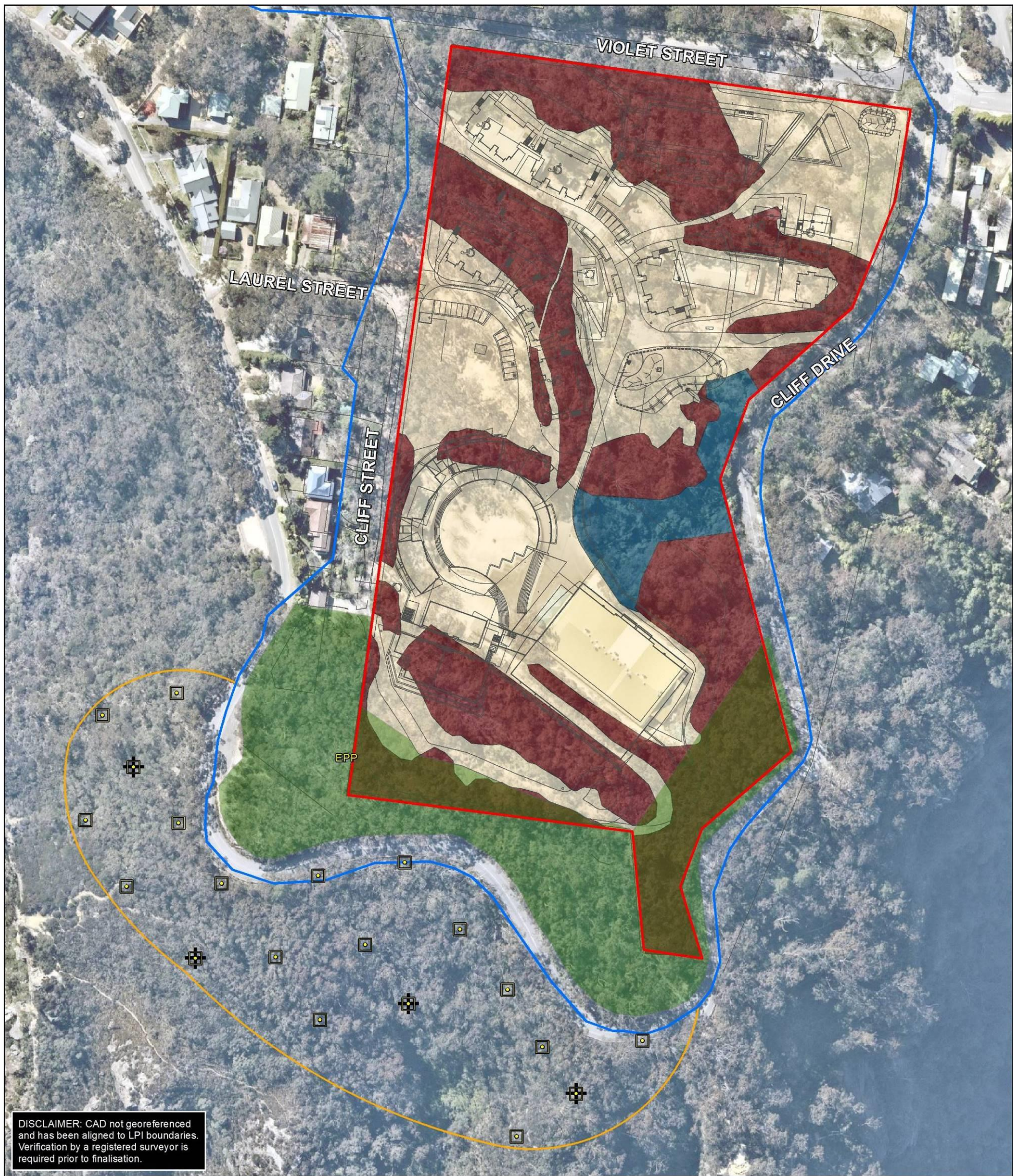


Figure 3a – Fauna survey effort and results



Legend			
 Site boundary - DA1	EPP Survey Effort October/November 2016	Fauna Survey Results March 2016	Vegetation Communities March 2016
 Study area	 Surveillance camera	EPP Eastern Pygmy Possum	 Dry Open Forest (<i>E. piperita</i> , <i>E. sieberi</i>)
 EPP trapping study area	+ Meat bait (targeting Spotted-tailed Quoll)		 Moist Gully Forest (<i>E. dalrympleana</i> , <i>E. piperita</i> , <i>E. sieberi</i> , <i>E. oreades</i>)
 Retained EPP habitat (1.572ha)			 Disturbed land (with scattered trees and garden beds)

Aerial source: Nearmap



PROJECT & MXD REFERENCE
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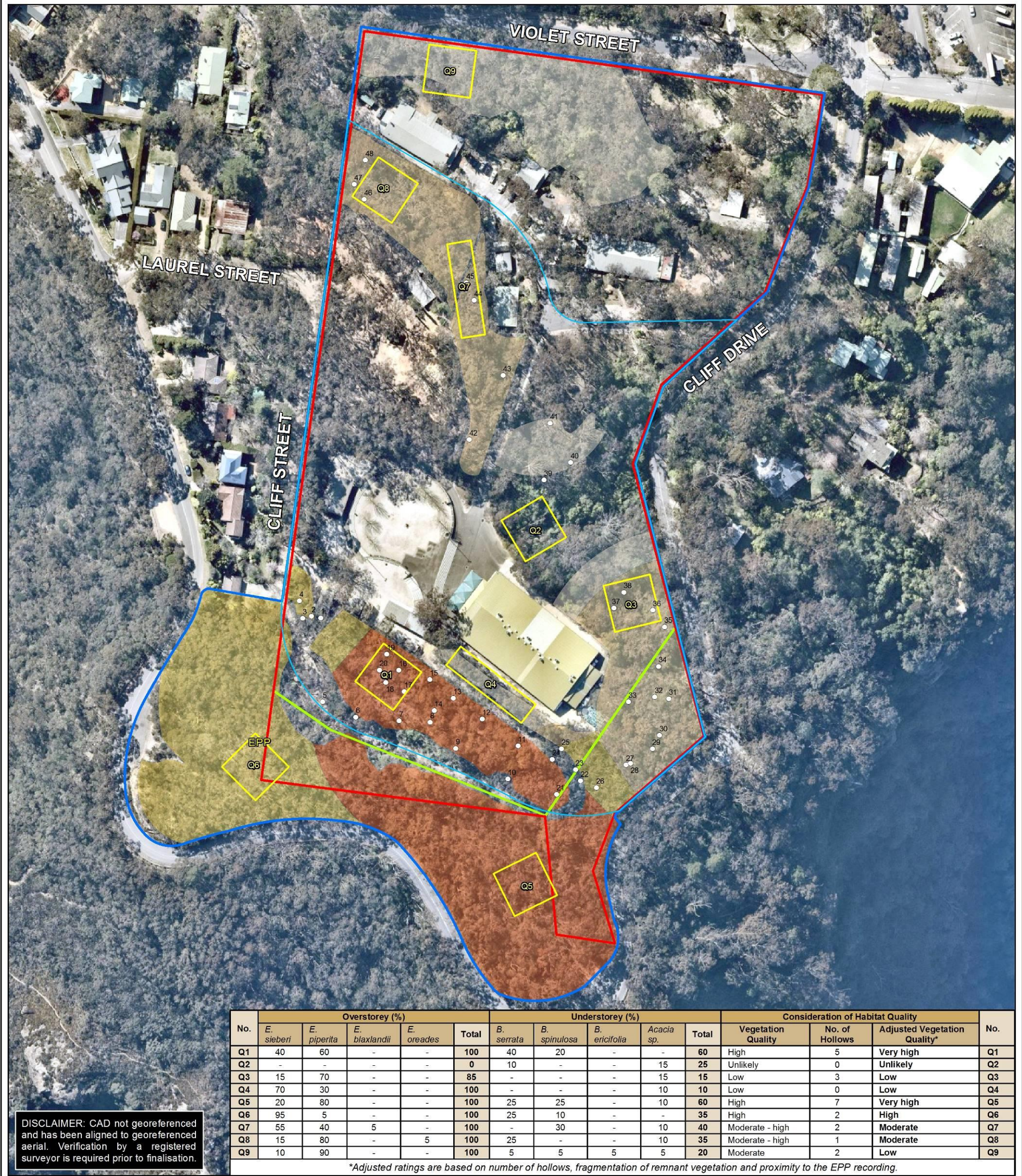
SCALE & COORDINATE SYSTEM
1:1,500 @ A3
GDA 1994 MGA Zone 56

TITLE
Eastern Pygmy Possum Targeted Survey

Document Path: N:\GIS\STORAGE\N Drive\A16026 Cliff Drive Katoomba\MXD\A16026_EPP001.mxd

Disclaimer: 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.

Figure 3b – Eastern Pygmy Possum target survey by surveillance cameras



No.	Overstorey (%)				Total	Understorey (%)				Total	Consideration of Habitat Quality			No.
	<i>E. sieberi</i>	<i>E. piperita</i>	<i>E. blaxlandii</i>	<i>E. oreades</i>		<i>B. serrata</i>	<i>B. spinulosa</i>	<i>B. ericifolia</i>	<i>Acacia</i> sp.		Vegetation Quality	No. of Hollows	Adjusted Vegetation Quality*	
Q1	40	60	-	-	100	40	20	-	-	60	High	5	Very high	Q1
Q2	-	-	-	-	0	10	-	-	15	25	Unlikely	0	Unlikely	Q2
Q3	15	70	-	-	85	-	-	-	15	15	Low	3	Low	Q3
Q4	70	30	-	-	100	-	-	-	10	10	Low	0	Low	Q4
Q5	20	80	-	-	100	25	25	-	10	60	High	7	Very high	Q5
Q6	95	5	-	-	100	25	10	-	-	35	High	2	High	Q6
Q7	55	40	5	-	100	-	30	-	10	40	Moderate - high	2	Moderate	Q7
Q8	15	80	-	5	100	25	-	-	10	35	Moderate - high	1	Moderate	Q8
Q9	10	90	-	-	100	5	5	5	5	20	Moderate	2	Low	Q9

*Adjusted ratings are based on number of hollows, fragmentation of remnant vegetation and proximity to the EPP recording.

Legend

- Site boundary - DA1
- EPP habitat study area
- Hollow study area
- Outer extent of asset protection zone (APZ) / development
- EPP habitat assessment quadrat (20x20m, 10x40m)
- Habitat tree (in habitat vegetation in 'Hollow study area')

Fauna Survey Results

March 2016

EPP Eastern Pygmy Possum

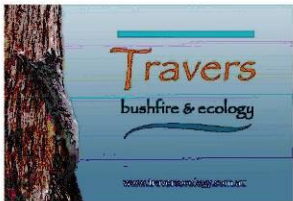
EPP Habitat Vegetation Quality

- Very high
- High
- Moderate
- Low

NOTE:

- Non-shaded areas within the EPP habitat study area are considered as 'Unlikely' habitat quality.
- Habitat assessment areas apply to those that have a eucalypt overstorey as well as an unmanaged native understorey. Anything else is categorised as 'Unlikely' habitat.
- This is not conclusive and Eastern Pygmy Possum may occur in 'Unlikely' habitat when seasonal flowering permits.

Aerial source: Nearmap



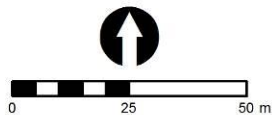
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Disclaimer: The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location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

Figure 3c – Eastern Pygmy Possum habitat assessment



Ecological Assessment

4

4.1 Previous surveys reviewed

The following regional vegetation mapping was examined to identify the potential vegetation communities' onsite.

- *Conacher Travers* (2006) Vegetation Management Plan for Clairvaux House, Cliff Drive Katoomba. (Ref: 6094VMP)
- *Conacher Travers* (2009) Flora and Fauna Assessment, Lot 5 DP 222736, 119 Cliff Drive Katoomba, (Ref: 9043)
- *Travers bushfire and ecology* (2011) Vegetation Management Plan, Lot 5 DP 222736 14-30 Violet Street, Katoomba (Ref: A10127V)
- *Travers bushfire and ecology* (2011) Flora and Fauna Assessment Clairvaux Oval Car Park, Katoomba Christian Convention
- Vegetation mapping (Blue Mountains City Council – web based Interactive Maps June 2016)

4.2 Flora

A number of exotic or landscaping species were observed within the study area. These were generally not taken into consideration in preparing the species list.

No threatened flora species were observed.

All species are listed in Table 3.1.

4.2.1 Local / Regional flora matters

Four vegetation communities observed within the study area are listed as Scheduled Vegetation Communities within the Blue Mountains City Council local government area. Vegetation communities have been scheduled as significant within the Blue Mountains City if they satisfy one or more of the following criteria:

- listed, or proposed for listing, in the Environmental Protection and Biodiversity Conservation Act 1999 (Commonwealth);
- listed, or proposed for listing, in Schedule 1 or 2 of the Threatened Species Conservation Act 1995 (NSW);
- listed in Schedule 3 of LEP 1991;
- rare and/or restricted distribution within the City of Blue Mountains;
- poorly or not represented within the Blue Mountains National Park;
- protect hydrological functions; and/or
- habitat for rare, threatened or ultra-endemic fauna or flora species.

The four scheduled vegetation communities observed within the study area were:

- Moist Gully Forest (*E. dalrympleana*, *E. piperita*, *E. sieberi*, *E. oreades*) (BMCC – Map Unit 2G)
- Fernland (BMCC – Map Unit 5A)
- Hanging Swamp (BMCC – Map Unit 5B)
- Moist Open Forest (*E. mannifera*, *E. radiata*) (BMCC – Map Unit 4A)

4.2.2 State legislative flora matters

(a) Threatened flora species (NSW)

TSC Act – A search of the *web based Bionet database* (OEH 2016) indicated a list of species that have been recorded within a 10 km radius of the study area. Those species are considered for suitable habitat and potential to occur in Table A2.1 (Appendix 2).

Based on the habitat assessment within Appendix 2, it is considered that the subject site 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	TSC Act	EPBC Act	Potential to occur
<i>Persoonia acerosa</i>	V	V	Low
<i>Pultenaea glabra</i>	V	V	Low

Note: Full habitat descriptions for these species are provided in Appendix 2

No state listed threatened flora species were observed within the study area during all flora surveys undertaken. The species with potential habitat within the study area as listed in Table 4.1 above have been assessed in detail within Appendix 3.

Other threatened flora species that have been recorded within the immediate locality (OEH, Bionet, 2016) include the following:

Xanthosia scopulicola – This is a perennial subshrub which is restricted to the Jamison Valley in the Blue Mountains between Kings Tableland and the Megalong Cleft. It grows in cracks and crevices of sandstone cliff faces or on rocky outcrops above the cliffs. Small numbers of individuals grow in crevices on dry rock faces at scattered locations along the National Pass walking track and along Leura Falls Creek from Leura Cascades to the base of the escarpment. This species has very restricted or specific habitat requirements which do not occur within the study area. Therefore it is considered that this species is highly unlikely to be present within the study area.

Pherosphaera fitzgeraldii – this is an ascending or erect shrub with a drooping habit which grows to 1 metre high and sometimes to 2m in diameter. It grows on wet rocks within the spray of waterfalls or on ledges or in caves near waterfalls; restricted to southerly aspects on sandstone near waterfalls in the Katoomba to Wentworth Falls area of the Blue Mountains. This species has very restricted or specific habitat requirements which do not occur within the study area. Therefore it is considered that this species is highly unlikely to be present within the study area.

Leionema lachnaeoides – This species occurs on exposed cliff tops and terraces in the Megalong and Jamison Valleys. The habitat occurs at 960-1000 m altitudes, and on SE to SW aspects on the southern side of plateaus extending into the two valleys. The geology is predominantly sandstone of the Triassic Narrabeen Group. This species occurs in 'montane heath' communities. Other species in common to many of the sites include *Eucalyptus stricta*, *Allocasuarina nana*, *Dillwynia retorta*, *Epacris microphylla* and *Caustis flexuosa*. The litter layer is usually several centimeters thick with sclerophyllous leaves or needles of *Allocasuarina nana*. This species has very restricted or specific habitat requirements which do not occur within the study area. Therefore it is considered that this species is highly unlikely to be present within the study area.

(b) Endangered flora populations (NSW)

No endangered flora populations occur within a 10km radius of the subject site, however, there is one endangered flora population within the Blue Mountains Local Government area this population is:

- *Pultenaea villifera* Sieber ex DC. population in the Blue Mountains local government area.

This endangered population is known only from the Springwood – Woodford area and comprises of less than 300 plants. This population is located in excess of 10 km from the study area. This species was not observed within the study area.

(c) Threatened ecological communities (NSW)

Two (2) threatened ecological communities (TECs) were observed within the study area. These ecological communities were:

- Fernland (BMCC Map Unit 5A)
- Hanging Swamp (BMCC – Map Unit 5B)

Both of these vegetation communities are commensurate with 'Blue Mountains Swamps in the Sydney Basin Bioregion' which is a Vulnerable Ecological Community (VEC) listed under the NSW TSC Act (1995).

The proposed development will not directly impact either of these two vegetation communities. It is recommended that a vegetation management plan (VMP) be prepared to specify the strategies and works required to manage these vegetation communities within the study area.

These communities have been assessed in detail within Appendix 3.

(d) Endangered wetland communities

A number of wetland communities have been listed as an 'endangered ecological community' under the NSW TSC Act. Those wetland communities must be given due consideration in accordance with the NSW Wetlands Policy (2010) and buffers provided in accordance with the NSW DPI - Office of Water - Controlled Activity Guidelines 2012.

- Artesian springs ecological community - endangered ecological community listing
- Castlereagh swamp woodland community - endangered ecological community listing

- Coastal saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions - endangered ecological community listing
- Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions - endangered ecological community listing
- Kurri sand swamp woodland in the Sydney Basin Bioregion - endangered ecological community listing
- Lagunaria swamp forest on Lord Howe Island - endangered ecological community listing
- Maroota Sands swamp forest - endangered ecological community listing
- Montane peatlands and swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions - endangered ecological community listing
- Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion - endangered ecological community listing
- Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions - endangered ecological community listing
- Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions - endangered ecological listing
- Sydney Freshwater Wetlands in the Sydney Basin Bioregion - endangered ecological community listing
- The shorebird community occurring on the relict tidal delta sands at Taren Point - endangered ecological community listing
- Upland wetlands of the drainage divide of the New England Tableland Bioregion - endangered ecological community listing

None of the above wetland communities were observed onsite.

(e) Groundwater dependent ecosystems (GDEs)

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

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

The State Groundwater Dependent Ecosystems Policy is specifically designed to protect our valuable ecosystems which rely on groundwater for survival so that, wherever possible, the ecological processes and biodiversity of their dependent ecosystems are maintained or restored, for the benefit of present and future generations. The following five principles are to be applied in the management of groundwater-dependent ecosystems in NSW.

Principle One

Groundwater-dependent ecosystems can have important values for groundwater users, ecosystem managers, scientists and the wider community and for the protection of our biodiversity and cultural heritage. These values, and how threats to them may be avoided, should be identified and action taken to ensure that the ecosystems are protected.

Principle Two

Groundwater extractions should be managed within the sustainable yield of aquifer systems, so that the ecological processes and biodiversity of their dependent ecosystems are maintained and/or restored. This will involve consideration of threshold levels that are critical for ecosystem health.

Principle Three

Priority should be given to ensuring that sufficient groundwater of suitable quality is available at the times when it is needed:

- for protecting ecosystems which are known to be, or are most likely to be, groundwater dependent; and,
- for ecosystems where there is an immediate or high degree of threat.

Principle Four

Where scientific knowledge is lacking, the precautionary principle should be applied to protect groundwater dependent ecosystems. The development of adaptive management systems and research to improve understanding of these ecosystems is essential to their management.

Principle Five

Planning, approval and management of developments and land use activities should aim to minimise adverse impacts on groundwater systems by:

- maintaining natural patterns of recharge and minimising disruption to groundwater levels that are critical for ecosystems;
- not polluting or causing changes in groundwater quality; and
- rehabilitating degraded groundwater systems where possible.

The proposed development within the study area does not affect the Hanging Swamp area. The Hanging Swamp vegetation is a Groundwater Dependent Ecosystem (GDE) as it is likely fed from an aquifer created by impervious shale lenses within the sandstone. In addition, this vegetation community may be situated on a humic or peaty substrate which is also capable of holding large quantities of water.

The Hanging Swamp vegetation will be wholly retained within the study area. The proposed development will provide a 40 metre wide buffer around this vegetation community, in order to retain, improve and manage it. It is recommended that a vegetation management plan (VMP) be prepared to specify the strategies and works required to manage this vegetation community within the study area.

4.2.3 Matters of national environmental significance - flora

(a) Threatened flora species (national)

A review of the schedules of the *EPBC Act* undertaken via the web based *Protected Matters Search Tool* (DoE 2016) indicated the potential for a list of threatened flora species to occur within a 10km radius of the site. These species have been considered for habitat presence and potential to occur within Appendix 2.1.

Based on the habitat assessment within Appendix 2.1, it is considered that the subject site 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	TSC Act	EPBC Act	Potential to occur
<i>Persoonia acerosa</i>	V	V	Low
<i>Pultenaea glabra</i>	V	V	Low

Note: Full habitat descriptions for these species are provided in Appendix 2

No Commonwealth listed threatened flora species were observed within the study area during all flora surveys undertaken. The species with potential habitat within the study area as listed in Table 4.1 above have been assessed in detail within Appendix 3.

(b) Endangered ecological communities (national)

The Hanging Swamp vegetation community is commensurate with 'Temperate Highland Peat Swamps on Sandstone' which is listed as an Endangered Ecological Community (EEC) within the Commonwealth EPBC Act.

This community will be wholly retained within the study area and will be protected by a 40 metre buffer around it. This EEC has been assessed according to the EPBC Impact Criteria within Appendix 4.

It is recommended that a vegetation management plan (VMP) be prepared to specify the strategies and works required to retain, improve and manage the Hanging Swamp vegetation within the study area.

4.3 Fauna

All fauna species recorded during survey(s) are listed in Table 3.2.

4.3.1 Fauna habitat

The fauna habitats present within the site are identified within Table 4.3.

Table 4.3 – Observed fauna habitat

Topography										
Flat	✓	Gentle	✓	Moderate	✓	Steep	Drop-offs			
Vegetation structure										
Closed Forest		Open Forest	✓	Woodland		Heath	Grassland	✓		
Disturbance History										
Fire	✓			Under-scrubbing	✓		Cut and fill works	✓		
Tree clearing	✓			Grazing						
Soil Landscape										
DEPTH:		Deep		Moderate		Shallow	✓	Skeletal	✓	
TYPE:		Clay		Loam	✓	Sand	✓	Organic		
VALUE:		Surface foraging	✓			Sub-surface foraging		Denning/burrowing	✓	
WATER RETENTION:		Well Drained	✓		Damp / Moist		Water logged		Swamp / Soak	✓

Rock Habitat						
CAVES:	Large		Small		Deep	
CREVICES:	Large		Small		Deep	
ESCARPMENTS:	Winter / late sunny aspects				Shaded winter / late aspects	
OUTCROPS:	High Surface Area Hides		Med. Surface Area Hides		Low Surface Area Hides	
SCATTERED / ISOLATED:	High Surface Area Hides		Med. Surface Area Hides		Low Surface Area Hides ✓	
Feed Resources						
FLOWERING TREES:	Eucalypts ✓		Corymbias		Melaleucas	
	Banksias ✓		Acacias ✓			
SEEDING TREES:	Allocasuarinas ✓		Conifers			
WINTER FLOWERING EUCALYPTS:	C. maculata		E. crebra		E. globoidea	
	E. squamosa		E. grandis		E. multicaulis	
	E. robusta		E. tereticornis		E. agglomerata	
FLOWERING PERIODS:	Autumn		Winter		Spring ✓	
OTHER:	Mistletoe ✓		Figs / Fruit		Sap / Manna	
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 HOLLOWES:	Large ✓		Medium ✓		Small ✓	
TEE HOLLOW TYPES	Spouts / branch ✓		Trunk ✓	Broken Trunk ✓		Basal Cavities ✓
GROUND HOLLOWES:	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)
RATE OF FLOW:	Still ✓		Slow			Rapid
CONSISTENCY:	Permanent ✓		Perennial			Ephemeral
RUNOFF SOURCE:	Urban / Industrial ✓		Parkland ✓		Grazing	
RIPARIAN HABITAT:	High quality ✓		Moderate quality ✓		Low quality ✓	
Artificial Habitat						
STRUCTURES:	Sheds		Infrastructure ✓		Equipment	
SUB-SURFACE	Pipe / culvert(s)		Tunnel(s)		Shaft(s)	
FOREIGN MATERIALS:	Sheet		Pile / refuse			

4.3.2 Habitat trees

A complete assessment of the location of habitat trees and the size of hollows within was not conducted as part of surveys undertaken. The available size range and quality of hollows were noted during site visits.

Data on significant habitat trees was however collected and identified by GPS; locations are depicted on Figure 3a and data is provided in Table 4.4 below. Significant habitat trees are generally defined as trees containing large hollows suitable for use by threatened owls or cockatoos and/or containing a number of good quality hollows typically consisting of more than one medium (10-30cm) sized hollow. A tree may also be considered significant if otherwise potentially important for a threatened species.

Within the study are no large hollows identified are considered suitable for use by large forest owl. The recorded Gang-gang Cockatoo however is a smaller bird species that may utilise medium-large sized hollows. Table 4.4a and Figure 3a identifies which of the recorded significant habitat trees within the study area are considered suitable, or with low potential suitability, for use by Gang-gang Cockatoo for nesting. This includes 2 suitable (SHT4 & SHT7) and three unlikely suitable (SHT3b, SHT6 & SHT8) within the subject site. Of these SHT 4 and SHT 3b appear to require removal as part of the proposal. The modification of parking areas may retain these two trees. If Gang-gang Cockatoo was currently using the subject site for nesting, this would be occurring within the disturbed landscape areas and such potential may remain as part of the proposed layout. Gang-gang Cockatoo is not expected to be nesting within these trees given the disturbed nature and likely attention to this from current staff.

Some trees containing small to medium sized hollows have been included as a significant habitat tree based on their apparent good quality and given the relative low density of hollows present overall within the study area. Dominant tree species including Silvertop Ash and Sydney Peppermint are not species typically providing a high number of hollows.

All trees containing small hollows suitable for use by the recorded Little Lorikeet, Eastern Pygmy Possum and Eastern Falsistrelle have not been included as a significant habitat tree in the data. Often nesting hollows for Little Lorikeet are also quite discrete. Nesting trees for this species are best located during survey in the breeding season. Given the recording of Eastern Pygmy Possum a detailed habitat tree survey was undertaken through potential habitat areas of the subject site. Such potential habitat areas and subsequent locations of habitat trees are shown on Figure 3c and data for these trees is provided in Table 4.4b. This data was used to assist the Eastern Pygmy Possum assessment of impact.

Remaining portions of the subject site that have not been subject to habitat tree survey include the northern patch of vegetation adjacent to Violet Street indicated on Figure 3c as well as all remaining areas unshaded on this map (areas with a managed understorey).

Table 4.4a – Significant habitat tree data

Tag No.	Tree Survey No.	Common Name	DBH (cm)	Basal diam. (cm)	Height (m)	Spread (m)	Vigour (%)	Hollows Recorded
SHT1		Sydney Peppermint	55	80	31	13	60	1x 20-30cm trunk (showing wear) ✓GGC
SHT2	284	Sydney Peppermint	45/55	100	17	15	70	1x 5-10cm trunk (good quality showing wear)
SHT3a		Sydney Peppermint	45	75	26	12	70	1x 5-10cm trunk (good quality)
SHT3b	132	Sydney Peppermint	75	120	20	13	10	1x 10-15cm trunk, 2x 20-30cm trunk, all exposed. ?GGC
SHT4	749	Sydney Peppermint	90/23	145	25	9	30	1x 30-40cm low broken trunk ✓GGC
SHT5		Sydney Peppermint	60	80	24	12	60	1x 5-10cm branch spout, 1x 10-15cm trunk (good quality)
SHT6	12/T53	Sydney Peppermint	70	100	26	17	65	3x 15-20cm trunk (good quality) ?GGC
SHT7	14	Sydney Peppermint	85	120	25	19	75	1x 20-30cm trunk (good quality) ✓GGC
SHT8		Sydney Peppermint	85/25	120	24	13	30	1x 5-10cm trunk, 1x 15-20cm trunk ?GGC

✓GGC = suitable for Gang-gang Cockatoo

?GGC = low potential suitability for Gang-gang Cockatoo

Table 4.4b – Hollow-bearing tree data (EPP study area)

Tag No.	Common Name	DBH (cm)	Hollows Recorded
HT1	Silvertop Ash	50	1x 5-10cm trunk
HT2	dead stump	100	1x 5-10cm cut trunk
HT3	Sydney Peppermint	28/32	1x 0-5cm trunk (good)
HT4	Sydney Peppermint	45/45/17/12	1x 0-5cm trunk (good)
HT5	stag	15/9	1x 0-5cm vertical branch spout
HT6	Sydney Peppermint	14	1x 0-5cm trunk
HT7	Silvertop Ash	60	1x 0-5cm trunk crack
HT8	Sydney Peppermint	9/10	1x 5-10cm trunk
HT9	Silvertop Ash	35/30	1x 0-5cm trunk, 1x 0-5cm trunk
HT10	Sydney Peppermint	55	1x 0-5cm trunk open
HT11	Silvertop Ash	80	2x 5-10cm trunk, 1x5-10cm broken trunk
HT12	Silvertop Ash	35	1x 5-10cm branch spout
HT13	Silvertop Ash	7	1x 0-5cm trunk
HT14	stag	8	1x 0-5cm broken trunk open
HT15	stag	45	1x 5-10cm trunk 1x 15-20cm broken trunk, 1x 20-30cm broken trunk
HT16	Sydney Peppermint	65/12	1x 0-5cm trunk, 1x 0-5cm branch spout, 2x 5-10cm trunk
HT17	Sydney Peppermint	17/17/17/12	1x 0-5cm trunk
HT18	stag	5	1x 0-5cm broken trunk (shelter open)
HT19	Sydney Peppermint	34/3450	1x 5-10cm trunk
HT20	Sydney Peppermint	11/13	1x 0-5cm trunk open
HT21	Sydney Peppermint	40/42	2x 0-5cm trunk
HT22	Sydney Peppermint	32	1x 0-5cm branch spout
HT23	stag	28	1x 0-5cm branch spout
HT24	Sydney Peppermint	65	1x 5-10cm trunk
HT25	Sydney Peppermint	10/20/15	1x 5-10cm trunk open
HT26	Sydney Peppermint	70	1x 0-5cm trunk split
HT27	Sydney Peppermint	35	1x 0-5cm trunk base
HT28	Sydney Peppermint	50	1x 0-5cm trunk, 1x 0-5cm trunk
HT29	Sydney Peppermint	30	1x 0-5cm branch spout
HT30	Sydney Peppermint	32	1x 0-5cm trunk open
HT31	Sydney Peppermint	33	1x 10-15cm trunk
HT32	Silver Wattle	10	1x 5-10cm trunk split
HT33	Sydney Peppermint	0	1x 0-5cm trunk, 1x 0-5cm trunk
HT34	Sydney Peppermint	62	1x 5-10cm branch
HT35	Sydney Peppermint	27	1x 0-5cm trunk
HT36	Silvertop Ash	60	1x 5-10cm trunk split
HT37	Silvertop Ash	55	2x 0-5cm branch spout, 1x 10-15cm branch spout
HT38	stag	34	2x 0-5cm branch spout
HT39	Sydney Peppermint	34	1x 5-10cm trunk
HT40	Sydney Peppermint	50	1x 0-5cm branch spout, 1x 5-10cm branch spout

Tag No.	Common Name	DBH (cm)	Hollows Recorded
HT41	Sydney Peppermint	55/25/25	1x 0-5cm branch spout
HT42	Sydney Peppermint	55/30	1x 0-5cm trunk crack
HT43	Sydney Peppermint	35	1x 0-5cm branch
HT44	Sydney Peppermint	80/34	1x 0-5cm branch, 1x 5-10 trunk, 1x 10-15cm trunk split
HT45	Sydney Peppermint	44	1x 0-5cm trunk 1x 5-10 trunk, 1x 5-10 branch 1x 10-15cm trunk
HT46	Sydney Peppermint	40	2x 0-5cm trunk
HT47	Sydney Peppermint	45	1x 5-10cm trunk split
HT48	Sydney Peppermint	44	1x 5-10cm broken trunk

4.3.3 Local fauna matters

The Blue Mountains City Council Flora and Fauna Guidelines and website do not require or provide a list of locally or regionally significant fauna species to consider for assessment.

4.3.4 State legislative fauna matters

(a) Threatened fauna species (NSW)

TSC Act – A search of the *Atlas of NSW Wildlife* (OEH, 2016) provided a list of threatened fauna species previously recorded within a 10km radius of the subject site. These species are listed in Table A2.2 (Appendix 2) and are considered for potential habitat within the subject site.

Based on the habitat assessment within Appendix 2, it is considered that the subject site provides varying levels of potential habitat for the following state listed threatened fauna species:

Table 4.5 – State listed threatened fauna species with suitable habitat present

Common name	TSC Act	Potential to occur
Gang-gang Cockatoo	V	recorded
Little Lorikeet	V	recorded
Grey-headed Flying-fox	V	recorded
Eastern Falsistrelle	V	recorded
Eastern Pygmy Possum	V	recorded
Blue Mountains Water Skink	E	✓
Glossy Black-Cockatoo	V	✓
Powerful Owl	V	✓
Sooty Owl	V	✓
Varied Sittella	V	✓
Spotted-tailed Quoll	V	✓
Eastern Bentwing-bat	V	✓
Greater Broad-nosed Bat	V	✓
Giant Dragonfly	E	✓
Broad-headed Snake	E	low
Scarlet Robin	V	low

Common name	TSC Act	Potential to occur
Flame Robin	V	low
Yellow-bellied Glider	V	low
East-coast Freetail Bat	V	low
Large-eared Pied Bat	V	low
Masked Owl	V	unlikely

Note: Full habitat descriptions for these species are provided in Appendix 2

Five (5) state listed threatened fauna species including Eastern Pygmy Possum (*Cercartetus nanus*), Gang-Gang Cockatoo (*Callocephalon fimbriatum*), Little Lorikeet (*Glossopsitta pusilla*), Grey-headed Flying-fox (*Pteropus poliocephalus*) and Eastern Falsistrelle (*Falsistrellus tasmaniensis*) were recorded within the study area during surveys. These species have been assessed in detail within Appendix 3.

Eastern Pygmy Possum impact assessment

The impact assessment for EPP has concluded that the proposed development will have an impact on habitat for the Eastern Pygmy Possum (EPP) but will not cause a significant impact on the local population. Asset protection zones are required for the proposed facilities and has been reduced to minimum setbacks to retain habitat as much as possible for the proposed development.

All residual habitats to the south of the APZ as indicated on Figure 3a will be retained for the EPP. Further target surveys across Cliff Drive to the south was undertaken to determine if this suitable habitat area further supported the local population, however no records were made. It is expected that EPP could be utilising the foraging resources of the site seasonally but we have not been able to identify the presence of a larger population on or adjoining the site. Hollow inspections are recommended within the affected area prior to commencing any works to ensure that the proposed APZ works do not impact on a breeding resource and to able wildlife to be relocated if at all present.

Following the survey findings on Eastern Pygmy Possum to date it is worth noting that:

- There are no other records of EPP on the entire Katoomba plateau; however this species is now considered to be more common than previously thought. Improvements in survey methodology including seasonally placed nest tubes or Infrared capture cameras have not typically been undertaken preferring to use Elliot trapping. Given the better results of tubes and remote cameras we believe that the population distribution of this species is highly underestimated.
- Katoomba to the north and the cliff escarpment to the south provide a barrier to movement for this population, therefore connectivity beyond the study area is restricted along the upper plateau on the remaining narrow southern fringes of the township towards the east and west.
- Despite apparent high quality habitat across Cliff Drive to the south, the species has not been detected adjoining the site. However improvements in the placement and seasonal survey for this species over winter when nectar resources are scarce may yield further observations.
- Feral cats and foxes were in notable presence within habitat to the south and foxes were also recorded within the study area itself. EPP expert Dr Ross Goldingay, in his Land and Environment Court evidence for a separate recorded EPP site at Helensburgh (2016), indicated that scat analysis of introduced predators suggest that while dogs are a potential predator, they are not significant as they did not show evidence of EPP predation. Furthermore, only

1% of fox scats showed predation on EPP; while cats are demonstrated predators. The site may act as a refuge for EPP against the presence of feral cats but the site is not fenced and you would expect feral predation to occur.

Based on these findings and the subsequent potential impact on an isolated local population of EPP, further habitat assessment survey and mapping was undertaken in June 2017 to guide the assessment on this species.

Habitat assessment

The methods undertaken to determine areas of *low*, *moderate*, *high* and *very high* areas of EPP habitat within the study area bound by Cliff Drive are outlined in Section 2.5. The quality of EPP habitat is based on the presence of a eucalypt overstorey, the diversity and extent of flowering understorey shrub species for foraging (particularly banksias), the density of available hollows and the degree of habitat fragmentation. The classes of EPP habitat are a reflection of the potential for EPP to occur. Any areas unshaded within the study area are considered as 'unlikely' habitat'.

The results and calculated tables to determine habitat quality classes are depicted on Figure 3c. This figure shows that the area to the south of the existing auditorium within the site (where the individual EPP was recorded) represents the higher quality habitat.

The difference between *high* and *very high* areas of habitat are generally the density of available hollows. The Quadrat 6 undertaken to the west found this area to have less hollows which is expected to be a reflection of the reduced number of Sydney Peppermint in this portion of the hilltop. Hollows were more apparent in Sydney Peppermint by comparison to Silvertop Ash, which were the two dominant canopy tree species in all communities present.

Areas of habitat to the east of the existing hall reduces to *moderate* habitat quality due to the reduction in banksia species. All other areas of *moderate* and *low* quality habitat in the northern portions of the site are rated this way due to reduced hollow density combined with higher fragmentation from the major connective remnant. Whilst these two classes are also considered on a reduced potential for EPP to occur, no camera or trapping survey has been undertaken within these areas to verify usage and such grading. Recorded presence would increase the habitat value, particularly given that the species was not recorded south of Cliff Drive. Despite the survey results, it should be noted here that the EPP are expected to occur in the surrounding contiguous high quality habitat areas south of Cliff Drive,.

Calculated habitat impact

From the mapped areas of habitat quality, the impacts as a result of the proposal have been calculated in Table 4.6.

Table 4.6 – Calculated impacts on varying EPP quality habitat

EPP Habitat Vegetation Quality	Habitat within EPP study area (ha)	Area of impact (ha)	Habitat retained (%)
Very high	0.96	0.26	72
High	0.69	0.07	89
Moderate	0.72	0.51	29
Low	0.69	0.59	15
TOTAL	3.06	1.43	

Conclusion based on extent of impacted habitat

The above table shows that 1.1ha (77%) of the 1.43ha potential EPP habitat areas impacted are considered as *low* to *moderate* areas of habitat. Subsequently the remaining 0.33ha (23%) of habitat removed is considered as *high* to *very high* quality. The removal of this will impact on EPP but would not be an impact of 'significant' proportions based on:

- The impact is less than $\frac{1}{4}$ of the *high* to *very high* habitat available within the EPP habitat study area; and
- *High* to *very high* areas of habitat in the study area remain adjacent to further extensive similar quality habitat above the plateau (despite the absence of adjacent records to date); and
- The recorded location will be retained,
- Important habitat attributes (fundamentally hollows) within the 0.26ha area of *very high* quality habitat to be removed can be relocated within retained *high* quality habitat areas in order to improve the rating of these areas up to *very high*. EPP nest boxes may also enhance these areas;
- The majority of the 0.26ha area of *very high* quality habitat calculated for removal is located within the outer limits of the APZ. These areas can be managed to retain some selective habitat features such as hollows in healthy trees and occasional banksias so they retain some potential for use; and
- A fox and cat control program would enhance the entire local connective habitat to the south above the escarpment to similar potential levels. This would also have other benefits to birds, etc.

With consideration to the impact on EPP habitats and the available mitigation measures, the seven part test assessment has concluded a 'not significant' impact on this species.

State listed species conclusion

Whilst recent survey has not been undertaken for the Gang-gang Cockatoo and Little Lorikeet during the October to January breeding period neither species are expected to utilise the site for nesting. This is given that Little Lorikeet has not been recorded in the locality in recent years and the sub-optimal nature of hollows for Gang-gang Cockatoo within the existing landscaped areas of the site. Both species are therefore not expected to utilise the subject site for important nesting habitat.

The study area does not support roosting and subsequent breeding habitat for Grey-headed Flying-fox and the Eastern Falsistrelle can be effectively managed via careful habitat tree inspections and relocation during habitat removal.

It is therefore expected that the proposal is unlikely to cause a significant impact on all state listed threatened fauna species recorded or with considered potential to occur. Therefore a SIS is not expected to be required.

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

(b) Endangered fauna populations (NSW)

There are no endangered fauna populations within the Blue Mountains LGA.

(c) SEPP 44 Koala Habitat Protection

SEPP 44 Koala Habitat Protection applies to land within Local Government Areas (LGAs) listed under Schedule 1 of the Policy. In addition, Part 2 of the Policy outlines a three (3) step process to assess the likelihood of the land in question being potential or core koala habitat. Part 2 applies to land which has an area of greater than 1 hectare or has, together with any adjoining land in the same ownership, an area of more than 1 hectare.

The subject site is required to be considered under SEPP 44 as it falls within the Blue Mountains LGA, which is listed on Schedule 1 of this Policy. In addition, the total area of the subject site is greater than 1 hectare, hence Part 2 – Development Control of Koala Habitats, of the Policy applies.

Potential Koala Habitat (PKH) is defined as land where at least 15% of the total number of trees in the upper or lower strata constitutes any of the tree species listed in Schedule 2 of the policy.

Core Koala Habitat (CKH) is defined as an area of land with a resident population of koalas, evidenced by attributes such as breeding females (i.e. females with young) and recent sightings of and historical records of a population.

A Koala Plan of Management is required to be prepared where council is satisfied that the land is CKH.

Step 1 – Is the land PKH?

No Koala food tree species as listed on Schedule 2 of State Environmental Planning Policy No. 44 - Koala Habitat Protection, were observed within the study area. As such the study area is not considered to comprise 'potential Koala habitat' as defined under SEPP 44 and no further assessment or requirements under this policy is required.

4.3.5 National environmental significance - fauna

(a) Threatened fauna species (National)

EPBC Act – A review of the schedules of the *EPBC Act* identified a list of threatened fauna species or species habitat likely to occur within a 10km radius of the subject site. These species have been listed in Table A2.2 (Appendix 2), and those with potential habitat within the subject site are considered in the seven-part test within Appendix 3.

Based on the habitat assessment within Appendix 2, it is considered that the subject site provides varying levels of potential habitat for the following nationally listed threatened fauna species:

Table 4.7 – Nationally listed threatened fauna species with suitable habitat present

Common name	EPBC Act	Potential to occur
Grey-headed Flying-fox	V	recorded
Blue Mountains Water Skink	E	✓
Spotted-tailed Quoll	E	✓
Broad-headed Snake	V	low
Greater Glider	V	low
Large-eared Pied Bat	V	low
New Holland Mouse	V	unlikely

One (1) nationally listed threatened fauna species, Grey-headed Flying-fox (*Pteropus poliocephalus*), was recorded foraging within the study area during surveys undertaken. This is also a state listed fauna species and a detailed assessment under state legislation (*EPA Act 1979*) is undertaken within the 7 part test (Appendix 3).

Grey-headed Flying-fox

Three (3) Grey-headed Flying-foxes were observed by *Conacher Travers* foraging within flowering eucalyptus within the study area on the 6 February 2007. The proposed action is likely to result in a small reduction of foraging habitat in the local area. The local area contains extensive amounts of similar or higher quality habitat for this species. There is no likelihood of this species utilising the site for roosting and subsequent breeding habitat. Although there are limited other records of this species within 10km of the subject site, these individuals observed are not likely to utilise the study area exclusively given the surrounding quality foraging resources.

The Significant Impact Criteria for a vulnerable species listed under the *EPBC Act* (Appendix 4) was reviewed to assess the impacts on this species as a result of the proposed subdivision layout within the subject site. As the subject site 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 proposed development.

Other EPBC species to consider:

Blue Mountains Water Skink

This species has potential to occur in the Hanging Swamp vegetation community. Based on the retention of this community and the buffers provided from the nearest APZ, it is considered that there will be no likely significant impact on this species.

Spotted-tailed Quoll

With consideration to local records, this species has potential to periodically forage into the edge of the urban landscape along the outer southern Katoomba plateau. Based on the large home ranges and extensive available habitat to the south there will be no likely significant impact on this species.

(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 10km radius of the subject site. The habitat potential of migratory species is considered in Table A2.3 (Appendix 2). The habitat potential of threatened migratory species is considered in Table A2.3 Table A2.2 (Appendix 2).

Two (2) nationally protected migratory bird species including Black-faced Monarch (*Monarcha melanopsis*) and Rufous Fantail (*Rhipidura rufifrons*) were recorded within the study area.

The impact assessment for this species and other nationally protected migratory species with potential to occur has concluded a not significant impact based on the extent of suitable habitat remaining within the study area and surrounding locality.

4.4 Vegetation connectivity

Vegetation within the study area has connectivity to the vast natural habitats of Blue Mountains National Park. The natural vegetation that occurs around the outer perimeter of the study area is good of high quality, particularly the southern end, which is only separated from the world heritage area by Cliff Drive. Cliff Drive is not a busy road particularly after dark.

Despite this, the vegetation within the central areas of the site becomes quickly fragmented due to the existing buildings, roads and other clearings for existing development (see Figure 4). Some small pockets of quality vegetation do occur within these central areas of the site but they are already fragmented from connective areas such that terrestrial fauna movement through the site would be limited to tolerant species. The aerial photograph in Figure 4 suggests that the vegetation in some areas remains consistent across the site, however much of the central areas of vegetation seen are canopy only.

Given that the canopy connectivity is relatively consistent throughout, there is diverse bird activity. A higher seasonal variation in bird species is expected in addition to the recorded sedentary species.

Eastern Pygmy Possum has been recorded in the southern extent of the study area where habitat is of the highest natural quality and has the largest area within the confines of Cliff Drive. This recording is unique due to the lack of other records in the locality but it is expected to be part of a population that makes passage across Cliff Drive and extends around the surrounding plateau of Malaita Point. The habitats on the other side of Cliff Drive are equally rich in diverse foraging opportunities including both canopy and banksia species. Figure 4 shows an example of the connective opportunities for this and other mostly terrestrial species that are likely to remain within quality habitat connective opportunities.

Figure 4 also depicts how the fragmented habitat that does exist through the study area soon becomes more highly fragmented towards the Katoomba urban landscapes to the north. Therefore the site does not provide any corridor values between major areas of quality natural habitat.

The proposal will remove some areas of natural habitat that does still exist within the study area, thus reducing the total available extent of this habitat for Eastern Pygmy Possum and other recorded threatened species within the confines of Cliff Drive. These proposed vegetation removal is due to the extension of the Auditorium, compliance with PBP 2006 requirements, however this removal will not fragment or isolate the most quality natural habitat areas around the site perimeter from the extensive world heritage areas described.



Figure 4 – Local connectivity

4.5 Ecological Observations

Threatened and protected migratory fauna species are likely to periodically or seasonally utilise the available habitat within the study area, particularly given the extensive Blue Mountains National Park to the adjacent south. Use of the subject site areas by such fauna has been reduced due to the fragmentation caused by existing roads and existing within site development.

Significant habitat trees containing large or notable quality hollows have been identified within the study area however other hollows do exist within the landscape and proposed development areas. These hollows are however at relatively low density as the constituent eucalypt trees present are not generally known for their provision of abundant hollows.

Hollow-dependent recorded threatened fauna including the Little Lorikeet, Eastern Pygmy Possum and Eastern Falsistrelle may utilise more discrete smaller hollows within the site for roosting and breeding, however the Gang-gang Cockatoo is only likely to utilise the hollows

already identified on Figure 3a and is not expected to utilize such disturbed landscape for breeding.

Eastern Pygmy Possum was recorded in the southern extent of the study area which provides habitat connectivity to adjacent extensive habitats. The proposed extension of the auditorium, the adjacent meeting rooms and their associated APZ's will impact on this recorded habitat area. A detailed habitat assessment was undertaken to determine the extent of potentially important habitat for EPP to be removed. This found that of the total available habitat bound within Cliff Drive contains 3.06 ha of potential EPP habitat areas. Of this 1.43ha will be impacted by the proposal made up of 1.1ha (77%) low to moderate and 0.33ha (23%) high to very high quality habitat. The removal of this will impact on EPP but was not considered likely 'significant'.

Otherwise, the study area is not expected to provide any unique or important habitat for threatened fauna that is utilised for breeding or central to home range requirements, particularly given the extent of the adjacent National Park area.

One (1) vulnerable ecological community (VEC), *Blue Mountains Swamp in the Sydney Basin Bioregion* (BMS), was recorded within the study area. BMS occurs in the north-eastern corner of the study area and is to be wholly retained and protected.

4.6 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:

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

- Removal or modification of 2.1 ha Dry Open Forest and Moist Gully Forest non-EEC vegetation. (This 2.1 hectares will be subject to modification to create and maintain a bushfire Asset Protection Zone. This will include select removal of trees, clearing of understorey and ground covers. Prioritization to retain canopy and habitat trees, trees endemic to the native vegetation community and with a high SULE rating has been made).
- Removal or modification of 1.43ha of habitat for Eastern Pygmy Possum that is likely to contain foraging, denning and potential breeding habitat. Denning habitat is represented by small hollows and fissures in older trees and stumps. As with the vegetation removal or modification above, prioritization to retain canopy and habitat trees, trees endemic to the native vegetation community and with a high SULE rating has been made. This will provide screening for the proposed auditorium and bookstore and EPP habitat will be carefully managed.
- Removal of other threatened fauna species seasonal foraging habitat.
- Removal of other hollows of various sizes suitable for threatened fauna species.

The potential indirect impacts of the proposal are considered as:

- Minor further fragmentation of connectivity for arboreal mammals
- Reduced cross-site movements by small bird species such as passerines.
- Edge effects such as weed incursions caused from soil disturbance, repeated clearing and landscaping species becoming a nuisance in the adjacent remnant bushland.
- Increased spill-over from noise, activity, scent and lighting effects into the adjacent quality natural habitat areas.

- Increased soil nutrients from changes to runoff that may provide further opportunities for weed plumes.
- Disturbance of water quality within the drainage that flows eastward off the escarpment from the study area.

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 Dry Open Forest and Moist Gully Forest within the locality
- Further fragmentation of the existing fragments and reduction in potential quality and use.
- Reduction of the existing plateau habitats utilised by Eastern Pygmy Possum
- 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 food or general waste and building refuse.
- Continued presence of feral predators in the local natural landscape placing pressures on local native species.



Conclusion

5

Ecological survey and assessment has been undertaken in accordance with relevant legislation including the *Environmental Planning and Assessment Act 1979*, the *Threatened Species Conservation Act 1995*, the commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the *Fisheries Management Act 1994*.

5.1 Legislative compliance

In respect of matters required to be considered under the *Environmental Planning and Assessment Act 1979* and relating to the species / provisions of the *Threatened Species Conservation Act 1995*, five (5) threatened fauna species including Eastern Pygmy Possum (*Cercartetus nanus*), Gang-Gang Cockatoo (*Callocephalon fimbriatum*), Little Lorikeet (*Glossopsitta pusilla*), Grey-headed Flying-fox (*Pteropus poliocephalus*) and Eastern Falsistrelle (*Falsistrellus tasmaniensis*) and no threatened flora species, or populations.

There is one (1) Threatened Ecological Community (TEC) occurring within the study area. This is the Fernland and the Hanging Swamp vegetation communities which are both commensurate with or components of the '*Blue Mountains Swamps of the Sydney Basin Bioregion*' which is listed as a Vulnerable Ecological Community (VEC) under the NSW TSC Act (1995). This Hanging Swamp vegetation community is also a component of the '*Temperate Highland Peat Swamp on Sandstone*' which is listed as an Endangered Ecological Community (EEC) within the Commonwealth EPBC Act.

In accordance with Section 5A of the *Environmental Planning and Assessment Act 1979*, the 7 part test of significance concluded that the proposed development will not have a likely significant impact on any threatened populations, EECs, recorded threatened species or those with considered potential to occur. Therefore a Species Impact Statement is not considered to be required.

In respect of matters required to be considered under the *Environment Protection and Biodiversity Conservation Act 1999*, one (1) threatened fauna species Grey-headed Flying-fox (*Pteropus poliocephalus*), two protected migratory bird species Black-faced Monarch (*Monarcha melanopsis*) and Rufous Fantail (*Rhipidura rufifrons*), no threatened flora species, and one EEC (*Blue Mountains Swamps in the Sydney Basin Bioregion*) listed under this Act were recorded within the study area.

The proposed development was not considered to have a significant impact on matters of national environmental significance. As such a referral to Department of Environment should not be 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 subject site and there are no matters requiring further consideration under this Act.

5.2 Mitigation and amelioration of Impacts

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

Flora

- It is recommended that a VMP be prepared to identify the ongoing management of habitat resources, weeds, future landscaping and site works to retain mature trees and habitat movement corridors to ensure the access options to foraging resources are maintained for threatened fauna species. This should include consideration to the Superb Lyrebird core foraging areas within the Moist Gully Forest area of the site. (See *Travers bushfire and ecology* Ref No: 16026V Feb 2018)
- Where they adjoin the development areas, the boundaries of the conservation 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
- If a VMP is produced for the study area, it is recommended that construction activities will be intermittently supervised on-site and monitored by a project ecologist to ensure that the recommendations of the VMP report are implemented. All staff involved with the development shall undergo an induction and training program to reinforce the ecological and environmental objectives of the development
- Targeted weed control is to be undertaken within 10m of any works to control the invasion or spread of noxious or invasive environmental weed species.
- Temporary vegetation protection fencing will be erected around the outer limit of the APZs associated with the new developments.
- Erosion control measures are to be in place to reduce temporary erosion and sedimentation risks to adjacent vegetation and any nearby drainage channel.
- 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 onsite found to contain soil or vegetation material is to be cleaned in a quarantined work area or wash station and treated with anti-fungal herbicides.

Fauna

- Mitigation measures to improve the viability of the local EPP population would include a feral predator baiting program.
- Where the felling of hollow-bearing trees is required, this 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 sectionally dismantled for relocation and all hollows should be inspected for occupation, signs of previous activity and potential for reuse.

- Subsequent hollows of retention value are to be relocated to nearby conservation 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. Where possible suitable hollow sections for Eastern Pygmy Possum should be reinstalled into remaining trees. Nest boxes should also target Eastern Pygmy Possum and other potentially occurring threatened 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.
- If a threatened species is found to be occupying the hollow then the 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. The hollow section should be well secured in the recipient tree in a manner that will not compromise the current or future health of that tree.
- 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.
- Noise and lighting spill-over is to be effectively managed to reduce their impacts into the natural habitat areas to the south at night. These may require downward facing baffles on outdoor lighting and rear landscaping walls where necessary.
- Where bushrock will be disturbed this should be relocated over other locations where surface outcrops occur closer to continuous terrestrial habitats. This should be undertaken under the guidance of a fauna ecologist and aim to enhance remaining habitat for reptiles.

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Fauna Survey Methodologies

A1

The fauna survey methods outlined within this Appendix are techniques employed by *Travers bushfire & ecology*, based on industry standards as well as additional methods found to be effective for select fauna groups. The fauna survey techniques deployed for each specific site are outlined within the survey effort table in the main body of this report. The techniques selected will depend upon the site characteristics and extent of available habitat as well as restrictions such as available survey time and weather conditions.

If any additional or target survey techniques for fauna species are undertaken, beyond the methods outlined within this Appendix, the details of these will be described within the main body of this report.

1 Standard survey techniques

1.1 Diurnal birds

Diurnal birds are typically identified visually and / or by calls during diurnal surveys. Habitat searches to identify nests, feathers, eggs, or signs of foraging may be utilised more specifically for identifying threatened diurnal bird species.

Visual observations are made more accurate with the use of binoculars and where necessary or practical, with the use of a spotting scope. Binoculars are carried by the fauna surveyor at all times during nocturnal and diurnal fauna surveys. A birding field guide is always available in the field when required for verifications.

Calls are identified in the field by the fauna surveyor. If an unknown call is heard it is cross-matched to comprehensive bird call reference libraries taken into the field. A call library of birds occupying the NSW coastal areas is also stored into a mobile phone for a quick reference. This phone is carried into the field at all times and may be used for call-playback methods and recording calls for later analysis.

Diurnal bird census points may be undertaken at large sites where the total area may not be effectively covered during the survey period, or as a measure to ensure focused bird only survey.

1.2 Nocturnal birds

Searches for evidence of Owl roosts, key perches and potential Owl roosting / breeding hollows are made during diurnal site searches. Whitewash, feathers or regurgitated pellets give key information. Pellets are sent for analysis of contents to assist in identification where necessary.

The presence of nocturnal birds during the nocturnal period is first determined by quiet listening after dusk for calls by individuals emerging from diurnal roosts. Following this, and provided no calls are heard, call-playback techniques are employed for threatened species that have suitable habitat present.

Threatened nocturnal birds known to provide response to call-playback techniques include Masked Owl (*Tyto novaehollandiae*), Powerful Owl (*Ninox strenua*), Barking Owl (*Ninox connivens*), Sooty Owl (*Tyto tenebricosa*), Grass Owl (*Tyto capensis*), Black Bittern (*Ixobrychus flavicollis*), Australian Bittern (*Botaurus poiciloptilus*) and Bush Stone-curlew (*Burhinus grallarius*).

Each call is typically played for five minute periods with five minute intervals of quiet listening for a response. This is followed with spotlighting and periods of quiet listening throughout the nocturnal survey.

Separation distances between broadcasting stations during a single night of survey are advised for different species within survey guidelines. These include 1km between Owl calls and 3km between Bush Stone-curlew calls. Subsequent to this, separate broadcasting stations will be deployed on the same night where sites of significant size are surveyed. Separations for bitterns are not advised and these may be broadcast at a number of stations along suitable habitat areas.

Stag-watching will be undertaken where suitable large hollows for Owl nesting / roosting show signs of activity or are located within development areas. Stag-watching of nesting trees should be undertaken during the recognised nesting period for Owls with potential to occur.

1.3 Arboreal mammals

Arboreal mammals may be surveyed using Elliott type A, B and / or C traps, small and / or large hair tubes, spotlighting, call-playback techniques, scat searches or searches for other signs of activity.

Baiting and layout for Elliott trapping and hair tubing are typically incorporated into terrestrial trapping and hair tubing effort, unless where target survey is undertaken. Standard baiting and layout is therefore described in Section A1.3.2 below within terrestrial survey methods. Where gliders are targeted, the standard bait mix may be additionally laced with a nectarivor powder mix used for feeding captive birds. Where Brush-tailed Phascogales are targeted the standard bait mix may be additionally laced with an insectivore powder mix. Where Eastern Pygmy Possum is targeted, the bait mix will be more heavily laced with honey.

Elliott traps for arboreal captures are placed onto tree mounted platforms that are attached to the trunk 2-3m above the ground, at an incline to facilitate drainage during inclement weather. Plastic sleeves are placed around or over traps when there is a possibility of wet weather in the forecast. Arboreal hair tubes are attached to the trunk of trees using rubber bands with the tube entry facing down, preventing water entry.

For all arboreal traps and hair tubes a mixture of honey and water is sprayed onto the trunk up to 8m above the trap and around the trap as a lure. Where Eastern Pygmy Possum is targeted, a high concentrate honey water mix is also sprayed from the base of trunk up and along connective branches.

Arboreal traps and hair tubes are placed in trees selected to bias target species. These are often flowering or sap flow trees for gliders, rough-barked trees for the Brush-tailed Phascogale and Banksias for the Eastern Pygmy possum.

Where habitat is suitable, the presences of Koala (*Phascolactos cinereus*), Yellow-bellied Glider (*Petaurus australis*) and Squirrel Glider (*Petaurus norfolcensis*) may be targeted by call-playback techniques. Calls are played for five minute periods during nocturnal surveys. This is followed by quiet listening and spotlighting.

1.3.1 Koala survey

Koala survey is undertaken where the site is considered to provide potential habitat under the definitions of SEPP 44 - Koala Habitat Protection, or in the presence of feed trees listed in Appendix 1 of the Recovery Plan for the Koala. Habitat may also be defined according to locally prepared Koala Plans of Management.

SEPP 44 is applied to land within Local Government Areas (LGAs) listed under Schedule 1 of the Policy. Part 2 is applied to land which has an area of greater than 1ha or has, together with any adjoining land in the same ownership, an area of more than 1ha.

To determine Potential Koala Habitat (PKH) under the definitions of SEPP 44 an estimate of the percentage density of each tree species within vegetation communities is determined by averaging the percentage of stems counted. PKH is defined as land where at least 15% of the total number of trees in the upper or lower strata constitutes any of the tree species listed in Schedule 2 of the Policy.

Where Koala habitat is considered to be present, the site will be surveyed on foot, with known Koala food trees being inspected for signs of use. Trees are inspected for characteristic scratch and claw marks on the trunk and scats around the base of each tree. Koalas may also be targeted during nocturnal survey involving call-playback techniques and spotlighting.

For large sites, Koala search quadrats may be employed within portions of communities where feed trees are present at suitable densities. All Koala feed trees within quadrats are searched for signs of activity including characteristic claw marks on the trunk and faecal pellets around the base. Pellet searches are undertaken according to the tree base search methods described in *Phillips & Callaghan* (2008). Search quadrats are less labour intensive than the SAT techniques described below but may only be an initial survey effort to determine presence / absence.

Where any Koala activity is recorded the complete Spot Assessment Technique (SAT) described by *Phillips & Callaghan* (2008) may be undertaken as a measure of Koala activity. This technique may also be employed in the first instance as an indicator of presence / absence, particularly where a site has potential Koala activity based on previous records.

For any survey technique, the location and density of Koala droppings, if found, are documented.

1.4 Terrestrial mammals

Various traps may be used to survey for the presence of terrestrial mammals. These include Elliott trapping, medium and large cage trapping, small and large hair tubing and pitfall traps. Other survey methods for terrestrial mammals include the use of camera surveillance, spotlighting and activity searches.

Arboreal and terrestrial Elliott traps and hair tubes are placed in grids, or more commonly along trap-lines of 5-10 traps separated by distances of 20-50m, depending on site size and variation of habitat. Trap or hair tube sizes selected at each trap station may alternate or may have an emphasis on certain sizes according to target species.

Selection of terrestrial Elliott trap, cage trap, hair tube or pitfall trap locations has an emphasis on nearby foliage, runways, shelters and signs of activity.

Standard bait mix for all Elliott traps, medium cage traps and hair tubes is a mixture of rolled oats, honey and peanut butter. Standard bait mix may be supplemented with sardines in large hair tubes or cage traps to simultaneously target Spotted-tailed Quoll. Cage traps may also be baited solely with meat or roadkill to target Spotted-tailed Quoll. Where Potoroos or Bandicoots are targeted, truffle oil may be used to lace the standard bait mix or used on its own.

Where difficult to access, sensitive or extended trapping periods are undertaken, surveillance cameras can be used in terrestrial mammal surveys. The surveillance camera is mounted on a tree and directed towards a closed baited cage trap. Surveillance cameras may also be used to detect use or monitor activity at burrows, hollows, nests, etc.

During diurnal site searches, assessment is made of 'found' scats, markings, diggings, runways and scratches located. Any scats or pellets not readily identifiable (particularly predator scats) may be collected and sent to Barbara Triggs for identification of contents, hair or bone fragments.

1.5 Bats

Micro-chiropteran bats are surveyed by echolocation using Anabat detectors or trapped using harp (Constantine) traps, mist nets or trip lines. Microchiropteran bats are also surveyed by searches of subterranean habitats such as caves, tunnels or shafts where present, or by searching structures such as under bridges and abandoned buildings or wall / ceiling cavities, where entry is possible.

Anabat Mk 2 and SD-1 detectors are used in fixed passive monitoring positions and / or during active nocturnal monitoring. Active monitoring is used in conjunction with spotlighting or during stag-watching for greater accuracy of recorded call identification.

Bat call recordings are interpreted through Anabat V and Anabat CF Storage and Interface Module ZCAIM devices and analysed using Anabat 6 and Analook 3.3q computer software packages.

Harp traps and mist nets are placed along suitable 'flyways' such as along open narrow road / river corridors to maximise the likelihood of captures. Traps may be purpose set to capture bats emerging from roosts by being placed at the entry of tunnels / caves or draped over the edge of bridges. Trip lines are placed over water to trip low flying drinking bats into the water. These bats are collected as they swim to the waters edge.

Harp traps are checked during early nocturnal survey, as well as each morning. Mist nets and trip lines require constant monitoring. Captured bats are identified using field identification guides. Bats are released at the point of capture after dusk or placed under trunk bark / splits of nearby trees.

Mega-chiropteran bat species, such as Grey-headed Flying-fox, are surveyed by targeting flowering / fruiting trees during spotlighting activities and by listening to distinctive vocalisations. Suitable roosting habitat is searched for presence of small or large established camps during diurnal survey periods.

1.6 Amphibians

Amphibians are surveyed by vocal call identification, call-playback, spotlighting along the edge of water-bodies, pitfall trapping, funnel trapping, by driving along sealed roads near waterways, habitat searches and collection of tadpoles.

Calls are identified in the field by the fauna surveyor. For similar calling species, or if an unknown male call is heard, it is cross-matched to frog call reference libraries taken into the field. A call library of frogs occupying the NSW coastal areas is also stored into a mobile phone for a quick reference. This phone is carried into the field at all times and may be used for call-playback methods and recording calls for later analysis.

All threatened frog species may be targeted by use of call-playback techniques where suitable habitat exists, with some species more reliable than others in providing a response. Red-crowned Toadlet may also be targeted by clapping and loud retort along suitable habitat drainages in order to evoke a call response.

Any amphibians found are visually identified and, when required to be examined, are handled with latex gloves and kept moist until release. Any tadpoles requiring capture are collected with a scoop net and placed within a snap-lock clear plastic bag for analysis of colour and morphological features.

Amphibian survey yields best results during or following wet periods with seasonal breeding and subsequent male calling varying according each species. Targeted survey is thus undertaken in appropriate seasons.

1.7 Reptiles

Reptiles are surveyed opportunistically during diurnal site visit(s), but also by habitat searches, pitfall trapping, funnel trapping, by driving along roads on humid nights and by camera surveillance at burrows.

Habitat searches for reptiles are undertaken in likely localities such as under logs, rocky slabs on rock surfaces, under sheet debris, under bark exfoliations and leaf litter at the base of trees and along the edge of wetlands. Aspect and land surface thermal properties are considered to determine best search locations particularly along rocky escarpments.

During warmer months spotlighting may assist survey effort particularly during humid conditions.

1.8 Invertebrates

Target survey is undertaken for the Cumberland Plain Land Snail (*Meridolum corneovirens*) when in proximity to previous *Atlas of NSW Wildlife* records and particularly where its typical host vegetation community is present. The most appropriate areas of observed habitat are searched. Dense areas of leaf litter with likely moisture retaining properties are scraped using a three pronged rake. Logs, stumps, artificial refuse and rocks are also turned over. In large survey areas, search quadrats are undertaken evenly across highest quality habitat areas to estimate population size.

The top (spiral side), side (showing aperture) and underside (showing umbilicus) of snail specimens found are photographed and sent to Michael Shea of the Australian Museum Malacology Unit for confirmation of identification.

2 Habitat trees

Hollow-bearing tree surveys use a *Trimble* handheld GPS unit to log both field reference location as well as tree data. Data such as hollow types, hollow size, tree species, diameter at breast height, canopy spread and overall height are documented. A metal tag with the tree number is placed on the trunk for field relocation purposes. Other habitat features such as nests and significant sized mistletoe for foraging are also noted.

3 Survey effort table descriptors:

Target - Where effort is specifically concentrated towards an individual species. Selected target species will be identified within the survey effort table and where necessary described within the report.

Opportunistic - Where birds are identified by observation, call or indirect methods as the opportunity arises.

Habitat search - Where suitable areas of habitat for selected fauna groups such as frogs, reptiles and invertebrates are specifically searched.

Diurnal bird census point(s) - Bird surveys are undertaken within a specified area surrounding a point (or in a quadrat) for a specified amount of time. Size and time will be specified in the survey effort table. These are more typically undertaken across larger sites where the total area cannot be effectively covered during the survey period. Subsequently census points are selected to adequately represent each of the habitat areas present and particularly areas designated for proposed development. Often census points are commenced at locations where bird activity is noticeably high.

Spotting-scope outlook - A *Nikon* spotting scope with 16~47 zoom at x60 magnification on a mounted tripod is used for distant inspections of diurnal birds. This is undertaken at wetlands for viewing waterfowl and waders but also other difficult to access areas. It may also be used for inspecting activity at nests, hollows and combined with spotlight for a panoramic search in open areas.

Call-playback - This involves broadcasting recorded calls through a 15 watt Toa 'Faunatech' amplifier to evoke a response from species known to reply. Species selected for call-playback will be indicated in the survey effort table.

Spotlighting - Is carried out using a hand held 55 watt spotlight powered by a 12 volt rechargeable battery. This technique involves walking amongst the woodland areas, forest fringes, along roads, trails and fence lines so that a maximum number of trees can be observed. Spotlighting around water-bodies and particularly along the shallow fringes is used for finding frogs. Spotlighting is used in combination with binoculars or spotting scope for closer night inspections.

Stag-watching - Involves watching hollows in the dusk period approximately 15 minutes prior to dark until 30 minutes following dark. Placement of the observer on the ground allows for a silhouette of any emerging fauna to be seen against the lighter sky background such that a spotlight is not required, which would likely to disrupt emergence behaviour. Where any movement is observed, a spotlight may then be used for identification purposes.

Search quadrats - Are undertaken within a specified area surrounding a point (or in a quadrat) for a specified amount of time. These are more typically undertaken across larger sites where the total area cannot be effectively covered during the survey period. Subsequently quadrats are selected to adequately represent each of the suitable habitat areas present and particularly areas designated for proposed development. The use of this technique simply as an initial time-effective suitable indicator of presence / absence of Koalas has been discussed with Koala expert, Stephen Phillips.

Koala Spot Assessment Technique (SAT) - Method outlined by *Phillips & Callaghan* (2008) and accepted by the Australian Koala Foundation to determine Koala activity levels. Activity levels are calculated from the proportion of trees showing signs of Koala use as indicated by the presence of scats as well as site location within the state.

Elliott trapping - Using *Elliott* type A (33x10x10cm) and Type B (45x15x15cm), B and / or Type C traps for trapping small sized mammals. Trapping nights' effort will be indicated in the survey effort table. Trapping layout, trap sizes, baiting and trapping period will be outlined within the site specific methodology section.

Medium cage trapping - Using medium sized cage traps (17x17x45cm foldout cages with tread-plate mechanism or 22x25x58cm rigid cage with tread-plate mechanism) for trapping up to cat/bandicoot sized mammals. Trapping layout, target species, baiting and trapping period will be outlined within the site specific methodology section.

Large cage trapping - Using large sized cage traps (25x25x50cm foldout cages with pull lever (meat) mechanism, 28x28x60cm foldout cages with tread-plate mechanism or 30x30x70cm rigid cage with tread-plate mechanism) for trapping up to quoll sized mammals. Trapping layout, target species, baiting and trapping period will be outlined within the site specific methodology section.

Hair tubing - Using small (40mm diameter x 120mm long) and/or large (90mm diameter x 200mm long) PVC pipe sections for collecting mammal hair samples. At one end of each tube is an enclosed chamber where the bait is placed and capped. Small drill holes in the inside face of the chamber allow the smell of the bait to permeate out through the tube without allowing access to the bait. At the other open entry end, double-sided tape is attached around the inner rim so hair samples of animals entering the tube are collected. Hair samples collected are sent to Barbara Triggs for identification. Trapping layout, tube sizes, baiting and trapping period will be outlined within the site specific methodology section.

Pitfall trapping - Is used to survey for small terrestrial mammals, frogs, reptiles and invertebrates. Pitfall trapping involves the use of 15cm diameter and 60cm long PVC stormwater pipe sections placed vertically into pre dug holes. The pipe is placed and set firm with surrounding soil so that the top rim is level with the ground surface. Drift fences made of damp-proof-course 270mm wide are held tight and upright by wooden and steel pegs and run along the length of each trap-line. Drift fences are run over the middle of each pit in the trap line ensuring at least 5m of fencing is run along each side of each pit. Ground fauna passing beyond the pitfall transect are diverted towards the pits along the fence line.

Funnel trapping - Is used to survey mainly for frogs and reptiles. Funnel traps are 18cm x 18cm x 75cm long and constructed of shade cloth with an internal spring and wire frame in a similar design to yabby traps. At each end an inward facing funnel directs fauna through a 4cm hole and into the trap. Herpetofauna search the walls and corners for an exit and discover it difficult to re-find the internal exit hole. As with pitfall traps, funnel traps are used with drift fences that divert fauna towards the trap entry. At least 5m of fencing is run between each funnel trap which may be placed on either side of the fence. Trapping layout, target species, fence lengths and trapping period will be outlined within the site specific methodology section.

Passive Anabat monitoring - Involves leaving the bat recorder in a fixed mounted position to record call-sequences of passing bats. Recording locations are determined in order to represent different available foraging structures for various micro-chiropteran bat species. Dams, cleared flyways, high insect activity areas, forest edges and ecotones are particularly targeted.

Active Anabat monitoring - Is a method of active microbat recording during stag-watching or during complete nocturnal survey. Active monitoring involves an SD-1 recorder allied with a PDA for viewing call-sequences in real-time. When calls are heard the transducer microphone is actively directed towards the calling animal with the aid of a spotlight, so longer and clearer call sequences may be recorded. When calls of a potential threatened species are observed on the PDA screen a view by spotlight of the bat size and wing morphology is attempted for greater identification accuracy.

Active vehicle Anabat monitoring - Is a method of active microbat recording deployed when large distances need to be covered in a nocturnal survey period. A Hi-mic extension cable allows the transducer microphone to be placed on a bracket on the roof of a travelling vehicle so calls may be viewed whilst driving. The vehicle travels at no more than 40km/h to

prevent wind interference. When calls of a potential threatened species are observed on the dash mounted PDA screen active spotlighting is undertaken.

Harp trapping - Is used to capture microchiropteran bats. Harp traps have an aluminium frame with a two-bank 4.2m² area and calico capture bag set along the base area.

Mist netting - Is used to capture microchiropteran bats. The mist net capture area is 2.4m high and 9m wide and supported by two 3.5m poles which are braced with ropes and pegs. Design is a 0.08mm ultrafine nylon monofilament thread arranged in a 14x14mm mesh, with four horizontal capture pockets. These features are specific for the use to capture microchiropteran bat species and are provided from the only known supplier in Poland.

Trip lining - Is used to capture microchiropteran bats. Fishing line is strung tight on pegs in a zig-zag pattern across open water-bodies just above the water surface to trip drinking bats into the water.

Camera surveillance - Is used to monitor activity at burrows, hollows, etc. or to survey for species presence at baited stations. A Reconyx Hyperfire digital weatherproof camera is used with a passive infrared motion detector and a night-time infrared illuminator. The camera is mounted on a tree or tripod and takes three consecutive photo frames on the detection of movement up to 30m away or the detection of a heat/cold source different to the ambient temperature.

Weather conditions - Survey effort for each fauna group accounting for methods undertaken, duration, and weather conditions are provided in the survey effort table. Weather details are documented for all survey techniques and include:

- air temperature
- cloud cover
- rain (e.g. none, light drizzle, heavy drizzle, heavy rain)
- recent rain events (where relevant)
- wind strength e.g. calm, light (leaves rustle), moderate (moves branches), strong (moves tree crowns)
- wind direction
- moon (where relevant) (e.g. none, 1/4 moon, 1/2 moon, 3/4 moon, full moon)



Threatened & Migratory Species Habitat Assessment

A2

Table A2.1 provides an assessment of potential habitat within the subject site for state and nationally listed threatened flora species recorded within 10km on the Atlas of NSW Wildlife (OEH) or indicated to have potential habitat present within 10km on the *EPBC Act* Protected Matters Tool.

Table A2.1 – Threatened flora habitat assessment

Scientific name DATABASE SOURCE	TSC Act	EPBC Act	Growth form and habitat requirements	Recorded on site (✓)	If not recorded onsite				Considered in 7 part test of significance (✓) Refer to Attachment 4
					Suitable habitat present (✓)	Nearby and / or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (✓) Notes 1,2 & 3	Potential to occur	
<i>Acacia baueri</i> subsp. <i>aspera</i> OEH	V	-	Decumbent to spreading shrub with phyllodes irregularly whorled. Grows in low heath chiefly in Blue Mountains.	x	x	-	-	x	x
<i>Acacia bynoeana</i> OEH EPBC	E1	V	Erect or spreading shrub to 0.3m 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	✓	6.5 km ENE (4 within 10 km - all further E)	1972	x	-
<i>Acacia clunies-rossiae</i> OEH	V	-	Shrub to 2m tall, flowering in September. Grows in dry sclerophyll forest in valleys and on rocky slopes from the Kowmung River and adjacent Coxs River district.	x	x	-	-	x	x

Scientific name DATABASE SOURCE	TSC Act	EPBC Act	Growth form and habitat requirements	Recorded on site (✓)	If not recorded onsite				Considered in 7 part test of significance (✓) Refer to Attachment 4
					Suitable habitat present (✓)	Nearby and / or high number of record(s) (✓) <i>Notes 1,2 & 3</i>	Record(s) from recent years (✓) <i>Notes 1,2 & 3</i>	Potential to occur	
<i>Acacia flocktoniae</i> OEH EPBC	V	V	Shrub to 1.5 – 3m, flowers June – Sept, but also recorded March, April Oct December. Known from Blue Mtns – Mt Wilson south to Picton, rare. Grows in dry sclerophyll forest on sandstone	x	✓	3.5 km W (5 within 10km – all others further W & N)	1961	x	x
<i>Acrophyllum australe</i> OEH	V	V	Small shrub 1-2m high growing in damp crevices in sandstone usually near waterfalls. Distribution limits Springwood region.	x	x	-	-	x	x
<i>Asterolasia elegans</i> EPBC	E1	E	Erect shrub 1-3m high growing in moist sclerophyll forests on Hawkesbury sandstone slopes hillsides. Distribution limits Maroota region.	x	x	-	-	x	x
<i>Caladenia tessellata</i> EPBC	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
<i>Callistemon megalongensis</i> OEH EPBC	CE	CE	A bottlebrush shrub to 4.5 m occurring in shrubby swamp habitat and swampy woodland. Distribution is limited to within Megalong Valley in the western Blue Mountains.	x	x	-	-	x	x
<i>Carex klaphakei</i> OEH	E1	-	Sedge with culms to 1.6m. Confined to swamps on sandstone near Blackheath, Mt Werong and Penrose.	x	x	-	-	x	x

Scientific name DATABASE SOURCE	TSC Act	EPBC Act	Growth form and habitat requirements	Recorded on site (✓)	If not recorded onsite				Considered in 7 part test of significance (✓) Refer to Attachment 4
					Suitable habitat present (✓)	Nearby and / or high number of record(s) (✓) <i>Notes 1,2 & 3</i>	Record(s) from recent years (✓) <i>Notes 1,2 & 3</i>	Potential to occur	
<i>Cryptostylis hunteriana</i> EPBC	V	V	Saprophytic orchid. Grows in swamp heath on sandy soils. Distribution limits N-Gibraltar Range S-south of Eden.	x	x	-	-	x	x
<i>Derwentia blakelyi</i> OEH	V	-	Small hairless and bluish shrub up to 50cm high. Occurs in eucalypt forest, often in moist areas, and is restricted to the western Blue Mountains.	x	✓	>10km NNW (1 record within 10km)	1978	Not likely	x
<i>Epacris hamiltonii</i> OEH EPBC	E1	E	Procumbent to ascending shrub to 1m. Grows in skeletal sandy soil in sheltered damp rock situations in Blackheath area.	x	x	-	-	x	x
<i>Eucalyptus benthamii</i> OEH EPBC	V	V	Blue gum to 40m high. Wet forest on sandy alluvial soils. Distribution limits N-Yarramundi S-Bents Basin.	x	x	-	-	x	x
<i>Eucalyptus copulans</i> OEH EPBC	E1	E	Smooth barked tree to 10m. Only known from Wentworth Falls and is considered to be extinct.	x	✓	4.7 km NE (24 records within 10km – all >5km E)	2003	x	x
<i>Eucalyptus macarthurii</i> EPBC	V	E	Tall tree to 40m tall which occurs within grassy woodland vegetation types predominately around Moss Vale district to Kanangra-Boyd NP in the Southern Highlands.	x	x	-	-	x	x

Scientific name DATABASE SOURCE	TSC Act	EPBC Act	Growth form and habitat requirements	Recorded on site (✓)	If not recorded onsite				Considered in 7 part test of significance (✓) Refer to Attachment 4
					Suitable habitat present (✓)	Nearby and / or high number of record(s) (✓) <i>Notes 1,2 & 3</i>	Record(s) from recent years (✓) <i>Notes 1,2 & 3</i>	Potential to occur	
<i>Eucalyptus pulverulenta</i> EPBC	V	V	A small tree, typically mallee-like on shallow soils in open forest, typically dominated by Brittle Gum (<i>Eucalyptus mannifera</i>), Red Stringybark (<i>E. macrorhynca</i>), Broad-leafed Peppermint (<i>E. dives</i>), Silvertop Ash (<i>E. sieberi</i>) and Apple Box (<i>E. bridgesiana</i>). There are two main areas of occurrence including Lithgow to Bathurst, and Bredbo to Bombala.	x	x	-	-	x	x
<i>Euphrasia arguta</i> EPBC	CE	CE	An annual herb to 35cm tall, flowers October to January. Grows in grassy areas near rivers. Recorded from Bathurst to Walcha area. Considered extinct until recent rediscovery in 2008 near Nundle.	x	x	-	-	x	x
<i>Euphrasia bowdeniae</i> OEH EPBC	V	V	Herb to 20cm ascending to pendent. Grows on sandstone cliff or ledges in higher Blue Mountains.	x	x	-	-	x	x
<i>Haloragis exalata</i> subsp. <i>exalata</i> EPBC	V	V	Shrub to 1.5m high. Grows in damp places near watercourses. Distribution limits N-Tweed Heads S-south of Eden.	x	x	-	-	x	x
<i>Haloragodendron lucasii</i> OEH EPBC	E1	E	Straggling shrub to 1.5m high. Grows in open forest on sheltered slopes near creeks. Distribution limits Ku-ring-gai Plateau and Mt Wilson.	x	✓	>10km NE (3 within 10km - all >10km)	1994	x	x
<i>Isopogon fletcheri</i> OEH EPBC	V	V	Multi-stemmed shrub confined to sheltered moist positions on the escarpment in Blackheath district.	x	x	-	-	x	x

Scientific name DATABASE SOURCE	TSC Act	EPBC Act	Growth form and habitat requirements	Recorded on site (✓)	If not recorded onsite				Considered in 7 part test of significance (✓) Refer to Attachment 4
					Suitable habitat present (✓)	Nearby and / or high number of record(s) (✓) <i>Notes 1,2 & 3</i>	Record(s) from recent years (✓) <i>Notes 1,2 & 3</i>	Potential to occur	
<i>Kunzea cambagei</i> EPBC	V	V	A groundcover species which is restricted to damp, sandy soils in wet heath or mallee open scrub at higher altitudes on sandstone outcrops or Silurian group sediments. Flowers September – November. Occurs in the western and southern parts of the Blue Mountains, just west of Berrima, Loombah Plateau, Kanangara-Boyd NP and Nattai NP.	x	x	-	-	x	x
<i>Leionema lachnaeoides</i> OEH EPBC	E1	E	Tall shrub confined to barren rocky situations in the higher Blue Mountains. Found in 'montane heath' communities located along the Jamison and Megalong valleys on the tops and terraces of cliff lines with a SE to SW aspect.	x	x	-	-	x	x
<i>Lepidosperma evansianum</i> OEH	V	-	Sedge which grows on wet sandstone cliff faces in Blue Mountains.	x	x	-	-	x	x
<i>Melaleuca deanei</i> EPBC	V	V	Shrub to 3m high. Grows in heath on sandstone. Distribution limits N-Gosford S-Nowra.	x	x	-	-	x	x
<i>Pelargonium</i> sp. <i>Striatellum</i> EPBC	E1	E	Herb to 90cm 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
<i>Persoonia acerosa</i> OEH EPBC	V	V	Erect to spreading shrub. Grows in heath or dry sclerophyll forest on sandstone. Distribution limits N-Bilpin S-Hill Top.	x	✓	1 km N (187 within 10km)	2005	Low	✓

Scientific name DATABASE SOURCE	TSC Act	EPBC Act	Growth form and habitat requirements	Recorded on site (✓)	If not recorded onsite				Considered in 7 part test of significance (✓) Refer to Attachment 4
					Suitable habitat present (✓)	Nearby and / or high number of record(s) (✓) <i>Notes 1,2 & 3</i>	Record(s) from recent years (✓) <i>Notes 1,2 & 3</i>	Potential to occur	
<i>Persoonia nutans</i> OEH	E1	E	Erect to spreading shrub. Grows in dry sclerophyll forest and woodland on laterite and alluvial sands. Distribution limits Cumberland Plain.	X	X	-	-	X	X
<i>Ptherosphaera fitzgeraldii</i> OEH EPBC	E1	E	Erect shrub with dropping branches to 1m. Found within the spray zone or drip lines and seepage areas of waterfalls on steep, sandstone cliffs and ledges, at altitudes of 680 and 1000m above sea level.	X	X	-	-	X	X
<i>Prasophyllum fuscum</i> OEH EPBC	CE	V	Terrestrial orchid up to 45cm tall. Flowers from Oct-Dec and restricted in distribution to the Georges River and Wingicaribee Swamp near Burrawang at an altitude of 50-200m.	X	X	-	-	X	X
<i>Prasophyllum petilum</i> EPBC	E	E	Terrestrial orchid to 30cm high. Flowers Oct-Nov. Grows in patchy woodland in fertile soils (probably much reduced by farming); rare, confined to the A.C.T. and NSW Southern Tablelands and Central Western Slopes.	X	X	-	-	X	X
<i>Prasophyllum</i> sp. Wybong EPBC	-	CE	Terrestrial leek orchid to 30 cm. Flowers Sept-Oct, does not necessarily flower each year. Known from seven populations in eastern NSW near Ilford, Premer, Muswellbrook, Wybong, Yeoval, Inverell and Tenterfield. Known to occur in open eucalypt woodland, grassland and disturbed places.	X	X	-	-	X	X

Scientific name DATABASE SOURCE	TSC Act	EPBC Act	Growth form and habitat requirements	Recorded on site (✓)	If not recorded onsite				Considered in 7 part test of significance (✓) Refer to Attachment 4
					Suitable habitat present (✓)	Nearby and / or high number of record(s) (✓) <i>Notes 1,2 & 3</i>	Record(s) from recent years (✓) <i>Notes 1,2 & 3</i>	Potential to occur	
<i>Pultenaea glabra</i> OEH EPBC	V	V	Erect shrub. Grows in moist, sheltered section of dry sclerophyll forest on sandstone in Higher Blue Mountains and Glen Davis areas.	x	✓	1 km E (64 within 10 km)	2001	Low	✓
<i>Rhizanthella slateri</i> EPBC	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
<i>Thelymitra</i> sp. 'Kangaloon' (<i>Thelymitra kangaloonica</i>) EPBC	CE	CE	A terrestrial orchid with dark blue flowers, presented in mid-late spring. Only known from the Robertson area in the Southern Highlands. Often in association with the endangered ecological community <i>Temperate Highland Peat Swamps on Sandstone</i> .	x	x	-	-	x	x
<i>Thesium australe</i> EPBC	V	V	Erect herb to 0.4m high. Root parasite. Themeda grassland or woodland often damp. Distribution limits N-Tweed Heads S-south of Eden.	x	x	-	-	x	x
<i>Xanthosia scopulicola</i> OEH	V	-	Perennial subshrub which is restricted to the Jamison Valley in the Blue Mountains between Kings Tableland and the Megalong Cleft. It grows in cracks and crevices of sandstone cliff faces or on rocky outcrops above the cliffs.	x	x	-	-	x	x
<i>Zieria covenyi</i> OEH EPBC	E1	E	Erect shrub to 2m high. Only known from Eucalypt woodland on Narrow Neck Peninsula.	x	x	-	-	x	x

Scientific name DATABASE SOURCE	TSC Act	EPBC Act	Growth form and habitat requirements	Recorded on site (✓)	If not recorded onsite				Considered in 7 part test of significance (✓) Refer to Attachment 4
					Suitable habitat present (✓)	Nearby and / or high number of record(s) (✓) <i>Notes 1,2 & 3</i>	Record(s) from recent years (✓) <i>Notes 1,2 & 3</i>	Potential to occur	
<i>Zieria involucrata</i> OEH	E1	V	Tall erect shrub to 2m tall. Occurs primarily on Hawkesbury sandstone. Also occurs on Narrabeen Group sandstone and on Quaternary alluvium. Found primarily in sheltered forests on mid- to lower slopes and valleys although some populations extend upslope into drier vegetation. The canopy typically includes <i>Syncarpia glomulifera</i> , <i>Angophora costata</i> , <i>Eucalyptus agglomerata</i> and <i>Allocasuarina torulosa</i> . Distributed throughout Baulkham Hills, Hawkesbury, Hornsby and Blue Mountains local government areas.	X	X	-	-	X	X
OEH	- Denotes species listed within 10km of the subject site on the <i>Atlas of NSW Wildlife</i>								
EPBC	- Denotes species listed within 10km of the subject site in the <i>EPBC Act</i> habitat search								
V	- Denotes vulnerable listed species under the relevant Act								
E or E1	- Denotes endangered listed species under the relevant Act								
NOTE:	1. This field is not considered if no suitable habitat is present within the subject site 2. 'records' refer to those provided by the <i>Atlas of NSW Wildlife</i> 3. 'nearby' or 'recent' records are species specific accounting for home range, dispersal ability and life cycle								

Table A2.2 provides an assessment of potential habitat within the subject site for state and nationally listed threatened fauna species recorded within 10km on the *Atlas of NSW Wildlife* (OEH) or indicated to have potential habitat present within 10km on the *EPBC Act Protected Matters Tool*.

Table A2.2 – Threatened fauna habitat assessment

COMMON NAME <i>Scientific Name</i> DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT <i>Distribution Limit</i>	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				CONSIDERED IN 7 PART TEST (✓) (Refer to Appendix 3)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (✓) Notes 1,2 & 3	Potential to occur	
Giant Burrowing Frog <i>Heleioporus australiacus</i> OEH EPBC	V	V	Inhabits open forests and riparian forests along non-perennial streams, digging burrows into sandy creek banks. <i>Distribution Limit: N-Near Singleton S-South of Eden.</i>	x	marginal	x	x	Not likely	x
Stuttering Frog <i>Mixophyes balbus</i> EPBC	E	V	Terrestrial inhabitant of rainforest and wet sclerophyll forests. <i>Distribution Limit: N-near Tenterfield S-South of Bombala.</i>	x	x	-	-	x	x
Red-crowned Toadlet <i>Pseudophryne australis</i> OEH	V	-	Prefers sandstone areas, breeds in grass and debris beside non-perennial creeks or gutters. Individuals can also be found under logs and rocks in non-breeding periods. <i>Distribution Limit: N-Pokolbin. S-near Wollongong.</i>	x	x	-	-	x	x
Booroolong Frog <i>Litoria booroolongensis</i> EPBC	E	E	Found near rocky mountain streams on the slopes and tablelands of the Great Dividing Range. <i>Distribution limit: QLD border to VIC border restricted to highlands.</i>	x	x	-	-	x	x

COMMON NAME <i>Scientific Name</i> DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT <i>Distribution Limit</i>	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				CONSIDERED IN 7 PART TEST (✓) (Refer to Appendix 3)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) <i>Notes 1,2 & 3</i>	Record(s) from recent years (✓) <i>Notes 1,2 & 3</i>	Potential to occur	
Littlejohn's Tree Frog <i>Litoria littlejohnii</i> EPBC	V	V	Found in wet and dry sclerophyll forest associated with sandstone outcrops at altitudes 280-1,000m on eastern slopes of Great Dividing Range. Prefers flowing rocky streams. <i>Distribution Limit: N-Hunter River S-Eden.</i>	x	x	-	-	x	x
Blue Mountains Water Skink <i>Eulamprus leuraensis</i> OEH EPBC	E	E	Inhabits swampy heathland over sandstone. Lives in burrows under dense grass tussocks. <i>Distribution: known only from restricted areas in the Blue Mountains and on the Newnes Plateau.</i>	x	✓	✓	✓	✓	✓
Rosenberg's Goanna <i>Varanus rosenbergi</i> OEH	V	-	Hawkesbury sandstone outcrop specialist. Inhabits woodlands, dry open forests and heathland sheltering in burrows, hollow logs, rock crevices and outcrops. <i>Distribution Limit: N-Nr Broke. S-Nowra Located in scattered patches near Sydney, Nowra and Goulburn.</i>	x	Sub-optimal	x	x	Not likely	x
Broad-headed Snake <i>Hoplocephalus bungaroides</i> OEH EPBC	E	V	Sandstone outcrops, exfoliated rock slabs and tree hollows in coastal and near coastal areas. <i>Distribution Limit: N-Mudgee Park. S-Nowra.</i>	x	marginal	✓	✓	low	✓

COMMON NAME <i>Scientific Name</i> DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT <i>Distribution Limit</i>	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				CONSIDERED IN 7 PART TEST (✓) (Refer to Appendix 3)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) <i>Notes 1,2 & 3</i>	Record(s) from recent years (✓) <i>Notes 1,2 & 3</i>	Potential to occur	
Australian Painted Snipe <i>Rostratula australis</i> EPBC	E	E	Most numerous within the Murray-Darling basin and inland Australia within marshes and freshwater wetlands with swampy vegetation. <i>Distribution Limit: N-Tweed Heads. S-South of Eden.</i>	x	x	-	-	x	x
Gang-gang Cockatoo <i>Callocephalon fimbriatum</i> OEH	V	-	Prefers wetter forests and woodlands from sea level to > 2,000m on the Great Dividing Range, timbered foothills and valleys, timbered watercourses, coastal scrubs, farmlands and suburban gardens. <i>Distribution Limit: mid north coast of NSW to western Victoria.</i>	✓	-	-	-	-	✓
Glossy Black-Cockatoo <i>Calyptorhynchus lathami</i> OEH	V	-	Open forests with <i>Allocasuarina</i> species and hollows for nesting. <i>Distribution Limit: N-Tweed Heads. S-South of Eden.</i>	x	✓	x	✓	✓	✓
Little Lorikeet <i>Glossopsitta pusilla</i> OEH	V	-	Inhabits forests, woodlands; large trees in open country; timbered watercourses, shelterbeds, and street trees. <i>Distribution Limit: N-Tweed Heads. S-South of Eden.</i>	✓	-	-	-	-	✓
Swift Parrot <i>Lathamus discolor</i> OEH EPBC	E	E	Inhabits eucalypt forests and woodlands with winter flowering eucalypts. <i>Distribution Limit: N-Border Ranges National Park. S-South of Eden.</i>	x	x	-	-	x	x

COMMON NAME <i>Scientific Name</i> DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT <i>Distribution Limit</i>	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				CONSIDERED IN 7 PART TEST (✓) (Refer to Appendix 3)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) <i>Notes 1,2 & 3</i>	Record(s) from recent years (✓) <i>Notes 1,2 & 3</i>	Potential to occur	
Turquoise Parrot <i>Neophema pulchella</i> OEH	V	-	Inhabits coastal scrubland, open forest and timbered grassland, especially ecotones between dry hardwood forests and grasslands. <i>Distribution Limit: N-Near Tenterfield. S-South of Eden.</i>	x	marginal	x	x	Not likely	x
Barking Owl <i>Ninox connivens</i> OEH	V	-	Inhabits principally woodlands but also open forests and partially cleared land and utilises hollows for nesting. <i>Distribution Limits: N-Border Ranges National Park. S-Eden.</i>	x	✓	x	x	Not likely	x
Powerful Owl <i>Ninox strenua</i> OEH	V	-	Forests containing mature trees for shelter or breeding and densely vegetated gullies for roosting. <i>Distribution Limits: N-Border Ranges National Park. S-Eden.</i>	x	✓	x	✓	✓	✓
Masked Owl <i>Tyto novaehollandiae</i> OEH	V	-	Open forest and woodlands with cleared areas for hunting and hollow trees or dense vegetation for roosting. <i>Distribution Limit: N-Border Ranges National Park. S-Eden.</i>	x	✓	x	x	unlikely	✓
Sooty Owl <i>Tyto tenebricosa</i> OEH	V	-	Tall, dense, wet forests containing trees with very large hollows. <i>Distribution Limit: N-Border Ranges National Park. S-South of Eden.</i>	x	✓	✓	✓	✓	✓

COMMON NAME <i>Scientific Name</i> DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT <i>Distribution Limit</i>	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				CONSIDERED IN 7 PART TEST (✓) (Refer to Appendix 3)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) <i>Notes 1,2 & 3</i>	Record(s) from recent years (✓) <i>Notes 1,2 & 3</i>	Potential to occur	
Brown Treecreeper <i>Climacteris picumnus victoriae</i> OEH	V	-	Occupies Eucalypt woodlands, open woodland lacking a dense understorey with fallen dead timber. <i>Distribution Limit: (Sub species victoriae) Central NSW west of Great Div. Cumberland Plains, Hunter Valley, Richmond, Clarence, and Snowy River Valleys.</i>	x	x	-	-	x	x
Eastern Bristlebird <i>Dasyornis brachypterus</i> EPBC	E	E	Coastal woodlands, dense scrubs and heathlands, especially where low heathland borders taller woodland or dense tall tea-tree. <i>Distribution Limit: N-Tweed Heads. S-South of Eden.</i>	x	✓	x	x	Not likely	x
Regent Honeyeater <i>Xanthomyza Phrygia</i> EPBC	E4A	CE	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. <i>Distribution Limit: N-Urbanville. S-Eden.</i>	x	x	-	-	x	x
Painted Honeyeater <i>Grantiella picta</i> EPBC	V	V	A nomadic bird occurring in low densities within open forest, woodland and scrubland feeding on mistletoe fruits. Inhabits primarily Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. <i>Distribution Limit: N-Boggabilla. S-Albury with greatest occurrences on the inland slopes of the Great Dividing Range.</i>	x	marginal	x	x	Not likely	x

COMMON NAME <i>Scientific Name</i> DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT <i>Distribution Limit</i>	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				CONSIDERED IN 7 PART TEST (✓) (Refer to Appendix 3)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) <i>Notes 1,2 & 3</i>	Record(s) from recent years (✓) <i>Notes 1,2 & 3</i>	Potential to occur	
Varied Sittella <i>Daphoenositta chrysoptera</i> OEH	V	-	Open eucalypt woodlands / forests (except heavier rainforests); mallee, inland acacia, coastal tea-tree scrubs; golf courses, shelterbelts, orchards, parks, scrubby gardens. <i>Distribution Limit: N-Border Ranges National Park. S-South of Eden.</i>	x	✓	x	x	✓	✓
Scarlet Robin <i>Petroica boodang</i> OEH	V	-	Found in foothill forests, woodlands, watercourses; in autumn-winter, more open habitats: river red gum woodlands, golf courses, parks, orchards, gardens. <i>Distribution Limit: N-Tweed Heads. S-South of Eden.</i>	x	✓	x	✓	low	✓
Flame Robin <i>Petroica phoenicea</i> OEH	V	-	Summer: forests, woodlands, scrubs, from sea-level to c. 1800 m. Autumn-winter: open woodlands, plains, paddocks, golf courses, parks, orchards. <i>Distribution Limit: N northern NSW tablelands. S-South of Eden.</i>	x	✓	✓	x	low	✓
Diamond Firetail <i>Stagonopleura guttata</i> OEH	V	-	Found in Eucalypt woodlands, forests and mallee where there is grassy understorey west of the Great Div. also drier coastal woodlands of the Cumberland Plain and Hunter Richmond and Clarence River Valleys. <i>Distribution Limit: N-Rockhampton Q. S-Eyre Pen Kangaroo Is. SA.</i>	x	Sub-optimal	x	✓	Not likely	x

COMMON NAME <i>Scientific Name</i> DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT <i>Distribution Limit</i>	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				CONSIDERED IN 7 PART TEST (✓) (Refer to Appendix 3)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) <i>Notes 1,2 & 3</i>	Record(s) from recent years (✓) <i>Notes 1,2 & 3</i>	Potential to occur	
Spotted-tailed Quoll <i>Dasyurus maculatus</i> OEH EPBC	V	E	Dry and moist open forests containing rock caves, hollow logs or trees. <i>Distribution Limit: N-Mt Warning National Park. S-South of Eden.</i>	x	✓	✓	x	✓	✓
Southern Brown Bandicoot <i>Isodon obesulus</i> OEH EPBC	E	E	Utilises a range of habitats containing thick ground cover - open forest, woodland, heath, cleared land, urbanised areas and regenerating bushland. <i>Distribution Limit: N-Kempsey. S-South of Eden.</i>	x	✓	x	x	Not likely	x
Koala <i>Phascolarctos cinereus</i> OEH EPBC	V	V	Inhabits both wet and dry eucalypt forest on high nutrient soils containing preferred feed trees. <i>Distribution Limit: N-Tweed Heads. S-South of Eden.</i>	x	x	-	-	x	x
Eastern Pygmy Possum <i>Cercatetus nanus</i> OEH	V	-	Found in a variety of habitats from rainforest through open forest to heath. Feeds on insects but also gathers pollen from banksias, eucalypts and bottlebrushes. Nests in banksias and myrtaceous shrubs. <i>Distribution Limit: N-Tweed Heads. S-Eden.</i>	✓	-	-	-	-	✓

COMMON NAME <i>Scientific Name</i> DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT <i>Distribution Limit</i>	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				CONSIDERED IN 7 PART TEST (✓) (Refer to Appendix 3)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) <i>Notes 1,2 & 3</i>	Record(s) from recent years (✓) <i>Notes 1,2 & 3</i>	Potential to occur	
Yellow-bellied Glider <i>Petaurus australis</i> OEH	V	-	Tall mature eucalypt forests with high nectar producing species and hollow bearing trees. <i>Distribution Limit- N-Border Ranges National Park. S-South of Eden.</i>	x	✓	✓	x	low	✓
Squirrel Glider <i>Petaurus norfolcensis</i> OEH	V	-	Mixed aged stands of eucalypt forest & woodlands including gum barked & high nectar producing species & hollow bearing trees. <i>Distribution Limit: N-Tweed Heads. S-Albury.</i>	x	x	-	-	x	x
Greater Glider <i>Petauroides volans</i> EPBC	-	V	Favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species. Population density is optimal at elevation levels at 845 m above sea level. Prefer overstorey basal areas in old-growth tree stands. Highest abundance typically in taller, montane, moist eucalypt forests, with relatively old trees and abundant hollows <i>Distribution Limit: N-Border Ranges National Park. S- South of Eden.</i>	x	✓	✓	x	unlikely	✓
Brush-tailed Rock-wallaby <i>Petrogale penicillata</i> EPBC	E	V	Found in rocky gorges with a vegetation of rainforest or open forests to isolated rocky outcrops in semi-arid woodland country. <i>Distribution Limit: N-North of Tenterfield. S-Bombala.</i>	x	x	-	-	x	x

COMMON NAME <i>Scientific Name</i> DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT <i>Distribution Limit</i>	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				CONSIDERED IN 7 PART TEST (✓) (Refer to Appendix 3)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) <i>Notes 1,2 & 3</i>	Record(s) from recent years (✓) <i>Notes 1,2 & 3</i>	Potential to occur	
Grey-headed Flying-fox <i>Pteropus poliocephalus</i> OEH EPBC	V	V	Found in a variety of habitats including rainforest, mangroves, paperbark swamp, wet and dry open forest and cultivated areas. Forms camps commonly found in gullies and in vegetation with a dense canopy. <i>Distribution Limit: N-Tweed Heads. S-Eden.</i>	✓	-	-	-	-	✓
East-coast Freetail Bat <i>Micronomus norfolkensis</i> OEH	V	-	Inhabits open forests and woodlands foraging above the canopy and along the edge of forests. Roosts in tree hollows, under bark and buildings. <i>Distribution Limit: N-Woodenbong. S-Pambula.</i>	x	Sub-optimal	✓	✓	low	✓
Large-eared Pied Bat <i>Chalinolobus dwyeri</i> OEH EPBC	V	V	Warm-temperate to subtropical dry sclerophyll forest and woodland. Roosts in caves, tunnels and tree hollows in colonies of up to 30 animals. <i>Distribution Limit: N-Border Ranges National Park. S-Wollongong.</i>	x	✓	x	x	low	✓
Eastern Falsistrelle <i>Falsistrellus tasmaniensis</i> OEH	V	-	Recorded roosting in caves, old buildings and tree hollows. <i>Distribution Limit: N-Border Ranges National Park. S-Pambula.</i>	✓	-	-	-	-	✓

COMMON NAME <i>Scientific Name</i> DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT <i>Distribution Limit</i>	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				CONSIDERED IN 7 PART TEST (✓) (Refer to Appendix 3)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) <i>Notes 1,2 & 3</i>	Record(s) from recent years (✓) <i>Notes 1,2 & 3</i>	Potential to occur	
Eastern Bentwing-bat <i>Miniopterus orianae oceansis</i> OEH	V	-	Prefers areas where there are caves, old mines, old buildings, stormwater drains and well-timbered areas. <i>Distribution Limit: N-Border Ranges National Park. S-South of Eden.</i>	x	✓	✓	x	✓	✓
Large-footed Myotis <i>Myotis macropus</i> OEH	V	-	Roosts in caves, mines, tunnels, buildings, tree hollows and under bridges. Forages over open water. <i>Distribution limits: N-Border Ranges National Park. S-South of Eden.</i>	x	x	-	-	x	x
Greater Broad-nosed Bat <i>Scoteanax rueppellii</i> OEH	V	-	Inhabits areas containing moist river and creek systems, especially tree lined creeks. <i>Distribution Limit: N-Border Ranges National Park. S-Pambula.</i>	x	✓	✓	✓	✓	✓
New Holland Mouse <i>Pseudomys novaehollandiae</i> EPBC	-	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. <i>Distribution Limit: N-Border Ranges National Park. S-South of Eden.</i>	x	✓	x	x	unlikely	N/A

COMMON NAME <i>Scientific Name</i> DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT <i>Distribution Limit</i>	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				CONSIDERED IN 7 PART TEST (✓) (Refer to Appendix 3)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) <i>Notes 1,2 & 3</i>	Record(s) from recent years (✓) <i>Notes 1,2 & 3</i>	Potential to occur	
Giant Dragonfly <i>Petalura gigantean</i> OEH	E	-	Inhabits large relatively deep permanent swamps and bogs with high water quality and moss or other soft vegetation along the edge for egg laying. <i>It occurs in the far NE NSW, south to Kempsey, & in a patch between Gosford & Nowra.</i>	x	✓	x	✓	✓	✓
Macquarie Perch <i>Macquaria australasica</i> EPBC	V (FM Act 1994)	E	Occurs in south east Australia at moderate to high altitudes in rivers and reservoirs. Historical records show the species was widespread and abundant in the upper reaches of the Lachlan, Murrumbidgee and Murray Rivers and their tributaries. Allen (1989) states that introduced populations are present in Nepean River and water supply dams in the Sydney area. Occurs in lakes and flowing streams, usually in deep holes.	x	x	-	-	x	x
Australian Greyling <i>Prototroctes maraena</i> EPBC	Part 2, Section 19 – Protected Fish (FM Act 1994)	V	Clear, moderate to fast flowing water in the upper reaches of rivers (sometimes to altitudes above 1,000m). Typically found in gravel bottom pools. Often forming aggregations below barriers to upstream movement (e.g. weirs, waterfalls).	x	x	-	-	x	x
OEH	- Denotes species listed within 10km of the subject site on the <i>Atlas of NSW Wildlife</i>								
EPBC	- Denotes species listed within 10km of the subject site in the <i>EPBC Act</i> habitat search								
V	- Denotes vulnerable listed species under the relevant Act								
E	- Denotes endangered listed species under the relevant Act								

COMMON NAME <i>Scientific Name</i> DATABASE SOURCE		TSC Act	EPBC Act	PREFERRED HABITAT <i>Distribution Limit</i>	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				CONSIDERED IN 7 PART TEST (✓) (Refer to Appendix 3)
						Suitable Habitat Present (✓) Notes 1,2 & 3	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:	1. This field is not considered if no suitable habitat is present within the subject site 2. 'records' refer to those provided by the <i>Atlas of NSW Wildlife</i> 3. 'nearby' or 'recent' records are species specific accounting for home range, dispersal ability and life cycle									

Table A2.3 provides an assessment of potential habitat within the subject site for nationally *protected* migratory fauna species recorded within 10km on the *EPBC Act* Protected Matters Tool. Nationally *threatened* migratory species are considered in Table A2.2.

Table A2.3 – Migratory fauna habitat assessment

COMMON NAME <i>Scientific Name</i>	PREFERRED HABITAT <i>Migratory Breeding</i>	Suitable Habitat Present (✓)	Recorded on Site (✓)	COMMENTS
Oriental or Horsfield's Cuckoo (<i>Cuculus optatus</i>)	It mainly inhabits forests, occurring in coniferous, deciduous and mixed forest. It feeds mainly on insects and their larvae, foraging for them in trees and bushes as well as on the ground.	✓	x	-
White-bellied Sea Eagle (<i>Haliaeetus leucogaster</i>)	Coasts, islands, estuaries, inlets, large rivers, inland lakes, reservoirs. <i>Sedentary; dispersive.</i>	-	-	-
White-throated Needletail (<i>Hirundapus caudacutus</i>)	Airspace over forests, woodlands, farmlands, plains, lakes, coasts, towns; companies forage often along favoured hilltops and timbered ranges. <i>Breeds Siberia, Himalayas, east to Japan. Summer migrant to eastern Australia.</i>	✓	x	-
Rainbow Bee-eater (<i>Merops ornatus</i>)	Open woodlands with sandy, loamy soil; sandridges, sandspits, riverbanks, road cuttings, beaches, dunes, cliffs, mangroves, rainforest, woodlands, golf courses. <i>Breeding resident in northern Australia. Summer breeding migrant to south east and south west Australia.</i>	✓	x	-
Black-faced Monarch (<i>Monarcha melanopsis</i>)	Rainforests, eucalypt woodlands; coastal scrubs; damp gullies in rainforest, eucalypt forest; more open woodland when migrating. <i>Summer breeding migrant to coastal south east Australia, otherwise uncommon.</i>	✓	✓	Black-faced Monarch was heard calling on the 26th May 2016 (see Figure 3a for location). In consideration to the significant impact criteria, the proposed development will not likely cause a significant impact on this species.
Yellow Wagtail (<i>Motacilla flava</i>)	The yellow wagtail typically forages in damp grassland and on relatively bare open ground at edges of rivers, lakes and wetlands, but also feeds in dry grassland and in fields of cereal crops.	x	-	-

COMMON NAME <i>Scientific Name</i>	PREFERRED HABITAT <i>Migratory Breeding</i>	Suitable Habitat Present (✓)	Recorded on Site (✓)	COMMENTS
Satin Flycatcher (<i>Myiagra cyanoleuca</i>)	Heavily vegetated gullies in forests, taller woodlands, usually above shrub-layer; during migration, coastal forests, woodlands, mangroves, trees in open country, gardens. <i>Breeds mostly south east Australia and Tasmania over warmer months, winters in north east Qld.</i>	✓	x	-
Rufous Fantail (<i>Rhipidura rufifrons</i>)	Undergrowth of rainforests / wetter eucalypt forests / gullies; monsoon forests, paperbarks, sub-inland and coastal scrubs; mangroves, watercourses; parks, gardens. On migration, farms, streets buildings. <i>Breeding migrant to south east Australia over warmer months. Altitudinal migrant in north east NSW in mountain forests during warmer months.</i>	✓	✓	Rufous Fantail was recorded in the study area during surveys by <i>Conacher Travers</i> in 2007. The location was not specified. In consideration to the significant impact criteria, the proposed development will not likely cause a significant impact on this species.
Great Egret (<i>Ardea alba</i>)	Shallows of rivers, estuaries; tidal mudflats, freshwater wetlands; sewerage ponds, irrigation areas, larger dams, etc. <i>Dispersive; cosmopolitan.</i>	x	-	-
Cattle Egret (<i>Ardea ibis</i>)	Stock paddocks, pastures, croplands, garbage tips, wetlands, tidal mudflats, drains. <i>Breeds in summer in warmer parts of range including NSW.</i>	x	-	-
Latham's Snipe (<i>Gallinago hardwickii</i>)	Soft wet ground or shallow water with tussocks and other green or dead growth; wet parts of paddocks; seepage below dams; irrigated areas; scrub or open woodland from sea-level to alpine bogs over 2,000m; samphire on saltmarshes; mangrove fringes. <i>Breeds Japan. Regular summer migrant to Australia. Some overwinter.</i>	x	-	-
Bar-tailed Godwit (<i>Limosa lapponica</i>)	The Bar-tailed Godwit is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It is found often around beds of seagrass and, sometimes, in nearby saltmarsh.	x	-	-

COMMON NAME <i>Scientific Name</i>	PREFERRED HABITAT <i>Migratory Breeding</i>	Suitable Habitat Present (✓)	Recorded on Site (✓)	COMMENTS
Common Greenshank (<i>Tringa nebularia</i>)	Found in a wide variety of inland wetlands and sheltered coastal habitats (with large mudflats and saltmarsh, mangroves or seagrass) of varying salinity. Habitats include embayments, harbours, river estuaries, deltas and lagoons. It uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and saltflats. Also artificial wetlands, including sewage farms and saltworks dams, inundated rice crops and bores. In NSW the Hunter River estuary has been identified as a site of international importance. <i>Breeds in Eurasia, the northern British Isles, Scandania, east Estonia and north-east Belarus, through Russia and east.</i>	x	-	-
Little Curlew (<i>Numenius minutus</i>)	Feeds in short, dry grassland and sedgeland, including dry floodplains and blacksoil plains, which have scattered, shallow freshwater pools or areas seasonally inundated. Open woodlands with a grassy or burnt understorey, dry saltmarshes, coastal swamps, mudflats or sandflats of estuaries or beaches on sheltered coasts, mown lawns, gardens, recreational areas, ovals, racecourses and verges of roads and airstrips are also used. When resting, congregates around pools, river beds and water-filled tidal channels, and shallow water at edges of billabongs. Prefers pools with bare dry mud and they do not use pools if they are totally dry, flooded or heavily vegetated. <i>Breeds in Russia.</i>	x	-	-
Osprey (<i>Pandion haliaetus</i>)	Favours coastal areas, especially the mouths of large rivers, lagoons and lakes. Feeds on fish over clear, open water. Breeds from July to September in NSW. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometer of the sea.	x	-	-
Fork-tailed Swift (<i>Apus pacificus</i>)	Aerial: over open country, from semi-arid deserts to coasts, islands; sometimes over forests, cities. <i>Breeds Siberia, Himalayas, east to Japan south east Asia. Summer migrant to east Australia. Mass movements associated with late summer low pressure systems into east Australia. Otherwise uncommon.</i>	✓	x	-



7 Part Test of Significance

A3

Council, or the authorising authority is required to consider the impact upon threatened species, populations and / or EECs from any development or activity via the process of a 7 part test of significance. The significance of the assessment is then used to determine the need for a more detailed SIS.

The following 7 part test of significance relies on the ecological assessment provided in Sections 3 and 4 of this report and should be read as such.

Flora and fauna investigations and 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	TSC Act	Potential to occur	Potential impact
<i>Persoonia acerosa</i>	V	low	Removal of small areas of Low potential habitat. Species not observed within the study area. Closest record is 1km North in 2005.
<i>Pultenaea glabra</i>	V	low	Removal of small areas of Low potential habitat. Species not observed within study area. Closest record is 1 km East in 2001.

Threatened fauna

COMMON NAME	TSC Act	Potential to occur	Potential habitat impact
Gang-gang Cockatoo	V	recorded	Direct - on foraging and potential nesting
Little Lorikeet	V	recorded	Direct - on foraging and potential nesting
Grey-headed Flying-fox	V	recorded	Direct - on foraging
Eastern Falsistrelle	V	recorded	Direct - on foraging and potential roosting / breeding
Eastern Pygmy Possum	V	recorded	Direct - on recorded foraging, likely denning and potential breeding
Blue Mountains Water Skink	E	✓	Indirect - on dispersal
Glossy Black-Cockatoo	V	✓	Direct - on suitable foraging and nesting
Powerful Owl	V	✓	Direct - on suitable foraging and roosting
Sooty Owl	V	✓	Direct - on suitable foraging
Varied Sittella	V	✓	Direct - on suitable foraging, roosting and breeding
Spotted-tailed Quoll	V	✓	Direct - on suitable foraging and low potential denning / breeding
Eastern Bentwing-bat	V	✓	None anticipated
Greater Broad-nosed Bat	V	✓	Direct - on low potential foraging, roosting and breeding
Giant Dragonfly	E	✓	None anticipated

COMMON NAME	TSC Act	Potential to occur	Potential habitat impact
Broad-headed Snake	E	low	Indirect - on low potential foraging
Scarlet Robin	V	low	Direct - on low potential foraging, roosting and breeding
Flame Robin	V	low	Direct - on low potential foraging, roosting and breeding
Yellow-bellied Glider	V	low	Direct - on low potential foraging, denning and breeding
East-coast Freetail Bat	V	low	Direct - on low potential foraging, roosting and breeding
Large-eared Pied Bat	V	low	Direct - on low potential foraging
Masked Owl	V	unlikely	Direct - on low potential foraging

Endangered populations

- *Pultenaea villifera* Sieber ex DC. population in the Blue Mountains local government area.
- None for fauna

Endangered ecological communities

- Blue Mountains Swamps in the Sydney Basin Bioregion

The 7 part test of significance is as follows:

- a) ***In the case of a threatened species, whether the action proposed 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, indirect and cumulative impacts of the proposal are considered in Section 5.3.

Summary of threatened species recorded

Eastern Pygmy Possum (*Cercartetus nanus*)

The Eastern Pygmy-possum (EPP) is found from rainforest through sclerophyll forest to tree heath. The habitats of particular importance are those in which certain species of banksia dominate because they provide an important winter food source (Ward 1990; Bladon et al. 2002; Tulloch 2004; Rueegger et al. 2012). Eastern Pygmy-possums usually shelter alone in tree cavities, rotten stumps, holes in the ground, disused bird nests and possum dreys and in vegetation thickets such as *Xanthorrhoea* species (Menkhorst, 1996). Although the EPP may use a range of different shelter types, it appears that it is the tree hollows that are required for breeding (Tulloch 2004; Harris 2008; Rueegger et al. 2012). In particular, tree cavities of sufficient size (>5 cm diameter) appear critical for a female pygmy-possum to raise a litter.

Female EPPs build nests from various native plant species using fresh leaf material (Ward 1990; Rueegger et al. 2012). This distinguishes EPP nests from other small mammals such as the brown antechinus which builds nests mostly from dead eucalypt leaves (Goldingay personal observations).

Detailed investigation in New South Wales has revealed that home ranges are typically 3-7 ha in area (Law et al. 2013), and this is likely to hold true elsewhere because all studies report overnight movements of up to 300-500 m (Ward 1990; Bladon et al. 2002; Tulloch & Dickman 2006; Law et al. 2013). Law et al. (2013) estimated mean home range size for males and females to be 3.1 ha.

Apart from females with young in the nest, individuals may utilise a number of nest sites within the home range (Turner and Ward, 2008; Menkhorst, 1996). An important determinant of habitat quality may be the proportion of the year in which pollen is available and the species is usually associated with floristically diverse shrub community, especially those including *Banksia* species. However populations also occur in box-ironbark associations where the understorey is sparse but relatively diverse (Menkhorst, 1996).

An Eastern Pygmy Possum was recorded on surveillance camera in the far southern extent of the study area adjacent to Cliff Drive (see Figure 3a for location).

It is considered that the study area provides recorded foraging, likely denning and potential breeding habitat for this species. A number of small cavities and hollows exist within the impacted areas that may be utilised for breeding and shelter by this species. Impacted natural areas of Dry Open Forest habitat extends out towards the recorded location, thus reducing the total available extent of this habitat for EPP within the confines of Cliff Drive. The proposal will result in the removal of low to high quality habitat for the extension of the auditorium, construction of the adjacent meeting rooms and their associated APZ's.

The recorded individual is considered likely part of a population that makes passage across Cliff Drive and extends around the surrounding plateau of Malaita Point (see Connectivity Section 4.4 and Figure 4). Based on the estimated mean home range size for males and females of 3.1 ha by Law et al. (2013) the habitat on the other side of Cliff Drive is likely to form part of the home range for this individual. This is given that total area of quality habitat in the southern extent of the study area totals approximately 2 ha within the confines of Cliff Drive, which does not include the Moist Gully Forest area to the north of the auditorium. The habitats on the other side of Cliff Drive are equally rich in diverse foraging opportunities including both canopy and *banksia* species.

The recording of EPP as part of our study extends the known occurrence of this species. It is the only recording of Eastern Pygmy Possum on the plateau immediately surrounding the Katoomba township. Figure 5 below shows previous EPP records within 10km of which there are only 6 and none recorded within 3km. The closest record to the south is the only record within 5km. This may simply be due to limited fauna surveys undertaken along the nearby surrounding southern escarpment as this habitat extending into the Blue Mountains National Park is notably of high quality.

The Katoomba township to the north and the cliff escarpment to the south provide a barrier to movement for this population, therefore connectivity beyond the study area only exists along the narrow upper plateau on the remaining narrow southern fringes of the township towards the east and west.

Further target surveys incorporating a high concentration of surveillance camera survey across Cliff Drive to the south was undertaken to determine if this suitable connective habitat area further supported the local population, however no observations were made. We expect further EPP do occur in the locality as the further studies in other areas have shown that EPP have highly variable seasonal movements based on the available foraging resources which might not be picked up in one survey session.

Survey did also indicate that feral cats and foxes were in notable presence within habitat to the south. Foxes were also recorded within the study area itself. EPP expert Dr Ross Goldingay, in his Land and Environment Court evidence for a separate recorded EPP site at Helensburgh (2016), indicated that scat analysis of introduced predators suggest that while dogs are a potential predator, they are not significant as they did not show evidence of EPP predation. Furthermore, only 1% of fox scats showed predation on EPP; while cats are

demonstrated predators. Whilst the site may act as a refuge for EPP against the presence of feral cats it is unprotected and we expect feral cats can access the habitat of the site.

A detailed habitat assessment was undertaken in June 2017 to determine the extent of potentially important habitat for EPP to be removed (see Section 4.3.4 for calculated analysis). This found that the total available habitat bound within Cliff Drive contains 3.06 ha of potential EPP habitat areas. Of this 1.43ha (46.7%) will be removed or modified by the proposal. The impacted area is made up of 1.1ha (77%) *low* to *moderate* and 0.33ha (23%) *high* to *very high* quality habitat.

A detailed habitat tree survey was undertaken within the suitable EPP habitat areas within the site where a natural understorey exists, to quantify the total number of potential denning/nesting opportunities impacted. Seventeen (17) hollows were recorded in the *very high* quality habitat, seven (7) in the *high* quality habitat, eighteen (18) within the *moderate* quality habitat and three (3) within the *low* quality habitat areas. These are all hollows of varying sizes recorded in these areas and it is expected that many of these may be unsuitable for use by EPP.

The habitat quality rating was also in respect to potential to occur. The expected habitat areas in the southern portions containing *high* and *very high* quality habitat contain a total number of twenty-four (24) hollows within the subject site area. Many more also exist in the remaining portions of the EPP habitat study area outside of the APZ extents. The proposal will remove between 6-11 of these due to building footprints or due to poor health. The remaining majority may be retained within the APZ areas.

As the proposed buildings that extend into the *very high* quality habitat areas do not front the vegetation to the south, it is expected that noise and light spill-over can be effectively managed into these areas at night.

With consideration to the above, the extent of EPP quality habitat removal inclusive of number of hollows will impact directly on EPP, but this will not be concluded as being 'significant' based on:

- The impact is less than ¼ of the *high* to *very high* habitat available within the EPP habitat study area; and
- *High* to *very high* areas of habitat in the study area remain adjacent to further extensive similar quality habitat above the plateau (despite the absence of adjacent records to date); and
- The recorded location will be retained,
- Important habitat attributes (fundamentally hollows) within the 0.26ha area of *very high* quality habitat to be removed can be relocated within retained *high* quality habitat areas in order to improve the rating of these areas up to *very high*. EPP nest boxes may also enhance these areas;
- The majority of the 0.26ha area of *very high* quality habitat calculated for removal is located within the outer limits of the APZ. These areas can be managed to retain some selective habitat features such as hollows in healthy trees and occasional banksias so they retain some potential for use; and
- A fox and cat control program would enhance the entire local connective habitat to the south above the escarpment to similar potential levels. This would also have other benefits to birds, etc.

With consideration to the impact on EPP habitats and the available mitigation measures, the seven part test assessment has concluded a 'not significant' impact on this species.

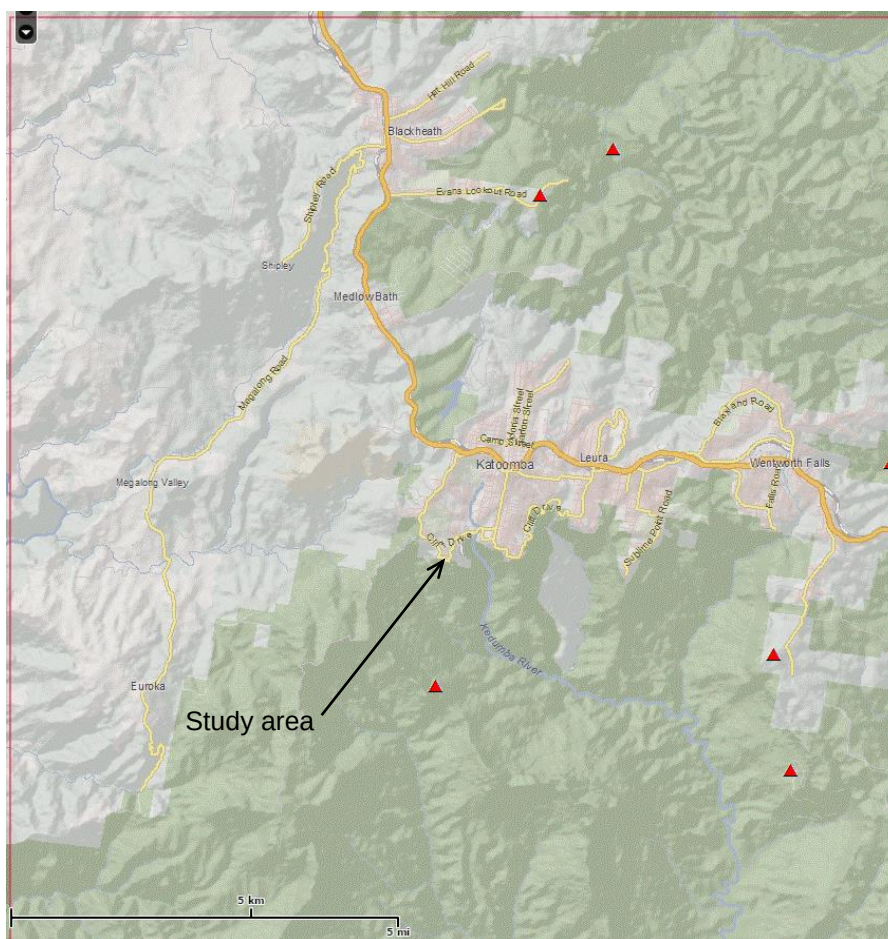


Figure 5 – Local Eastern Pygmy Possum records out to 10km (Bionet 2016)

Gang-gang Cockatoo (*Callocephalon fimbriatum*)

The Gang-gang Cockatoo (GGC) is a relatively small, dark grey Cockatoo. Both sexes have crests, with the male being distinguished by a bright red head. The Gang-gang Cockatoo is associated with a variety of woodland and forest habitats, and occasionally more open areas in south-eastern New South Wales and Victoria (NSW Scientific Committee, 2001). This species has been observed in eucalypt forests and exotic trees (Morris 1997), and is known to feed on the seeds of native shrubs and trees, in addition to some exotic species such as the Hawthorn and Cupressus species (Schodde & Tideman 1976). The Gang-gang Cockatoo nests in hollows in large, dead trees (NSW Scientific Committee, 2001).

The subject site provides suitable foraging, roosting and possible breeding habitat for the Gang-gang Cockatoo. Two large hollows within the subject site are considered potentially suitable for nesting and three other large hollows are considered unlikely suitable.

The Gang-gang Cockatoo was observed foraging within the study area and through the local area during the fauna surveys in 2007 and 2016. Figure 3a shows recorded locations and the recorded path of foraging during the late afternoon on the recent survey on the 25th May 2016.

The proposed action is likely to result in a small amount of foraging habitat, particularly mature myrtaceous trees being removed. It appears as though slight design modifications to roads and parking areas may retain all of the identified two potential and three low potential nesting trees. In either case, suitable habitat immediately surrounding these trees will be

removed by the existing proposal. The subject site is not expected to be utilised for breeding given its disturbed and fragmented setting by comparison to the extensive available bushland habitats to the immediate south.

In regard to foraging habitat lost, the local area also contains extensive amounts of similar or higher quality habitat for this species. Therefore the proposed development is not likely to significantly impact on a local population of this species.

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). The breeding season extends from May to September (Higgins 1999) and, if eucalypt nectar and pollen are available throughout this period, two broods of fledglings can be raised in a season.

The major threats to Little Lorikeets are loss of breeding sites and food resources from ongoing land clearing. New nest hollows are not being recruited at a rate that compensates this loss.

The subject site provides suitable foraging, roosting and potential breeding habitat for the Little Lorikeet. Potential nesting hollows may often be discrete and difficult to find in the absence of the birds, however activity during the breeding season may effectively locate nesting locations.

The Little Lorikeet was recorded during initial surveys within the study area by *Conacher Travers* in 2007. The species was not listed as threatened at this time therefore the recorded location was not documented. Subsequent fauna survey visits have not recorded the species in more recent years which is also a trend noted in local records. The recent site visit did correspond with the start of the recognised breeding period for birds occupying the western NSW slopes. The breeding period may vary for local birds.

Given the absence of Little Lorikeet during recent survey the proposed development is not expected to impact on any nesting locations within the subject site. In this case the proposal is unlikely to significantly impact on a local population, particularly as breeding habitat is of highest concern in impact assessments.

The proposed action is likely to result in a small amount of foraging habitat, particularly mature myrtaceous trees being removed. In regard to such habitat lost, the local area contains extensive amounts of similar or higher quality habitat for this species and as such

the concern of habitat impacts is restricted to potential breeding areas. Therefore this species is not likely to be significantly impacted by the proposal.

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 20km of camps but individuals are known to commute up to 50km to a productive food source.

Three (3) Grey-headed Flying-foxes were observed by *Conacher Travers* foraging within flowering eucalyptus within the study area on the 6 February 2007. The proposed action is likely to result in a small reduction of foraging habitat in the local area. The local area contains extensive amounts of similar or higher quality habitat for this species. There is no likelihood of this species utilising the site for roosting and subsequent breeding habitat. Although there are limited other records of this species within 10km of the subject site, these individuals observed are not likely to utilise the study area exclusively given the surrounding quality foraging resources.

Therefore the removal of habitat associated with the proposal will not likely significantly impact on a local population of Grey-headed Flying-foxes. It is recommended that foraging habitat is replaced by locally native flowering eucalypts within landscaping areas.

Eastern Falsistrelle (*Falsistrellus tasmaniensis*)

The Eastern Falsistrelle inhabits warm to cool temperate moist and dry open forests (Strahan 1995) with a preference for wet high altitude forests and being less common on ridge-tops where fertility is low (Law, Herr & Phillips, 2008). It is one of the larger and less common forest bats, with wing morphology indicating it to be a highly mobile species with a large foraging range with recordings up to 12km from roosting sites (Herr, Law & Phillips, 2008) and home ranges up to 136ha (Churchill, 2008).

Flight is not very manoeuvrable and as such foraging takes places in open structures or along trails in forest environs. It hunts beetles but also moths and bugs. The Eastern Falsistrelle roosts mainly in tree hollows, occasionally utilising caves and abandoned buildings (Parnaby 1992; Phillips et al. 1985). Roosts in trees are generally in hollow trunks of eucalypt trees in colonies of 3 to 80 (Churchill 2008). Cave roosting is recorded at Jenolan, NSW, with occasional roosts also recorded in old wooden structures (Churchill, 2008). Colonies are usually entirely male or female for reasons currently unknown.

The Eastern Falsistrelle was recorded to a 'probable' level of certainty during overnight ultrasonic recordings within the DA 1 area on the 25th May 2016 (refer to Figure 3a for locations). Several recordings at approximately 21:55 were made.

As the locating of bat roost sites by survey is an exhaustive, costly and unreliable process, the assessment for hollow-dependent threatened microbats is typically based on the available habitat present and retained for the species within the nearby locality. In this

respect the established conserved habitat areas and associated restoration measures as well as other areas of nearby local habitat will remain extensive such that habitat removal within the subject site will not likely impact on the local population to any significant level.

Despite this it is recommended that to provide additional assurance of reducing the potential impact, a hollow-bearing tree assessment is undertaken within the subject site, and remaining southern study area.

Where possible, identified hollow-bearing trees should be retained in-situ. Where the felling of hollow-bearing trees is required, this should be conducted under the supervision of a fauna ecologist to ensure appropriate animal welfare procedures are taken. Hollows of high quality or with fauna recorded residing within should be sectionally dismantled and all hollows should be inspected for occupation, activity and potential for reuse. In the instance of recording the presence of threatened microbats during tree removal, maximum effort should ensure safe relocation of the roosting colony.

Re-used hollows or those with likely occupation are to be relocated to conservation areas within close proximity to the site. All other hollows removed should be replaced with nest boxes. Every second box should be a design suitable for microbat species. Boxes should be constructed all of weatherproof timber (marine ply), fasteners and external paint.

With consideration to the relative direct and indirect impacts on all remaining 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.

b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction*

There are no endangered fauna populations within the Blue Mountains LGA.

There is one endangered flora populations within the Blue Mountains City Council LGA, This is:

- *Pultenaea villifera* Sieber ex DC. population in the Blue Mountains local government area.

This endangered flora population is known only from the Springwood – Woodford area and comprises of less than 300 plants. This population is located in excess of 10 km from the study area. This species was not observed within the study area.

Therefore, it is considered that the action proposed is not likely to have an adverse effect on the life cycle of this species that constitute the endangered population such that a viable local population of this species is likely to be placed at risk of extinction.

c) *In the case of a critically endangered or endangered ecological community, whether the action proposed:*

- 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***

One (1) Vulnerable Ecological Community (VEC) – *Blue Mountains Swamps in the Sydney Basin Bioregion* was observed within the subject site.

The Blue Mountains Swamps vegetation is commensurate with the Fernland and the Hanging Swamp vegetation types previously described in Section 3.1.2 of this document. The Blue Mountains Swamps VEC occupies approximately 0.25 hectares within the north-eastern corner of the study area.

Within the locality this VEC corresponds with Map Unit 5A - Blue Mountains Heath/Scrub/Sedgeland/Fernland as well as Map Unit 5B - Blue Mountains Swamps described within the Blue Mountains City Council's "Native Vegetation Mapping in the Blue Mountains 1999-2002".

The proposed development will not impact upon any of this VEC's extent within the study area. This VEC will be wholly retained and protected through the implementation of a 40 metre wide buffer around the Hanging Swamp.

It is therefore considered that the proposed development is unlikely to have an adverse effect on the extent of any ecological community such that its local occurrence is likely to be placed at risk of extinction.

ii. Is likely to substantially and adversely modify the composition such that its local occurrence is likely to be placed at risk of extinction,

The retention and protection of this VEC within the study area will conserve this vegetation type within the locality. It is recommended that a VMP be prepared that targets weed control within these communities within the study area.

Within the LGA, the 5A – Heath/Scrub/Sedgeland/Fernland vegetation community has been mapped as occupying 3031ha, while the 5B – Blue Mountains Swamps vegetation community has been mapped as occupying 1134ha (BMCC 2002). Given the proposed retention, protection and management of these vegetation types within the study area via a VMP, it is unlikely that the proposed development will substantially and adversely modify the composition of these communities such that their local occurrence is likely to be placed at risk of extinction

d) In relation to the habitat of threatened species, populations or ecological community:

It is considered that the habitat attributes of the subject site provide known or potential habitat for *Persoonia acerosa*, *Pultenaea glabrata*, Blue Mountains Swamps in the Sydney Basin Bioregion, Blue Mountains Water Skink, Broad-headed Snake, Gang-gang Cockatoo, Glossy Black-Cockatoo, Little Lorikeet, Powerful Owl, Sooty Owl, Varied Sittella, Scarlet Robin, Flame Robin, Spotted-tailed Quoll, Eastern Pygmy Possum, Yellow-bellied Glider, Grey-headed Flying-fox, East-coast Freetail Bat, Large-eared Pied Bat, Eastern Falsistrelle, Eastern Bentwing-bat, Greater Broad-nosed Bat, Giant Dragonfly and Masked Owl.

i. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The southern DA-1 study area is approximately 5.43 ha in size which comprises approximately 2.58 ha of natural vegetation and 2.85 ha of cleared or disturbed vegetation, all connected to a large patch of similar native vegetation greater than 500ha located across Cliff Drive to the immediate south into the Blue Mountains National Park. The proposed development is likely to remove or modify approximately 2.1 ha of natural vegetation providing habitat for the aforementioned 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 action, and

The subject site is covered by a mixture of disturbed natural bushland and cleared areas and is currently fragmented by existing developments within the study area and by Violet Street which bisects the study area creating the northern and southern portions. The site is bound to the north, east and west by existing residential development and to the south-west, south and south-east by large areas of natural bushland (Blue Mountains National Park). The proposal will not further fragment or isolate currently connected areas of habitat.

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, population or ecological community in the locality

Habitat to be removed may be important to a local population of Eastern Pygmy Possum. There are no other local records of this species within the connective habitats and further surveys have not detected the species in adjacent habitat outside of the immediate study area. Whilst the habitat to be removed is not of any notable unique habitat attributes for this species, it may contribute to the recorded population area. This population is considered to be isolated however a precautionary approach to this concept should be undertaken.

Hollows to be removed are suitable but not expected for use by the recorded Gang-gang Cockatoo, Eastern Falsistrelle and Little Lorikeet. In respect to other 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 other species such that behaviour or ecology of these species will be significantly altered in any way.

The proposed development is likely to impact approximately 2.1 ha or 81% of the site's existing natural habitats.

The proposal will not directly impact on the VEC known as Blue Mountains Swamps in the Sydney Basin Bioregion. The Blue Mountains Swamps VEC will be retained, protected and managed via the implementation of a 40 metre wide buffer. It is recommended that a Vegetation Management Plan (VMP) be prepared to manage the entire study area with regards to the required APZs, weed control and protection and management of the VEC.

Given the occurrence of at least 500ha of similar vegetation adjoining the subject site and the retention of the existing habitats (including the retention and protection of the VEC) within the site, 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.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

The site has not been identified as critical habitat within the provisions of the TSC Act. Therefore this matter does not require any further consideration at this time.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

No draft state recovery plans have been prepared for threatened species with potential habitat within the subject site:

Approved state recovery plans have been prepared for the following threatened species with potential habitat within the subject site:

- Blue Mountains Water Skink (*Eulamprus leurensis*) (NPWS 2001)
- Large Forest Owls ((Powerful Owl (*Ninox strenua*), Sooty Owl (*Tyto tenebricosa*) and Masked Owl (*Tyto novaehollandiae*)) (DEC 2006).
- Yellow-bellied Glider (*Petaurus australis*) (NPWS 2003)

Blue Mountains Water Skink

This recovery plan makes the following notable comments for consideration in the species assessment:

The remaining five known populations, as well as several potential locations where the species may occur, are located in close proximity to human habitation (in some cases surrounded by houses) and are likely to be subject to a variety of immediate threats. These include direct disturbance, pollution, stormwater run-off, alteration to hydrology, weed infestation, predation by cats, and inappropriate fire regimes (LeBreton 1994c). Other swamps where the species may have occurred in the past have been cleared for urbanisation (e.g. above Megalong Street in Leura and areas in north Katoomba). The isolation of known sites and the discontinuity of most known potential habitat raises questions regarding the genetic status of individual populations. Investigations of the genetic differences between populations of the Blue Mountains Water Skink may reveal that separate populations are unique.

Some individuals move out of the waterlogged areas of swamp into surrounding vegetation in the winter to take advantage of cover when available. Captures on the forest/swamp margin indicate that skinks may use part of the forest at times

Development of areas adjacent to swamps and in their catchment has the potential to threaten Blue Mountains Water Skink populations and habitat in a number of ways including; pollution, erosion, sedimentation, invasion by weeds, predation by cats, alterations to hydrology, and direct disturbance.

The Hanging Swamp vegetation community located within the northern portions of the study area will be retained as part of future works and protected with a 40m buffer.

It is therefore considered that the proposed development is generally consistent with the objectives or actions of the above-mentioned draft and approved recovery plans.

g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

A key threatening process is defined in the *TSC Act* 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 under the *TSC Act*, 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 (<i>Manorina melanocephala</i>)			✓
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 (<i>Oryctolagus cuniculus</i>)		✓	
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 <i>Psittacine circoviral</i> (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 <i>Phytophthora cinnamomi</i>		✓	
Introduction of the large earth bumblebee (<i>Bombus terrestris</i>)			✓
Invasion and establishment of exotic vines and scramblers			✓
Invasion and establishment of Scotch Broom (<i>Cytisus scoparius</i>)	✓		
Invasion and establishment of the Cane Toad (<i>Bufo marinus</i>)		✓	
Invasion, establishment and spread of <i>Lantana camara</i>			✓
Invasion of native plant communities by bitou bush & boneseed <i>Chrysanthemoides monilifera</i>			✓
Invasion of native plant communities by exotic perennial grasses			✓
Invasion of native plant communities by African Olive (<i>Olea europaea</i> subsp. <i>cuspidata</i>)			✓
Invasion of the Yellow Crazy Ant (<i>Anoplolepis gracilipes</i>)			✓

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
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 (<i>Canis lupus familiaris</i>)			✓
Predation by the European Red Fox (<i>Vulpes vulpes</i>)			✓
Predation by the Feral Cat (<i>Felis catus</i>)			✓
Predation by <i>Gambusia holbrooki</i> Girard, 1859 (plague minnow or mosquito fish)			✓
Predation by the Ship Rat (<i>Rattus rattus</i>) on Lord Howe Island			✓
Predation, habitat degradation, competition & disease transmission from Feral pigs (<i>Sus scrofa</i>)			✓
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.

Bushrock removal

The proposal may remove naturally occurring surface bushrock within the development areas and as such would be a class of development or activity that is recognised as a threatening process. The bush rocks present in these areas are however generally individually located in the soil surface areas and not in clumps, part of valued rock on rock habitat or part of a rocky escarpment which all represent higher quality habitat of this type.

The proposal should where possible maintain bush rock cover onsite. Where bushrock will be disturbed this should be relocated over other locations where surface outcrops occur closer to continuous terrestrial habitats. The bush rocks present within proposed development areas are not considered likely to support unique habitat or habitat of importance for threatened species.

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. The vegetation management process is to be undertaken in accordance with the

conditions of consent and any required vegetation and tree management plans for the proposed development. Offsetting the loss of native vegetation including trees is to be considered as part of the proposed works. The removal of native vegetation on the subject site is not likely to significantly affect the biodiversity of the local area due to the extent of better quality natural vegetation within the local area and the small area of vegetation to be removed.

Competition and grazing by the feral European rabbit

Rabbit was recorded present within the study area during survey. It is expected that the proposed development will increase or decrease the potential for rabbit invasion. Increase is more likely based on the increase in managed open grassy landscape. Rabbit management and control such as through exclusion fencing, destruction of warrens and target “Pindone” baiting is recommended as a standard protocol.

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 newly listed key threatening process. Similar protocols as to *Phytophthora cinnamomi* should be applied.

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. Any equipment found to contain soil or vegetation material is to be cleaned in a quarantined work area or wash station and treated with anti-fungal pesticides.

Invasion and establishment of exotic vines and scramblers

The proposal is of a class of development recognised as a threatening process due to the presence of exotic vines and scramblers within the site and the potential for these species to invade any sensitive vegetation onsite. Therefore a weed control program is recommended to ensure there is adequate eradication, and control of invasive vines species.

Invasion and establishment of Scotch Broom (Cytisus scoparius)

The study area currently contains this species, however it is expected that the proposed development will provide an opportunity to remove, control and manage this species throughout the whole of the site by the application of a bushland management plan or weed control program.

Invasion, establishment and spread of Lantana camara

The site does not currently contain this species, however it is possible that this species could invade the study area from adjoining areas. It is expected that the proposed development will provide an opportunity to remove, control and manage this species throughout the whole of the site by the application of a bushland management plan or weed control program.

Invasion of native plant communities by exotic perennial grasses

The proposal is of a class of development recognised as a threatening process due to the presence of exotic perennial grasses such as *Pennisetum clandestinum* (Kikuyu), *Anthoxanthum odoratum* (Sweet Vernal Grass), *Ehrharta erecta* (Panic Veldtgrass) and *Holcus lanatus* (Yorkshire Fog) within the study area. There is also the possibility of importation of a large number of exotic perennial grasses through horticultural activities and other propagule transportation vectors within the locality. However, the proposed development is not expected to significantly increase the prevalence of exotic perennial grasses. It is expected that the proposed development will decrease the number of exotic grass species and will provide an opportunity to manage the area with regard to weed invasion.

Loss of hollow-bearing trees

Significant hollow-bearing trees were identified based on size and number of hollows (refer to Section 2.5 and Figure 3a). Other small hollows have been identified within the EPP habitat study area. The proposal will require the removal of hollow-bearing trees and as such is of a class of development recognised as a threatening process.

The replacement of hollows with nest boxes is an adequate measure for Little Lorikeet and Eastern Pygmy Possum as both species have been demonstrated to utilise these. Bat boxes may be prepared however these have not had any recorded use by Eastern Falsistrelle.

The replacement of hollows with nest boxes within the conserved habitat areas of the site is recommended as a minimum to supplement the loss of natural hollows. Detailed hollow-bearing tree surveys should be completed to identify all potential hollows to be removed. These should then be adequately supervised by a Fauna Ecologist during the habitat removal process so that resident wildlife, particularly threatened species, can be adequately recovered and relocated within the hollow. Good quality hollows should also be cut, capped and installed into remaining trees given that some species do not utilise nest boxes.

Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants

There is currently a high risk of escaped garden plants impacting on locally occurring native vegetation. This is due to the large areas of landscaped gardens that already contain a wide variety of exotic plants. However, the proposed development is not expected to significantly increase the prevalence of escaped garden plants invading native plant and animal habitat. It is expected that the proposed development will decrease the number of exotic grass species and will provide an opportunity to manage the area with regard to weed invasion.

Loss and degradation of sites used for hilltopping by butterflies

The proposal is of a class of development recognised as a threatening process due to human alterations and increased presence within site hilltop areas which are the main areas designated for development.

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 subject site and likely dependent on dead wood or dead trees include Blue Mountains Water Skink, Broad-headed Snake, Varied Sittella, Scarlet Robin and Flame Robin,. These species have not been recorded to date within the study area. Given the low

quality habitat associated with deadwood and dead trees present within the development areas, the removal of dead wood and dead trees is not considered likely to impact on threatened species or the biodiversity of the local area.



National - Significant Impact Criteria

A4

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

CRITICALLY ENDANGERED AND ENDANGERED SPECIES

Significant impact criteria

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

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

>> What is a population of a species?

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

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

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

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

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

Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or

habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act.

VULNERABLE SPECIES

Significant impact criteria

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

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

>> What is an important population of a species?

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

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

CRITICALLY ENDANGERED AND ENDANGERED ECOLOGICAL COMMUNITIES

Significant impact criteria

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

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

MIGRATORY SPECIES

Significant impact criteria

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

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

>> What is important habitat for a migratory species?

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

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

>> What is an ecologically significant proportion?

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

>> What is the population of a migratory species?

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