

A photograph of a squirrel climbing a tree trunk, positioned on the left side of the cover. The squirrel is facing upwards, with its mouth open as if calling or communicating. The tree bark is rough and textured. The background of the cover is a light blue gradient.

Travers

bushfire & ecology

Flora & Fauna Assessment

Proposed Cemetery
Lot 2 DP 1108408
13 Park Road, Wallacia

October 2017
(REF: A17162)



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OCTOBER 2017

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

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- Attachment 1 Fauna Survey Effort
- Attachment 2 Flora & Fauna Species List
- Attachment 3 Threatened Flora & Fauna Habitat Assessment
- Attachment 4 7 Part Test of Significance (Section 5A EPA Act 1979)

List of abbreviations

AOBV	Area of Outstanding Biodiversity Value
APZ	asset protection zone
BAAS	Biodiversity Assessors Accreditation System
BAM	Biodiversity Assessment Method
BAMC	Biodiversity Assessment Method Calculator
BAR	Biodiversity Assessment Report
BC Act	Biodiversity Conservation Act (2016)
BCAR	Biodiversity Certification Assessment Report
BCT	Biodiversity Conservation Trust
BDAR	Biodiversity Development Assessment Report
BOAMS	Biodiversity Offsets and Agreement Management System
BOPC	Biodiversity Offsets Payment Calculator
BOS	Biodiversity Offset Scheme
BOSET	Biodiversity Offsets Scheme Entry Tool
BPA	bushfire protection assessment
BSA	Biodiversity Stewardship site Agreement
BSSAR	Biodiversity Stewardship Site Assessment Report
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DEC	NSW Department of Environment and Conservation (superseded by DECC from April 2007)
DECC	NSW Department of Environment and Climate Change (superseded by DECCW from October 2009)
DECCW	NSW Department of Environment, Climate Change and Water (superseded by OEH from April 2011)
DEWHA	Commonwealth Department of Environment, Water, Heritage & the Arts (superseded by SEWPAC)
DOEE	Commonwealth Department of Environment & Energy (replaces SEWPAC)
EEC	endangered ecological community
EPA	Environmental Protection Agency
EP&A Act	<i>Environmental Planning and Assessment Act (1979)</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act (1999)</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
IBRA	Interim Biogeographic Regionalisation for Australia
IPA	inner protection area
LEP	Local Environment Plan
LGA	local government area
LLS Act	<i>Local Land Services Act (2013)</i>
NES	national environmental significance
NPW Act	<i>National Parks and Wildlife Act (1974)</i>
NPWS	NSW National Parks and Wildlife Service
NSW DPI	NSW Department of Industry and Investment
OEH	Office of Environment and Heritage
OPA	outer protection area

PBP	<i>Planning for bushfire protection 2006</i>
PCT	Plant Community Type
POM	plan of management
RF Act	<i>Rural Fires Act</i>
RFS	NSW Rural Fire Service
ROTAP	rare or threatened Australian plants
SAIL	Serious and Irreversible Impacts
SEARs	<i>Secretary's Environmental Assessment Requirements</i>
SEPP	State Environmental Planning Policy
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
TEC	Threatened Ecological Community
TPO	tree preservation order
TPZ	tree preservation zone
TRRP	tree retention and removal plan
TSC Act	<i>Threatened Species Conservation Act (1995)– Now replaced by the Biodiversity Conservation Act (2016)</i>
VMP	vegetation management plan



Ecological Assessment

1.0 Background

Travers bushfire & ecology has been engaged to undertake survey and ecological assessment at No. 13 Park Road, Wallacia for proposed memorial development. The 'study area' referred to throughout this report incorporates Lot 2 DP 1108408 and Lot 512 DP 1079728. The 'subject site' alternatively refers to the area of proposed direct impacts on existing habitats for roads, buildings or infrastructure.

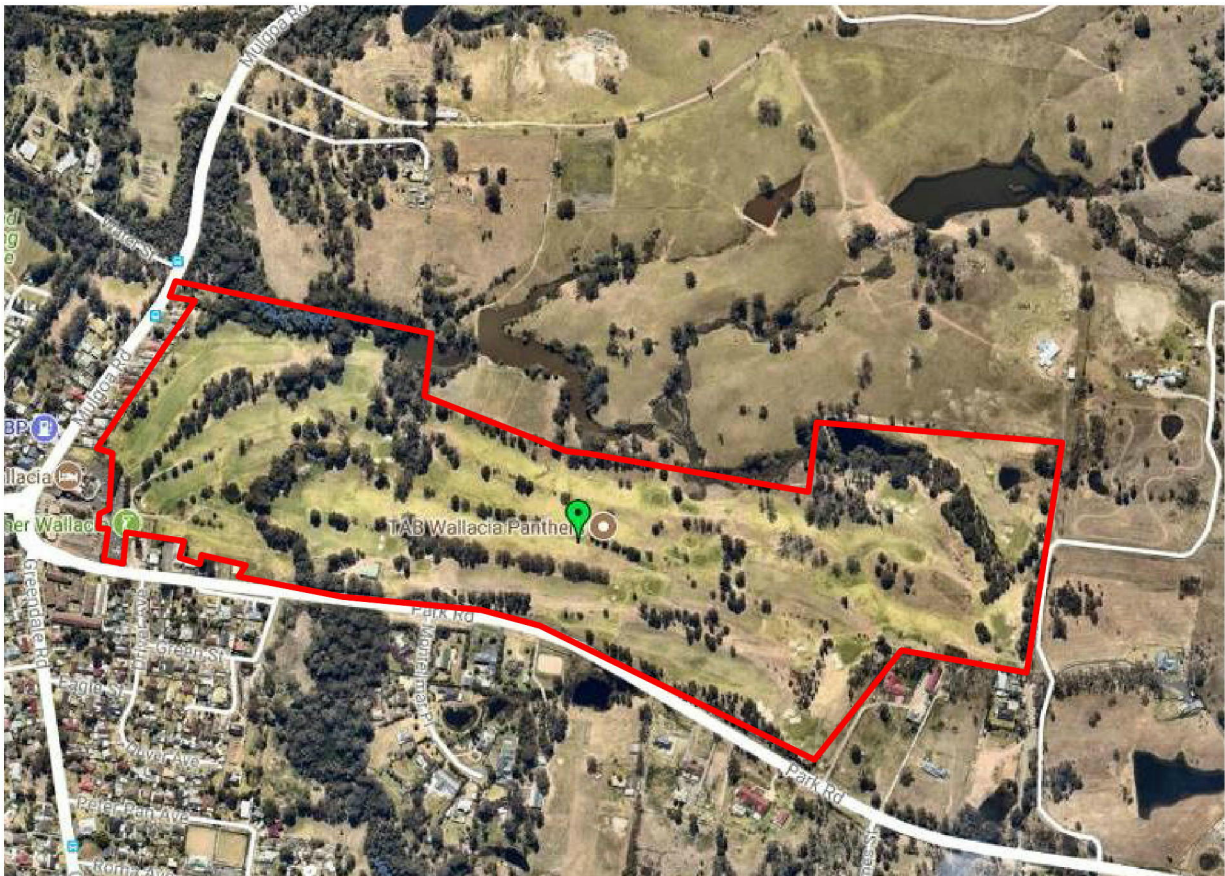


Figure 1 – Study Area

2.0 Biodiversity Conservation (Savings and Transitional) Regulation 2017

The NSW Government has established transitional arrangements related to biodiversity assessment for the various categories of development consent or approval that are underway or have been made already. These are set out in the *Biodiversity Conservation (Savings and Transitional) Regulation 2017*, and are summarised below:

All development applications which were submitted before commencement (25th of August 2017) will be considered under previous legislation.

Local developments

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.

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

Major Projects (state significant development/state significant infrastructure)

Major resources projects that have submitted a conceptual project development plan to the Division of Resources & Geoscience by 25 August 2017 will have 24 months to submit a development application under the previous legislation.

For other major projects, development applications can be considered under the previous legislation if assessment requirements have been issued or substantial environmental assessment was undertaken before 25 August 2017 (as determined by the Secretary of the Department of Planning and Environment). These development applications must be submitted within 18 months of 25 August 2017.

These deadlines can be extended by the Department of Planning and Environment to up to 3 years from 25 August 2017 by reissuing the assessment requirements.

This project is within the Wollondilly LGA and the proponent has opted to submit the project in accordance with the savings and transition provisions. Consequently this Flora and Fauna Assessment has been prepared in accordance with the requirements of the TSC Act.

3.0 Proposed development

The proposed development involves the construction of the following built facilities on site:

- A multipurpose chapel (with crematorium below);
- A administration office;
- Reuse of existing building as function room; and
- Reuse of existing workshop building.

A road network has been designed to allow access to each of these facilities and access to the various burial and memorial sites throughout the development. Pathways are also provided. Please refer to Figure 2 for an illustration of the proposed road network and built facilities.

4.0 Site description

Table 1 provides a summary of the planning, cadastral, topographical, and disturbance details of the subject site.

Table 1 – Site features

Location	13 Park Road, Wallacia
Size	Approx. 44 hectares
Local government area	Wollondilly
Grid reference	282400E 6250300N
Topography	The majority of slopes are gentle although there are some moderately

	steep short rises near to drainage lines.
Geology and soils	<p>Bringelly Shale Formation covers most of the site except around Jerrys Creek which bisects the site near the western end. This geological unit Quaternary Alluvium.</p> <p>The south-western tip around the club house is located on the Blacktown Soil Landscape. Jerrys Creek and immediate surrounds is located on the Richmond Soil Landscape. The remainder of the site is located on the Luddenham Soil Landscape.</p>
Catchment and drainage	Jerrys Creek bisects the site in the western portion. A tributary of Jerrys Creek runs close to the northern boundary of the site. Jerrys Creek joins onto the Nepean River approximately 500m to the west, but it meanders for approximately 1500m.
Vegetation	Natural remnant vegetation on site is shale or alluvium derived. Shale derived vegetation is Cumberland Plain Woodland, and alluvium derived is River-flat Eucalypt Forest on Coastal Floodplains.
Existing land use	Golf course.
Clearing	>90% of the natural vegetation has been cleared from the site.



Figure 2 – Proposed site layout plan



Figure 3 – Flora and fauna survey effort and results

5.0 Flora

4.1 Site assessment

A review of the Atlas of NSW Wildlife (OEH 2017) was undertaken prior to the site visit to determine threatened species previously recorded within 10km of the subject site.

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

Botanical survey included a random meander in accordance with *Cropper* (1993) to gain a full species list of the plants within the site. Tree assessments in particular areas have also been undertaken which have assisted in the preparation of a flora species list. Nine (9) 20x20m or 40x10m quadrats were undertaken within remnant bushland areas with one conducted in a plantation area.

Threatened species searches (as relevant) were conducted during the random meander and during stratified surveys. Flora species recorded during the survey are listed in Table A2.1 in Attachment 2. Figure 3 shows the mapped vegetation communities.

4.2 Vegetation communities

Four (4) vegetation communities were recorded on site:

- Forest Red Gum / Broad-leaved Apple / Swamp Oak Forest
- Grey Box / Forest Red Gum Woodland
- Open Waterbodies with Occasional Fringing Macrophytes
- Ornamental and Managed Landscape

Forest Red Gum / Broad-leaved Apple / Swamp Oak Forest

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

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

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

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

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



Photo 1 – Higher quality natural remnant on the northern boundary



Photo 2 – An example of younger vegetation around the edge of a dam where Quadrat 2 was undertaken



Photo 3 – The main mature remnant along Jerrys Creek



Photo 4 – Heavily impacted vegetation towards the north-west corner of the site along the site boundary where the mid-storey is dominated by Privet.

Grey Box / Forest Red Gum Woodland

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

One (1) patch contained a few species that are more common in Shale-Sandstone Transition Forest, however the quadrat that was located within this area was tested against the tool produced by Greg Steenbeeke (OEH) that uses documentation by *Tozer*. The

geology was also checked and both match more closely to the critically endangered ecological community Cumberland Plain Woodland.

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

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

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

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



Photo 5 – Cumberland Plain Woodland vegetation along the northern boundary where Quadrat 1 was undertaken



*Photo 6 – Canopy only vegetation, all *E. moluccana* that have likely been impacted by overuse of herbicide on understory weeds*



Photo 7 – Canopy only vegetation around Quadrat 9.



Photo 8 – Impacted Cumberland Plain Woodland near northern site boundary, 50-100m north of Quadrat 9

Open Waterbodies with Occasional Fringing Macrophytes

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

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



Photo 9 – Largest waterbody near tee no. 5

Ornamental and Managed Landscape (Plantings)

This description covers the remainder of the site to include the fairways and greens, planted vegetation between the fairways, general landscaping and revegetation. Many of the trees utilised are ornamental species which include pines and deciduous trees. There are many native trees used in the landscaping as well, but very few that would occur in Cumberland Plain Woodland or River-flat Eucalypt Forest on Coastal Floodplains.

There is a distinct planting of Swamp Oak trees towards the north-eastern corner of the site to the east of the largest waterbody which is appropriate for revegetation works, although could be supplemented with some native mid-storey species if that was the intent.

There do not appear to be any threatened species in the plantings.

There are common occurrences of the following species, *Sapium sebiferum*, *Photinia robusta*, *Acer negundo*, *Betula pendula*, *Ulmus parvifolius*, *Lophostemon confertus*, *Liquidambar styraciflua*, *Pinus* species, *Cupressus* species, *Populus alba*, *Grevillea robusta*, non-endemic Eucalypts and Melaleucas, *Callistemon viminalis*, *Corymbia citriodora*, *Celtis sinensis* and *Araucaria cunninghamiana*.



Photo 10 – Planted Swamp Oak trees in the north-east corner of the site



Photo 12 – Planted Eucalypts and Pines along the southern boundary



Photo 13 – Mixture of plantings along the fairways near the middle of the site

4.3 Threatened flora species

Threatened Species Conservation Act (TSC Act) – A search of the *Atlas of NSW Wildlife* (OEH, 2017) provided a list of threatened flora species previously recorded within a 10km radius of the subject site. These species are listed in Attachment 3 (Table A3.1) and are considered for potential habitat within the subject site.

Environmental Protection and Biodiversity Conservation Act (EPBC Act) – A review of the schedules of the *EPBC Act* identified a list of threatened flora species or species habitat likely to occur within a 10km radius of the subject site.

In accordance with Table A3.1, the following threatened flora species are considered to have potential habitat within the subject site.

Table 2 – Threatened flora species with suitable habitat present

Scientific Name	TSC Act	EPBC Act	Potential to occur
<i>Dillwynia tenuifolia</i>	V		Marginal habitat present, mostly along northern boundary in Cumberland Plain Woodland
<i>Eucalyptus benthamii</i>	V	V	Suitable habitat in the locality and lots of known records, sandy alluvium not present along Jerrys Creek so no potential to occur
<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	V		Marginal habitat present outside of floodplain areas
<i>Pimelea spicata</i>	E1	E	Marginal habitat present, mostly along northern boundary in Cumberland Plain Woodland
<i>Pultenaea parviflora</i>	E1	V	Marginal habitat present, mostly along northern boundary in Cumberland Plain Woodland

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

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

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

4.4 Endangered flora populations

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

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

It has a preference for:

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

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

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

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

Coastal Valley Grassy Woodlands

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

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

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

4.5 Threatened ecological communities

Remnant patches of native vegetation on site contribute to two (2) threatened ecological communities under the TSC Act or one (1) threatened ecological community under the EPBC Act.

- Forest Red Gum / Broad-leaved Apple / Swamp Oak Forest – *EEC River-flat Eucalypt Forest on Coastal Floodplains*

This is River-flat Eucalypt Forest on Coastal Floodplains under the TSC Act, which is listed as endangered. It is not part of any listed threatened ecological community under the EPBC Act.

The proposed impacts on the community include creek crossings by pathways in the west, and construction of the edge of a basin. There will be an impact along one edge by a proposed road near the north-east site corner. The estimation of impacts is 0.15 ha which represents 5% of all River-flat Eucalypt Forest on Coastal Floodplains within the site.

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

Given the small impacts on site, the lack of any fragmentation or connectivity loss, and that the EEC extends well beyond the site boundaries, it was considered that the proposal will not cause a significant impact upon this threatened ecological community.

- Grey Box / Forest Red Gum Woodland – *CECC Cumberland Plain Woodland*

This is the critically endangered CECC - Cumberland Plain Woodland under the TSC Act, which is listed as critically endangered. It has been observed as a number of fragmented remnants across the site, generally on higher elevation lands away from watercourses. The estimated extent on site is 2.35 ha. Impacts to the vegetation include the installation of roads and tracks, and application of asset protection zones for new dwellings / structures. Whilst many remnants are currently managed or canopy only vegetation, the roads, tracks or APZ's will continue to impact on the regenerative capacity of the trees, or they will impact partially on ground layer species. The impact area is estimated at 0.93 ha or 40% of all Cumberland Plain Woodland vegetation on site.

There is no connectivity from the Cumberland Plain Woodland vegetation on site, to vegetation off site. As such, the remnants on site are highly fragmented and sensitive to direct and indirect impacts.

Very little tree removal is required in the Cumberland Plain Woodland remnants, and all APZs occur in areas where the understorey is completely managed. The estimated impact of 40% there is overstated where for several patches there is almost no impact at all considering they are already APZ compliant.

The proposed land use is low impact, and future grave sites can be accommodated amongst native vegetation if required.

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

Under the EPBC Act, parts of the community are recognised as the critically endangered ecological community, Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (CPSWSGTF). Where remnants are generally within 100m of each other without any significant barrier, they are referred to as a patch. Canopy trees must have at least 10% projected foliage cover and the patch size must be 0.5 ha or more. There are additional criteria to check relating to larger patch sizes, contiguous vegetation, presence of large trees / hollows and proportion of native understorey species.

It was determined that the three (3) remnants along the eastern and southern-eastern boundary were not part of the CPSWSGTF community.

The proposal will have very minor impacts on CPSWSGTF due to the nature of the proposed development. With respect to the matters of national environmental significance guidelines, it was considered that the proposal does not meet the thresholds for impacts that require DOEE approval.

4.6 Endangered wetland communities

A number of wetland communities have been listed as an 'endangered ecological community' under the NSW TSC Act. We note that 'wetlands' are included in the definition of 'waterfront lands' in accordance with the Water Management Act 2000 due to their inclusion in the definition of a 'lake' under the same act.

Impacts on wetland communities must be assessed under the TSC Act and if present the management of wetland communities must be given due consideration in accordance with the objectives and principles of management as contained within the NSW Wetlands Policy (2010), and appropriate management as determined by NSW DPI - Office of Water in their general terms of approval (GTA's). This may include but not limited to the provision of buffers, management of stormwater runoff and maintenance of natural inflows or runoff into those wetland communities.

- 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

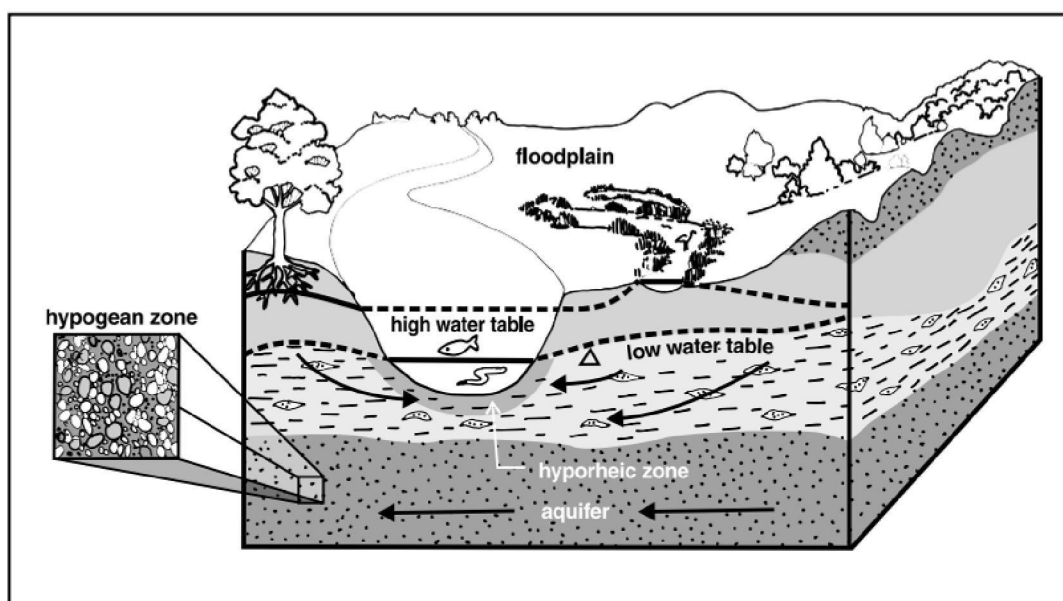
- Lagunaria swamp forest on Lord Howe Island - endangered ecological community listing
- Maroota Sands swamp forest - endangered ecological community listing
- Montane peatlands and swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian 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 listed vegetation communities are present within the bounds of the study area.

4.7 Groundwater dependent ecosystems

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.



Alluvial groundwater system discharging into a river

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

The River-flat Eucalypt Forest on Coastal Floodplains community is a Groundwater Dependent Ecosystem (GDE) as it contains Red Gum forest.

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

Considerations of creek crossings that minimise soil and water disturbance will assist in limiting impacts upon the groundwater.

6.0 Fauna

6.1 Site assessment

Fauna survey including diurnal and nocturnal survey and threatened species habitat assessment was undertaken within the study area on 27th - 29th September, 5th - 6th October and 9th-12th October 2017. This was predominantly opportunistic diurnal surveys undertaken during tree health surveys but also included afternoon and nocturnal fauna survey on the 5th October 2017.

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

Nocturnal fauna survey included spotlighting, frog call identification, Green and Golden Bell Frog call-playback, microbat ultrasonic recording (x4 passive stations) and threatened owl, bitterns, glider and Koala call-playback.

The full survey effort table showing timing and weather conditions is provided in Attachment 1. Specific survey effort locations and results are shown on Figure 3. All fauna species recorded during survey within the subject site and nearby surrounds are listed in Table A2.2 in Attachment 2.

A review of the Atlas of NSW Wildlife (OEH 2017) was undertaken prior to the site visit to determine threatened species previously recorded within 10km of the subject site.

6.2 Hollow-bearing trees

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

A total of nineteen (19) trees containing forty-five (45) hollows were recorded within the tree study area. Tree species, dimension and hollow data for these is provided in Table 3. A review of all other remaining trees within the study area indicated that no hollows are considered suitable for threatened large forest owls or cockatoos. No such suitable hollows for nesting/roosting will also be likely indirectly impacted nearby.

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

Table 3 – Hollow-bearing tree data

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

The recorded hollows present may be suitable for hollow-dependent threatened species with considered potential to occur including the recorded East-coast Freetail Bat, Large-footed Myotis and Greater Broad-nosed Bat. These species utilise hollows for roosting and breeding and impacts on such habitat features may be significant to the long-term viability of local populations. The other hollow-dependent threatened fauna with considered potential to occur are not considered likely to utilise the hollows present due to unsuitability of habitat (Powerful Owl, Masked owl and Gang-gang Cockatoo) or low/unlikely potential to occur (Little Lorikeet or Yellow-bellied Glider). At this stage trees HT1, HT3, HT6, HT10, HT15 and HT20 may be of importance to threatened species.

Locations of habitat trees are shown on Figure 3. Habitat trees HT3, HT11, HT12, HT19 & HT21 are all located either within or close to the proposed road layout. It is recommended that the road alignment is revised to prevent any hollow-bearing tree loss. Habitat trees otherwise located within the proposed APZ's include HT6, HT7, HT8, HT9 & HT18.

Further hollow inspection surveys of all abovementioned hollows in particular will be required to determine if any of the identified hollows are utilised by threatened microbats and to determine appropriate protection and buffer measures. Identifying microbat roosting hollows can sometimes however prove difficult from a single visit given that roost sites may also vary through a single week. One roost site was recorded during tree surveys when a microbat emerged while a tree tag was being nailed into the tree. This was tree HT10 (T784) which is potentially located in the proposed road alignment.

The assessment for threatened microbats has therefore recommended the retention of HT10 (T784) as well as any other hollows where possible within the development landscape. The tree health assessment should also make adequate consideration of habitat value when considering poor health trees for removal. Where habitat trees are required for removal this is to be undertaken according to a strict protocol.

This initially includes stag-watching for signs of activity. A recorded threatened bat species roost should be retained in-situ and the proposal amended accordingly. Any direct impact on a known threatened microbat roost will be considered a potential significant impact.

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

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

6.3 Threatened fauna species

TSC Act – A search of the *Atlas of NSW Wildlife* (OEH, 2017) provided a list of threatened fauna species previously recorded within a 10km radius of the subject site. These species are listed in Attachment 3 (Table A3.2) and are considered for potential habitat within the subject site. Strictly coastal and oceanic threatened species found within 10km have not been included as there is no coastal interface or marine related habitat present within the study area.

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

The 7 part test (Attachment 4) has concluded that there is unlikely to be a significant impact on any state listed threatened fauna species as a result of the proposal provided that habitat tree retention or relocation and supervision during hollow removal measures are undertaken as recommended.

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

Fisheries Management Act (FM Act) – No habitats suitable for threatened aquatic species were observed within the study area and as such the provisions of this act do not require any further consideration.

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 Attachment 3 (Table A3.2). Two (2) nationally listed threatened fauna species including Grey-headed Flying-fox and Large-eared Pied Bat were recorded present during survey. No potential roosting or breeding habitat for either of these two species will be impacted by the proposal. Based on a review of the EPBC significant impact criteria, no threatened species listed under this act are likely to be significantly impacted by the proposal.

In accordance with Table A3.2 the following state and nationally listed threatened fauna species are considered to have potential habitat within the subject site. The TSC Act listed species are to be considered for impact assessment in a seven-part test of significance (Attachment 4).

Table 4 – Threatened fauna species with suitable habitat present

Common name	TSC Act	EPBC Act	Potential to occur
Grey-headed Flying-fox	V	V	recorded
East-coast Freetail Bat	V	-	recorded
Large-eared Pied Bat	V	V	recorded
Eastern Bentwing-bat	V	-	recorded
Large-footed Myotis	V	-	recorded
Greater Broad-nosed Bat	V	-	recorded
White-bellied Sea Eagle	V	-	✓
Gang-gang Cockatoo	V	-	✓
Swift Parrot	E	E	✓
Powerful Owl	V	-	✓
Varied Sittella	V	-	✓
Dusky Woodswallow	V	-	✓
Eastern Falsistrelle	V	-	✓
Little Bentwing-bat	V	-	✓
Square-tailed Kite	V	-	low
Masked Owl	V	-	low
Regent Honeyeater	E4A	CE	low
Cumberland Plain Land Snail	E	-	low

Common name	TSC Act	EPBC Act	Potential to occur
Green and Golden Bell Frog	E	V	unlikely
Black-necked Stork	E	-	unlikely
Little Lorikeet	V	-	unlikely
Speckled Warbler	V	-	unlikely
Black-chinned Honeyeater	V	-	unlikely
Scarlet Robin	V	-	unlikely
Flame Robin	V	-	unlikely
Diamond Firetail	V	-	unlikely
Koala	V	V	unlikely
Yellow-bellied Glider	V	-	unlikely

The potential habitat for protected migratory species listed under the *EPBC Act* is considered in Table A3.3. No protected migratory bird species were recorded present during survey. Based on a review of the EPBC significant impact criteria, no protected migratory species are likely to be significantly impacted by the proposal.

6.4 Endangered fauna populations

There are no endangered fauna populations within the Penrith LGA.

6.5 Vegetation connectivity

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

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

The connectivity values associated with the study area are demonstrated on Figure 4. Riparian connectivity along the northern boundary of the study area is along an unnamed drainage that runs from the Nepean River nearby to the west and narrows and almost dissipates before it reaches the eastern site boundary. Whilst it almost terminates, this connectivity has some consolidated patches as well as large open water dams that all contribute to quality habitat outcomes overall. The connectivity along the eastern edge of the Nepean River is itself quite narrow.

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

Habitat loss associated with the proposed development may be effectively offset by the restoration of the two abovementioned riparian drainage channels. The restoration of the first mentioned drainage would be of benefit given the habitat within represented by open water features and some larger patches. The restoration of the second mentioned drainage would be of benefit to provide improved linkage to adjacent larger patches to the south (these continue beyond the view of Figure 4).

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

Given the above considerations, the restoration of riparian channels will be recommended as an effective measure to offset the proposed habitat loss for the development. Furthermore the remaining perimeter of the study area will also be recipient to tree plantings to create a screening to the site and provide further secondary connectivity opportunity and foraging channels by birds and bats. This vegetation management strategy concept is provided on Figure 5.



Figure 4 – Local connectivity

7.0 Conclusions

The proposal will remove and modify existing remnant habitat present within the study area. This is mostly the removal of mature trees for the placement of roads, buildings, stormwater detention or due to poor health.

With respect to threatened fauna species, this may include direct or indirect impacts on hollow-dependent microbats such as the recorded East-coast Freetail Bat, Greater Broad-nosed Bat and Large-footed Myotis. These species utilise hollows for roosting and breeding and impacts on such habitat features may be significant to the long-term viability of local populations.

Habitat tree HT10 was recorded to contain a microbat roosting hollow during survey. The locating of roosting hollows can however prove difficult given that roost sites may also vary through a single week. Measures have been recommended to identify all roosting sites that may be present and the resident species. Any recorded threatened microbat roost should be avoided.

Further measures have been outlined in the case that a roost is discovered during the habitat tree removal process. This has specifically outlined measures to ensure that the roost is effectively recovered and relocated. With appropriate adherence to these measures

outlined in detail in Section 6.1 it is concluded that the proposal will not likely significantly impact on threatened fauna species recorded or with potential to occur.

No threatened flora species were detected during the survey by *Travers bushfire & ecology*. The site provides low quality habitat for only a few species, all of which occur outside of floodplains within Cumberland Plain Woodland.

Native vegetation is of moderate quality, but the riparian vegetation is heavily impacted by weed invasion in the mid-storey. Many patches of vegetation are along fairways and have had the understorey removed and mown. One such patch appears to be impacted from overuse of herbicide.

The impacts on Cumberland Plain Woodland are often the result of remnant trees being located within an asset protection zone. It is likely that all trees could be retained in these areas as the understorey is fully managed and compliant with planning for bushfire standards. Where APZs occur in the location of remnant canopy trees, they have been counted as an impact which appears to overstate the amount and proportion of impact up to 40% of all Cumberland Plain Woodland. For River-flat Eucalypt Forest on Coastal Floodplains, the impact is 0.15 ha of 5%.

Given consideration to the available habitat present, local records and species with potential to occur, the 7 part test of significance (Attachment 4) has concluded a not significant conclusion with respect to the potential impact upon threatened species, communities and populations. This is provided recommended mitigation measures are carefully adhered to. Therefore, a Species Impact Statement should not be required for the proposed subdivision and development.

The Significant Impact Criteria for species listed under the *EPBC Act* was reviewed to assess the impacts of the proposed subdivision layout on nationally listed species. It is concluded that there will not be a likely significant impact on any nationally listed threatened species and as such, a referral to the Commonwealth Department of Environment (DOE) is not required.

7.1 Recommendations

To mitigate adverse ecological impacts, the following avoid, reduce and minimise measures are proposed:

- The impacts on Cumberland Plain woodland should be avoided and minimised and residual impacts offset through combination of onsite conservation./restoration measures or offsite offsetting
- A Vegetation Management Plan is to be prepared to outline the vegetation restoration areas advised by this report and to outline the extent of weed control measures. The vegetation management plan should aim to restore to at least the core riparian zone as determined by the 50% offset line from top of bank using locally occurrence native vegetation species from the communities. It is to incorporate any equivalent area riparian offsets for the removal of the central watercourse adjacent to the proposed chapel.

Canopy trees plantings are to be specified and include at least one half of locally occurring native species representing year-round nectar foraging potential. The perimeter of the site should have plantings of trees as a natural screen and connective resolve, particularly along the northern boundary to restore arboreal connectivity for birds and arboreal mammals.

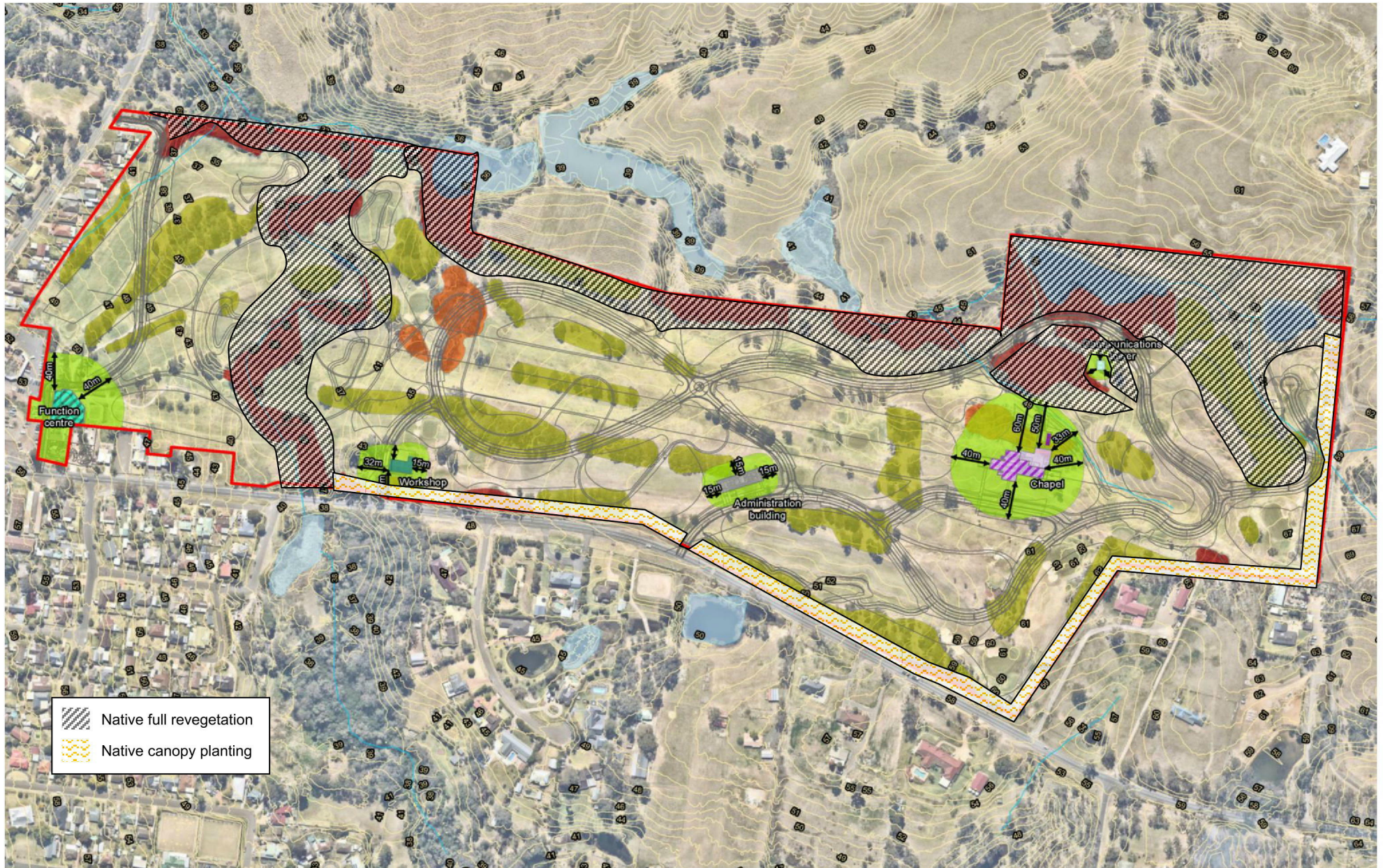


Figure 5 – Vegetation management strategy (concept)

Figure 5 shows a concept of the vegetation management strategy to guide the VMP to restore the core riparian zone and provide arboreal habitat connectivity. Replanted trees should represent locally occurring species that provide a seasonal foraging resource for nectivorous birds and mammals as specified by the VMP.

- Sediment and erosion control measures in accordance with *Managing Urban Stormwater: Soils and Construction* (Landcom 2004) to minimise impact of possible sedimentation to local drainage lines.
- Landscaping should consider the use of locally occurring (endemic) native species commensurate with Cumberland Plain Woodland on non-floodplain areas, and River-flat Eucalypt Forest on Coastal Floodplains in floodplain areas adjacent to watercourses.
- Recorded hollow-bearing trees are to be retained in-situ where possible, with consideration to their health and safety. This is particularly for HT10 which was recorded to support microbat roosting activity. The proposed road layout should therefore be amended accordingly.
- All hollow-bearing trees to be removed or close to proposed roads and buildings are to be stag-watched during warmer months between October - March to determine any use by microbats (DEC 2004). This is to be undertaken with an ultrasonic recorder so that any emerging bats can be identified. These hollows may alternatively be inspected by tree climber and videoscope for signs of current or previous use.
- Any habitat trees observed to contain a threatened microbat is to be retained as a priority within the landscape with appropriate protection measures, if safe to do so. If the tree is unsafe and cannot be made safe then it is to be fenced to exclude access.
- The removal of all hollows is to be under the supervision of a fauna ecologist. This is particularly given that microbat may regularly change roost sites and surveys may not be reliable. Any hollows found to contain fauna or otherwise identified as high quality hollows by the fauna ecologist is to be prepared for reattachment to a retained tree. The management and relocation of resident fauna is to be undertaken by the fauna ecologist at the time of hollow removal and priority measures for threatened species encountered. In this case the hollow section is to be effectively cut and relocated into a suitable nearby recipient tree to permit its ongoing use. This is particularly important given that artificially constructed bat boxes have not been demonstrated effective for any threatened microbat species. If the hollow is a large section this may require the use of a crane and advanced securing measures and the selection of a large and structurally sound recipient tree.
- It is recommended that all hollows that are not relocated to another trees are instead replaced with a constructed nest box placed along the restored riparian areas. The number and type of boxes is to be estimated and installed prior to any habitat tree removal so that a represented number of the boxes may be used as temporary housing for the recovered displaced fauna. Therefore boxes suitable for the various fauna likely to be encountered is to be provided.

Attachment 1:

Fauna Survey Effort

Table A1.1 - Fauna survey effort

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

Attachment 2:

Flora & Fauna Species Lists

Table A2.1 - Flora species list

Family	Scientific Name	Common Name
Trees		
Mimosaceae	<i>Acacia decurrens</i>	Black Wattle
Mimosaceae	<i>Acacia parramattensis</i>	Parramatta Wattle
Aceraceae	<i>Acer negundo</i> *	Box Elder
Myrtaceae	<i>Angophora bakeri</i>	Narrow-leaved Apple
Myrtaceae	<i>Angophora floribunda</i>	Rough-barked Apple
Myrtaceae	<i>Angophora subvelutina</i>	-
Araucariaceae	<i>Araucaria cunninghamii</i> *	Hoop Pine
Betulaceae	<i>Betula pendula</i> *	Silver Birch
Casuarinaceae	<i>Casuarina cunninghamiana</i>	River Oak
Casuarinaceae	<i>Casuarina glauca</i>	Swamp Oak
Ulmaceae	<i>Celtis sinensis</i> *	Chinese Hackberry
Lauraceae	<i>Cinnamomum camphora</i> *	Camphor Laurel
Myrtaceae	<i>Corymbia citriodora</i> *	Lemon-scented Gum
Myrtaceae	<i>Corymbia eximia</i>	Yellow Bloodwood
Myrtaceae	<i>Corymbia maculata</i>	Spotted Gum
Cupressaceae	<i>Cupressus macrocarpa</i> *	Monterey Cypress
Myrtaceae	<i>Eucalyptus acmenoides</i>	White Mahogany
Myrtaceae	<i>Eucalyptus amplifolia</i>	Cabbage Gum
Myrtaceae	<i>Eucalyptus beyeriana</i>	Beyer's Ironbark
Myrtaceae	<i>Eucalyptus botryoides</i>	Bangalay / Southern Mahogany
Myrtaceae	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark
Myrtaceae	<i>Eucalyptus elata</i>	River Peppermint
Myrtaceae	<i>Eucalyptus eugenioides</i>	Thin-leaved Stringybark
Myrtaceae	<i>Eucalyptus fibrosa</i>	Broad Leaved Ironbark
Myrtaceae	<i>Eucalyptus microcorys</i>	Tallowwood
Myrtaceae	<i>Eucalyptus moluccana</i>	Grey Box
Myrtaceae	<i>Eucalyptus paniculata</i>	Grey Ironbark
Myrtaceae	<i>Eucalyptus punctata</i>	Grey Gum
Myrtaceae	<i>Eucalyptus robusta</i>	Swamp Mahogany
Myrtaceae	<i>Eucalyptus saligna</i>	Sydney Blue Gum
Myrtaceae	<i>Eucalyptus sclerophylla</i>	Scribbly Gum
Myrtaceae	<i>Eucalyptus tereticornis</i>	Forest Red Gum
Santalaceae	<i>Exocarpos cupressiformis</i>	Native Cherry
Phyllanthaceae	<i>Glochidion ferdinandi</i>	Cheese Tree
Proteaceae	<i>Grevillea robusta</i>	Silky Oak
Bignoniaceae	<i>Jacaranda mimosifolia</i> *	Jacaranda
Malvaceae	<i>Lagunaria patersonii</i>	Norfolk Island Hibiscus
Hamamelidaceae	<i>Liquidambar styraciflua</i> *	Sweet Gum
Arecaceae	<i>Livistona australis</i>	Cabbage Tree Palm
Myrtaceae	<i>Lophostemon confertus</i>	Brush Box
Myrtaceae	<i>Melaleuca linariifolia</i>	Snow in Summer
Myrtaceae	<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark

Family	Scientific Name	Common Name
Myrtaceae	<i>Melaleuca styphelioides</i>	Prickly-leaved Tea Tree
Meliaceae	<i>Melia azedarach</i> var. <i>australasica</i>	White Cedar
Arecaceae	<i>Phoenix canariensis</i> *	Canary Island Date Palm
Rosaceae	<i>Photinia robusta</i> *	Red Leaf Photinia
Pinaceae	<i>Pinus elliotti</i> *	Slash Pine
Pinaceae	<i>Pinus patula</i> *	Mexican Weeping Pine
Pinaceae	<i>Pinus radiata</i> *	Radiata or Monterey Pine
Salicaceae	<i>Populus alba</i> *	White Poplar
Salicaceae	<i>Salix babylonica</i> *	Weeping Willow
Anacardiaceae	<i>Schinus areira</i> *	Pepper Tree
Myrtaceae	<i>Syzygium australe</i>	Brush Cherry
Ulmaceae	<i>Ulmus parvifolia</i> *	Chinese Elm
Shrubs		
Mimosaceae	<i>Acacia binervia</i>	Coast Myall
Mimosaceae	<i>Acacia falcata</i>	Sickle Wattle
Mimosaceae	<i>Acacia floribunda</i>	Sally Wattle
Mimosaceae	<i>Acacia implexa</i>	Hickory
Proteaceae	<i>Banksia spinulosa</i>	Hairpin Banksia
Pittosporaceae	<i>Bursaria spinosa</i> var. <i>spinosa</i>	Native Blackthorn
Buxaceae	<i>Buxus</i> sp.*	-
Myrtaceae	<i>Callistemon citrinus</i>	Crimson Bottlebrush
Myrtaceae	<i>Callistemon linearis</i>	Narrow-leaved Bottlebrush
Myrtaceae	<i>Callistemon salignus</i>	Willow Bottlebrush
Myrtaceae	<i>Callistemon viminalis</i>	Weeping Bottlebrush
Fabaceae	<i>Dillwynia sieberi</i>	Prickly Parrot-pea
Sapindaceae	<i>Dodonaea triquetra</i>	Hop Bush
Rubiaceae	<i>Gardenia</i> sp. (cultivar)*	Gardenia
Proteaceae	<i>Hakea salicifolia</i>	Willow Hakea
Fabaceae	<i>Jacksonia scoparia</i>	Dogwood
Verbenaceae	<i>Lantana camara</i> *	Lantana
Oleaceae	<i>Ligustrum lucidum</i> *	Large-leaved Privet
Oleaceae	<i>Ligustrum sinense</i> *	Small-leaved Privet
Myrtaceae	<i>Melaleuca armillaris</i>	Bracelet Honey Myrtle
Berberidaceae	<i>Nandina domestica</i> *	Sacred Bamboo
Ochnaceae	<i>Ochna serrulata</i> *	Mickey Mouse Plant
Oleaceae	<i>Olea europaea</i> subsp. <i>cuspidata</i> *	African Olive
Poaceae	<i>Phyllostachys aurea</i> *	Bamboo
Phytolaccaceae	<i>Phytolacca octandra</i> *	Inkweed
Malaceae	<i>Rhaphiolepis indica</i> *	Indian Hawthorn
Rosaceae	<i>Rubus fruticosus</i> sp. agg.*	Blackberry Complex
Solanaceae	<i>Solanum sisymbriifolium</i>	-
Euphorbiaceae	<i>Triadica sebifera</i>	Chinese Tallow
Groundcovers		
Poaceae	<i>Aristida vagans</i>	Three-awn Speargrass
Anthericaceae	<i>Arthropodium milleflorum</i>	Pale Vanilla Lily

Family	Scientific Name	Common Name
Poaceae	<i>Arundo donax</i> *	Giant Reed
Asparagaceae	<i>Asparagus aethiopicus</i> *	Asparagus Fern
Poaceae	<i>Avena fatua</i> *	Wild Oats
Poaceae	<i>Axonopus fissifolius</i> *	Narrow-leaved Carpet Grass
Asteraceae	<i>Bidens pilosa</i> *	Cobbler's Pegs
Brassicaceae	<i>Brassica juncea</i> *	Indian Mustard
Poaceae	<i>Briza maxima</i> *	Quaking Grass
Poaceae	<i>Briza minor</i> *	Shivery Grass
Poaceae	<i>Bromus cartharticus</i> *	Prairie Grass
Carophyllaceae	<i>Cerastium glomeratum</i> *	Mouse-ear Chickweed
Poaceae	<i>Chloris gayana</i> *	Rhodes Grass
Poaceae	<i>Chloris ventricosa</i>	Tall Chloris
Liliaceae	<i>Chlorophytum comosum</i> *	Spider Plant
Asteraceae	<i>Cirsium vulgare</i> *	Spear Thistle
Asteraceae	<i>Conyza bonariensis</i> *	Flaxleaf Fleabane
Asteraceae	<i>Conyza sumatrensis</i> *	Fleabane
Apiaceae	<i>Cyclospermum leptophyllum</i> *	Slender Celery
Poaceae	<i>Cynodon dactylon</i> *	Common Couch
Cyperaceae	<i>Cyperus eragrostis</i> *	Umbrella Sedge
Cyperaceae	<i>Cyperus gracilis</i>	-
Phormiaceae	<i>Dianella caerulea</i> var. <i>caerulea</i>	Flax Lily
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed
Iridaceae	<i>Dietes grandiflora</i> *	Wild Iris
Poaceae	<i>Echinopogon caespitosus</i> var. <i>caespitosus</i>	Tufted Hedgehog Grass
Boraginaceae	<i>Echium plantagineum</i> *	Patterson's Curse
Poaceae	<i>Ehrharta erecta</i> *	Panic Veldtgrass
Chenopodiaceae	<i>Einadia hastata</i>	Berry Saltbush
Chenopodiaceae	<i>Einadia trigonos</i> subsp. <i>trigonos</i>	Fishweed
Poaceae	<i>Entolasia marginata</i>	Bordered Panic
Poaceae	<i>Eragrostis brownii</i>	Brown's Lovegrass
Poaceae	<i>Eragrostis curvula</i> *	African Lovegrass
Asteraceae	<i>Euchiton sphaericus</i>	Cudweed
Euphorbiaceae	<i>Euphorbia peplus</i> *	Spurge
Fumariaceae	<i>Fumaria muralis</i> *	Wall Fumitory
Rubiaceae	<i>Galium aparine</i> *	Cleavers
Goodeniaceae	<i>Goodenia hederacea</i> subsp. <i>hederacea</i>	Ivy-leaved Goodenia
Dilleniaceae	<i>Hibbertia diffusa</i>	-
Asteraceae	<i>Hypochoeris radicata</i> *	Flatweed
Dennstaedtiaceae	<i>Hypolepis muelleri</i>	Harsh Ground Fern
Poaceae	<i>Imperata cylindrica</i> var. <i>major</i>	Blady Grass
Juncaceae	<i>Juncus acutus</i> *	-
Juncaceae	<i>Juncus usitatus</i>	Common Rush
Lomandraceae	<i>Lomandra hyrstix</i>	Creek Mat-rush

Family	Scientific Name	Common Name
Lomandraceae	<i>Lomandra longifolia</i>	Spiky-headed Mat-rush
Lomandraceae	<i>Lomandra multiflora</i> var. <i>multiflora</i>	Many-flowered Mat-rush
Fabaceae	<i>Lotus suaveolans</i> *	Hairy Bird's Foot Trefoil
Onagraceae	<i>Ludwigia peploides</i> subsp. <i>montevidensis</i>	Water Primrose
Primulaceae	<i>Lysimachia arvensis</i> *	Scarlet Pimpernel
Poaceae	<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass
Malvaceae	<i>Modiola caroliniana</i> *	Red-flowered Mallow
Poaceae	<i>Oplismenus aemulus</i>	Basket Grass
Cactaceae	<i>Opuntia stricta</i> *	Prickly Pear
Oxalidaceae	<i>Oxalis corniculata</i> *	Yellow Wood Sorrel
Poaceae	<i>Paspalum distichum</i>	Water Couch
Poaceae	<i>Paspalum urvillei</i> *	Vasey Grass
Geraniaceae	<i>Pelargonium</i> sp. (cultivar)*	-
Poaceae	<i>Pennisetum clandestinum</i> *	Kikuyu
Polygonaceae	<i>Persicaria decipiens</i>	Slender Knotweed
Polygonaceae	<i>Persicaria strigosa</i>	-
Plantaginaceae	<i>Plantago lanceolata</i> *	Ribwort
Poaceae	<i>Poa annua</i> *	Winter Grass
Poaceae	<i>Poa sieberiana</i>	Tussock Grass
Acanthaceae	<i>Pseuderanthemum variabile</i>	Pastel Flower
Ranunculaceae	<i>Ranunculus repens</i> *	Creeping Buttercup
Rubiaceae	<i>Richardia stellaris</i> *	-
Iridaceae	<i>Romulea rosea</i> var. <i>australis</i> *	Onion Grass
Polygonaceae	<i>Rumex crispus</i> *	Curled Dock
Asteraceae	<i>Senecio madagascariensis</i> *	Fireweed
Poaceae	<i>Setaria parviflora</i> *	-
Malvaceae	<i>Sida rhombifolia</i> *	Paddy's Lucerne
Solanaceae	<i>Solanum nigrum</i> *	Black Nightshade
Solanaceae	<i>Solanum prinophyllum</i>	Forest Nightshade
Solanaceae	<i>Solanum pseudocapsicum</i> *	-
Asteraceae	<i>Soliva sessilis</i> *	Jojo
Asteraceae	<i>Sonchus asper</i> subsp. <i>asper</i> *	Prickly Sowthistle
Asteraceae	<i>Sonchus oleraceus</i> *	Common Sow-thistle
Poaceae	<i>Sporobolus africanus</i> *	Parramatta Grass
Asteraceae	<i>Taraxacum officinale</i> *	Dandelion
Poaceae	<i>Themeda triandra</i>	Kangaroo Grass
Commelinaceae	<i>Tradescantia fluminensis</i> *	Wandering Jew
Fabaceae	<i>Trifolium repens</i> *	White Clover
Juncaginaceae	<i>Triglochin microtuberosa</i>	Water Ribbons
Typhaceae	<i>Typha orientalis</i>	Cumbungi
Verbenaceae	<i>Verbena bonariensis</i> *	Purpletop
Poaceae	<i>Vulpia myuros</i> *	Rat's Tail Fescue
Campanulaceae	<i>Wahlenbergia gracilis</i>	Australian Bluebell
Vines		

Family	Scientific Name	Common Name
Basellaceae	<i>Anredera cordifolia</i> *	Madeira Vine
Apocnyaceae	<i>Araujia sericifera</i> *	Mothvine
Ranunculaceae	<i>Clematis aristata</i>	Old Man's Beard
Convolvulaceae	<i>Convolvulus erubescens</i>	Austrialian Bindweed
Fabaceae	<i>Glycine clandestina</i>	Twining Glycine
Fabaceae	<i>Hardenbergia violacea</i>	False Sarsparilla
Caprifoliaceae	<i>Lonicera japonica</i> *	Japanese Honeysuckle
Fabaceae	<i>Vicia sativa</i> subsp. <i>sativa</i> *	Common Vetch

* denotes exotic species

Table A2.2 - Fauna species list

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

Common name	Scientific name	Method Observed	
Red-rumped Parrot	<i>Psephotus haematonotus</i>	OW	
Red-whiskered Bulbul *	<i>Pycnonotus jocosus</i>	W	
Rufous Whistler	<i>Pachycephala rufiventris</i>	W	
Sacred Kingfisher	<i>Todiramphus sanctus</i>	W	
Satin Bowerbird	<i>Ptilonorhynchus violaceus</i>	OW	
Scarlet Honeyeater	<i>Myzomela sanguinolenta</i>	OW	
Spotted Pardalote	<i>Pardalotus punctatus</i>	W	
Spotted Turtle-Dove *	<i>Streptopelia chinensis</i>	O	
Sulphur Crested Cockatoo	<i>Cacatua galerita</i>	OW	
Tawny Frogmouth	<i>Podargus strigoides</i>	O	
Variigated Fairy-wren	<i>Malurus lamberti</i>	OW	
Welcome Swallow	<i>Hirundo neoxena</i>	OW	
White-faced Heron	<i>Egretta novaehollandiae</i>	OW	
White-necked Heron	<i>Ardea pacifica</i>	OW	
Willie Wagtail	<i>Rhipidura leucophrys</i>	OW	
Yellow-faced Honeyeater	<i>Caligavis chrysops</i>	W	
Yellow-tailed Black-Cockatoo	<i>Calyptorhynchus funereus</i>	OW	
Mammals			
Common Brushtail Possum	<i>Trichosurus vulpecula</i>	O	
Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>	O	
Sheep	<i>Ovis aries</i>	O	
Grey-headed Flying-fox ^{TS}	<i>Pteropus poliocephalus</i>	O	
Horse *	<i>Equus caballus</i>	O	
Rabbit *	<i>Oryctolagus cuniculus</i>	O	
Reptiles			
Eastern Water Dragon	<i>Intellagama lesueurii</i>	O	
Eastern Water Skink	<i>Eulamprus quoyii</i>	O	
Lace Monitor	<i>Varanus varius</i>	O	
Red-bellied Black Snake	<i>Pseudechis porphyriacus</i>	O	
Amphibians			
Common Eastern Froglet	<i>Crinia signifera</i>	W	
Dwarf Tree Frog	<i>Litoria fallax</i>	W	
Laughing Tree Frog	<i>Litoria taylori</i>	W	
Peron's Tree Frog	<i>Litoria peronii</i>	W	
Striped Marsh Frog	<i>Limnodynastes peronii</i>	W	
<p>Note: * indicates introduced species ^{TS} indicates threatened species</p> <p>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.</p>			
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

Attachment 3:

Threatened Flora & Fauna Habitat Assessment

Table A3.1 - 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) (✓) <i>Notes 1,2 & 3</i>	Record(s) from recent years (✓) <i>Notes 1,2 & 3</i>	Potential to occur	
<i>Allocasuarina glareicola</i> EPBC	E1	E	Small shrub 1-2m high growing in open sclerophyll forest on lateritic soils derived from tertiary alluviums. Distribution limits Castlereagh NR region.	x	x	-	-	x	x
<i>Ancistrachne maidenii</i> OEH	V	-	Decumbent grass. Grows in sandstone-derived soils. Distribution limits Berowra Waters, Brooklyn and Wisemans Ferry.	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>Cryptostylis hunteriana</i> EPBC	V	V	Saprophytic orchid. Grows in swamp heath on sandy soils. Distribution limits N-Gibraltar Range S-south of Eden.	x	x	-	-	x	x
<i>Cynanchum elegans</i> EPBC	E1	E	Climber or twiner to 1m. Grows in rainforest gullies, scrub & scree slopes. Distribution limits N-Gloucester S-Wollongong.	x	x	-	-	x	x
<i>Dillwynia tenuifolia</i> OEH	V	-	Erect shrub 0.6-1m high. Grows in Woodlands and Open Forest on sandstone shale or laterite. Distribution limits N-Howes Valley S-Cumberland Plain.	x	marginal	8 records within 10km, nearest is 3km away	✓	low	✓

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>Epacris purpurascens</i> var. <i>purpurascens</i> OEH	V	-	Erect shrub to 1.5m high growing in sclerophyll forest and scrub and near creeks and swamps on Sandstone. Distribution limits N-Gosford S-Blue Mountains.	x	x	-	-	x	x
<i>Eucalyptus aggregata</i> EPBC	V	V	Small or medium sized tree to approximately 18m tall. Grows usually on alluvial soils, on cold, poorly-drained flats and hollows adjacent to creeks and small rivers. Higher altitude species. Distributed near to Blayney, Crookwell, Goulburn, Braidwood and Bungendore.	x	x	-	-	x	x
<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	Many records along the Nepean River 500m away. Substrate along watercourse on site likely to not be suitable	✓	✓	x	x
<i>Genoplesium baueri</i> EPBC	E1	E	A terrestrial orchid that grows in sparse sclerophyll forest and moss gardens over sandstone. Distribution limits N – Hunter Valley S – Nowra	x	x	-	-	x	x

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>Grevillea juniperina</i> subsp. <i>juniperina</i> OEH	V	-	Erect to spreading shrub 0.5-1.5m tall. Grows on laterite and Tertiary alluvium. Distribution limits St Marys-Londonderry-Prospect.	x	marginal	nearest is 2km away	✓	low	✓
<i>Grevillea parviflora</i> subsp. <i>parviflora</i> EPBC	V	V	Open to erect shrub to 1m. Grows in woodland on light clayey soils Distribution limits N-Cessnock S-Appin.	x	x	-	-	x	x
<i>Haloragis exalata</i> subsp. <i>exalata</i> EPBC	V	V	Shrub to 1.5m high. Grows in damp places near watercourses. Distribution limits N-Tweed Heads S-south of Eden.	x	x	-	-	x	x
<i>Melaleuca deanei</i> OEH EPBC	V	V	Shrub to 3m high. Grows in heath on sandstone. Distribution limits N-Gosford S-Nowra.	x	x	-	-	x	x
<i>Micromyrtus minutiflora</i> OEH	E1	V	Spreading shrub to 2m high. Grows in dry sclerophyll forest dominated by Scribbly gums and Ironbarks on Tertiary Alluviums. Distribution limits Western part of Cumberland Plain.	x	x	-	-	x	x
<i>Persoonia acerosa</i> EPBC	V	V	Erect to spreading shrub. Grows in heath or dry sclerophyll forest on sandstone. Distribution limits N-Bilpin S-Hill Top.	x	x	-	-	x	x
<i>Persoonia hirsuta</i> OEH	E1	E	Erect to decumbent shrub. Grows in dry sclerophyll forest and woodland on Hawkesbury sandstone with infrequent fire histories. Distribution limits N-Glen Davis S-Hill Top.	x	x	-	-	x	x

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>Pimelea curviflora</i> <i>var. curviflora</i> OEH EPBC	V	V	Woody herb or sub-shrub to 0.2-1.2m high. Grows on Hawkesbury sandstone near shale outcrops. Distribution Sydney.	x	x	-	-	x	x
<i>Pimelea spicata</i> OEH EPBC	E1	E	Decumbent or erect shrub to 0.5m high. Occurs principally in woodland on soils derived from Wianamatta Shales. Distribution limits N-Lansdowne S-Shellharbour.	x	marginal	only 4 records in 10km radius	x	low	x
<i>Pomaderris brunnea</i> EPBC	V	V	Shrub to 3m high. Confined to Upper Nepean and Colo Rivers where it grows in open forest.	x	marginal	no records within 10km	-	unlikely	x
<i>Pterostylis chaetophora</i>	V	-	A terrestrial orchid with a few known locations predominately between Taree, Tea Gardens and Kurri Kurri, as well as Denman and Wingen. The preferred habitat is seasonally moist, dry sclerophyll forest with a grass and shrub understorey. Flowers September to November.	x	x	-	-	x	x
<i>Pterostylis saxicola</i> EPBC	E1	E	Terrestrial orchid. Grows in shallow sandy soil above rock shelves, usually near Wianamatta / Hawkesbury transition. Distribution limits N-Hawkesbury River S-Campbelltown.	x	x	-	-	x	x
<i>Pultenaea glabra</i> 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	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 parviflora</i> OEH EPBC	E1	V	Erect shrub. Grows in dry sclerophyll forest at the intergrade between Tertiary Alluviums and Wianamatta Shales. Distribution limits Cumberland Plain.	x	marginal	many, nearest is 4km away	✓	✓ in Cumberland Plain Woodland	✓
<i>Syzygium paniculatum</i> EPBC	V	V	Small tree. Subtropical and littoral rainforest on sandy soil. Distribution limits N-Forster S-Jervis Bay.	x	x	-	-	x	x
<i>Tetratheca glandulosa</i> OEH	V	-	Spreading shrub to 0.2m high. Sandy or rocky heath or scrub. Distribution limits N-Mangrove Mountain S-Port Jackson.	x	x	-	-	x	x
<i>Thelymitra</i> sp. 'Kangaloon' (<i>Thelymitra kangaloonica</i>) EPBC	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
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								
CE	- Denotes critically endangered listed species under the relevant Act								

Scientific name <small>DATABASE SOURCE</small>	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) (✓) <small>Notes 1,2 & 3</small>	Record(s) from recent years (✓) <small>Notes 1,2 & 3</small>	
NOTE:	<ol style="list-style-type: none"> 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 A3.2 - 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 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	
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	x	-	-	x	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
Green and Golden Bell Frog <i>Litoria aurea</i> OEH EPBC	E	V	Prefers the edges of permanent water, streams, swamps, creeks, lagoons, farm dams and ornamental ponds. Often found under debris. <i>Distribution Limit: N-Byron Bay S-South of Eden.</i>	x	✓	x	x	unlikely	✓

Common name <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 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	
Littlejohn's Tree Frog <i>Litoria littlejohnii</i> EPBC	V	V	Found in wet and dry sclerophyll forest associated with sandstone outcrops at altitudes 280-1,000m on eastern slopes of Great Dividing Range. Prefers flowing rocky streams. <i>Distribution Limit: N-Hunter River S-Eden.</i>	x	x	-	-	x	x
Broad-headed Snake <i>Hoplocephalus bungaroides</i> EPBC	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	x	-	-	x	x
Black-necked Stork <i>Ephippiorhynchus asiaticus</i> OEH	E	-	Occurs in tropical to warm temperate terrestrial wetlands, estuarine and littoral habitats such as mangroves, tidal mudflats, floodplains, open woodlands, irrigated lands, bore drains, sub-artesian pools, farm dams and sewerage ponds. <i>Distribution Limit: N-Tweed Heads. S-Nowra.</i>	x	✓	✓	x	unlikely	✓
Australasian Bittern <i>Botaurus poiciloptilus</i> OEH EPBC	E	E	Found in or over water of shallow freshwater or brackish wetlands with tall reedbeds, sedges, rushes, cumbungi, lignum and also in ricefields, drains in tussocky paddocks, occasionally saltmarsh, brackish wetlands. <i>Distribution Limit: N-North of Lismore. S-Eden.</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 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	
Black Bittern <i>Ixobrychus flavicollis</i> OEH	V	-	Found in shadowy, leafy waterside trees such as callistemons, casuarinas, paperbarks, eucalypts, mangroves and willows along tidal creeks, freshwater and brackish streams and ponds, sheltered mudflats and oyster slats. <i>Distribution Limit: N-Tweed Heads. S-South of Eden.</i>	x	marginal	x	x	Not likely	x
White-bellied Sea Eagle <i>(Haliaeetus leucogaster)</i> OEH	V	-	Occupies coasts, islands, estuaries, inlets, large rivers, inland lakes and reservoirs. <i>Sedentary; dispersive. N-Tweed Heads. S-South of Eden.</i>	x	✓	✓	✓	✓	✓
Square-tailed Kite <i>Lophoictinia isura</i> OEH	V	-	Utilises mostly coastal and sub-coastal open forest, woodland or lightly timbered habitats and inland habitats along watercourses and mallee that are rich in passerine birds. <i>Distribution Limit: N-Goondiwindi. S-South of Eden.</i>	x	✓	✓	x	low	✓
Bush Stone-curlew <i>Burhinus grallarius</i> OEH	E	-	Utilises open forests and savannah woodlands, sometimes dune scrub, savannah and mangrove fringes. <i>Distribution Limit: N-Border Ranges National Park. S-Near Nowra.</i>	x	✓	x	x	Not likely	x

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 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	
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	marginal	x	x	Not likely	x
Curlew Sandpiper <i>Callidris ferruginea</i> EPBC	E	CE	Mainly coastal, but many inland feeding along tidal mudflats, salt marsh, salt fields, fresh, brackish or saline wetlands and sewerage ponds. <i>Distribution Limit: N-Tweed Heads. S-South of Eden.</i>	x	marginal	x	x	Not likely	x
Black-tailed Godwit <i>Limosa limosa</i> OEH	V	-	Regular summer migrant that forages along tidal mudflats, estuaries, sandspits, shallow river margins, sewerage ponds, inland on large shallow fresh or brackish waters. <i>Distribution Limit: N-Tweed Heads. S-South of Eden.</i>	x	marginal	x	x	Not likely	x
Eastern Curlew <i>Numenius madagascariensis</i> EPBC	-	CE	Primarily coastal especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. Occasionally on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. Often recorded among saltmarsh and on mudflats fringed by mangroves and also in coastal saltworks and sewage farms. <i>Distribution Limit: N-Tweed Heads. S-South of Eden.</i>	x	x	-	-	x	x

Common name Scientific name DATABASE SOURCE	TSC Act	EPBC Act	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				Considered in 7 part test (✓) (Refer to Attachment 4)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) <small>Notes 1,2 & 3</small>	Record(s) from recent years (✓) <small>Notes 1,2 & 3</small>	Potential to occur	
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>	x	✓	✓	✓	✓	✓
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	-	-	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>	x	✓	x	✓	unlikely	✓
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	✓	✓	✓
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

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 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	
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	marginal	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	✓	✓	✓	✓	✓
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	✓	low	✓
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	x	-	-	x	x
Speckled Warbler <i>Chthonicola sagittata</i> OEH	V	-	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. <i>Distribution Limit: N-Urbanville. S-Eden.</i>	x	✓	x	✓	unlikely	✓

Common name Scientific name DATABASE SOURCE	TSC Act	EPBC Act	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				Considered in 7 part test (✓) (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	
Regent Honeyeater <i>Xanthomyza Phrygia</i> OEH EPBC	E4A	CE	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. <i>Distribution Limit: N-Urbanville. S-Eden.</i>	x	✓	✓	x	low	✓
Painted Honeyeater <i>Grantiella picta</i> EPBC	V	V	A nomadic bird occurring in low densities within open forest, woodland and scrubland feeding on mistletoe fruits. Inhabits primarily Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. <i>Distribution Limit: N-Boggabilla. S-Albury with greatest occurrences on the inland slopes of the Great Dividing Range.</i>	x	marginal	x	x	Not likely	x
Black-chinned Honeyeater <i>Melithreptus gularis gularis</i> OEH	V	-	Found in woodlands containing box-ironbark associations and River Red Gums, also drier coastal woodlands of the Cumberland Plain and Hunter Richmond and Clarence. <i>Distribution Limit: N-Cape York Pen. Qld. S-Victor H. Mt Lofty Ra & Flinders Ra. SA.</i>	x	✓	x	✓	unlikely	✓
Varied Sittella <i>Daphoenositta chrysoptera</i> 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	✓	✓	✓	✓	✓

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					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	
Dusky Woodswallow <i>Artamus cyanopterus cyanopterus</i> OEH	V	-	Found in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. It has also been recorded in shrublands and heathlands and various modified habitats, including regenerating forests; very occasionally in moist forests or rainforests. Prefers habitat with an open understorey. Often observed in farmland tree patches or roadside remnants. <i>Widespread in eastern, southern and southwestern Australia.</i>	x	✓	✓	✓	✓	✓
Hooded Robin <i>Melanodryas cucullata cucullata</i> OEH	V	-	Found in Eucalypt woodlands, <i>Acacia</i> scrubland, open forest, and open areas adjoining large woodland blocks, with areas of dead timber. <i>Distribution Limit: N-Central Qld. S-Spencer Gulf SA.</i>	x	marginal	x	x	Not likely	x
Scarlet Robin <i>Petroica boodang</i> 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	x	unlikely	✓

Common name Scientific name DATABASE SOURCE	TSC Act	EPBC Act	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				Considered in 7 part test (✓) (Refer to Attachment 4)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) <small>Notes 1,2 & 3</small>	Record(s) from recent years (✓) <small>Notes 1,2 & 3</small>	Potential to occur	
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	x	unlikely	✓
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	✓	✓	x	unlikely	✓
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	-	-	x	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	Sub-optimal	x	✓	unlikely	✓

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 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	
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>	x	x	-	-	x	x
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	x	unlikely	✓
Greater Glider <i>Petauroides volans</i> EPBC OEH	-	V	Favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species. Population density is optimal at elevation levels at 845 m above sea level. Prefer overstorey basal areas in old-growth tree stands. Highest abundance typically in taller, montane, moist eucalypt forests, with relatively old trees and abundant hollows <i>Distribution Limit: N-Border Ranges National Park. S- South of Eden.</i>	x	x	-	-	x	x

Common name <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 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	
Brush-tailed Rock-wallaby <i>Petrogale penicillata</i> OEH 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
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>	x	✓	✓	✓	✓	✓
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>	✓	-	-	-	-	✓
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>	✓	-	-	-	-	✓

Common name <i>Scientific name</i> <small>DATABASE SOURCE</small>	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 Attachment 4)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) <small>Notes 1,2 & 3</small>	Record(s) from recent years (✓) <small>Notes 1,2 & 3</small>	Potential to occur	
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>	x	✓	x	✓	✓	✓
Little Bentwing-bat <i>Miniopterus australis</i> OEH	V	-	Roosts in caves, old buildings and structures in the higher rainfall forests along the south coast of Australia. <i>Distribution Limit: N-Border Ranges National Park. S-Sydney.</i>	x	✓	x	✓	✓	✓
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>	✓	-	-	-	-	✓
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>	✓	-	-	-	-	✓

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 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	
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>	✓	-	-	-	-	✓
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	x
Cumberland Plain Land Snail <i>Meridolum corneovirens</i> OEH	E	-	Inhabits remnant eucalypt woodland of the Cumberland Plan. Shelters under logs, debris, clumps of grass, around base of trees and burrowing into loose soil. <i>Distribution Limit: Cumberland Plain of Sydney Basin Region.</i>	x	Sub-optimal	x	✓	low	✓

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 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	
Dural Land Snail <i>Pommerhelix duralensis</i> EPBC	-	E	Inhabits shale-influenced habitat along the north-western fringes of the Cumberland Plan on shale-sandstone transitional landscapes. Occur in low abundance and shelters under logs, debris, and leaf litter. <i>Distribution Limit: St Albans to Mulgoa with most records from The Hills LGA.</i>	x	x	-	-	x	x
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								

Common name <i>Scientific name</i> <small>DATABASE SOURCE</small>	TSC Act	EPBC Act	Preferred habitat <i>Distribution limit</i>	Recorded on site (✓)	If not recorded on site			Potential to occur	Considered in 7 part test (✓) (Refer to Attachment 4)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) <small>Notes 1,2 & 3</small>	Record(s) from recent years (✓) <small>Notes 1,2 & 3</small>		
E	- Denotes endangered listed species under the relevant Act								
NOTE:	<ol style="list-style-type: none"> 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 A3.3 – Migratory fauna habitat assessment

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

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

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

Attachment 4:

7 Part Test of Significance
(Section 5A EPA Act 1979)

7 Part Test of Significance

(Section 5A EPA Act 1979)

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.

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>Dillwynia tenuifolia</i>	V	low	Impacts upon potential habitat related to remnant Cumberland Plain Woodland
<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	V	low	Impacts upon potential habitat related to remnant Cumberland Plain Woodland or areas above the floodplain
<i>Pimelea spicata</i>	V	low	Impacts upon potential habitat related to remnant Cumberland Plain Woodland
<i>Pultenaea parviflora</i>	V	✓	Impacts upon potential habitat related to remnant Cumberland Plain Woodland

Threatened fauna

Common name	TSC Act	Potential to occur	Potential Impact
East-coast Freetail Bat	V	recorded	Direct – potential roosting/breeding habitat
Large-eared Pied Bat	V	recorded	Indirect – on foraging only
Eastern Bentwing-bat	V	recorded	None anticipated
Large-footed Myotis	V	recorded	Direct – potential roosting/breeding habitat
Greater Broad-nosed Bat	V	recorded	Direct – potential roosting/breeding habitat
White-bellied Sea Eagle	V	✓	None anticipated
Gang-gang Cockatoo	V	✓	Direct – potential roosting/breeding habitat
Swift Parrot	E	✓	Direct – potential foraging habitat
Powerful Owl	V	✓	Direct – low potential foraging habitat
Varied Sittella	V	✓	Direct – potential foraging/roosting/breeding habitat
Dusky Woodswallow	V	✓	Direct – potential foraging/roosting/breeding habitat
Grey-headed Flying-fox	V	✓	Direct – potential foraging habitat
Eastern Falsistrelle	V	✓	Indirect – low potential roosting/breeding habitat
Little Bentwing-bat	V	✓	Direct – low potential foraging habitat
Square-tailed Kite	V	low	Direct – low potential foraging habitat
Masked Owl	V	low	Indirect – low potential foraging habitat
Regent Honeyeater	E4A	low	Direct – low potential foraging habitat

Common name	TSC Act	Potential to occur	Potential Impact
Cumberland Plain Land Snail	E	low	Direct – low potential habitat
Green and Golden Bell Frog	E	unlikely	Indirect – low potential shelter habitat
Black-necked Stork	E	unlikely	Indirect – unlikely potential foraging habitat
Little Lorikeet	V	unlikely	Direct – unlikely roosting/breeding/foraging habitat
Speckled Warbler	V	unlikely	Indirect - unlikely potential habitat
Black-chinned Honeyeater	V	unlikely	Indirect – unlikely potential foraging habitat
Scarlet Robin	V	unlikely	Indirect – unlikely potential foraging habitat
Flame Robin	V	unlikely	Indirect – unlikely potential foraging habitat
Diamond Firetail	V	unlikely	Indirect – unlikely potential habitat
Koala	V	unlikely	Indirect – unlikely potential habitat
Yellow-bellied Glider	V	unlikely	Direct – unlikely denning/breeding/foraging habitat

Endangered populations

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

Endangered ecological communities

- Cumberland Plain Woodland
- River-flat Eucalypt Forest on Coastal Floodplains

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

- Impacts by roads / paths and basins amount to 0.15 ha of River-flat Eucalypt Forest on Coastal Floodplains and 0.61 ha of Cumberland Plain Woodland. This includes sufficient space for cut and fill either side of roads / paths or 5m around the basins.
- Modification of <0.01 ha of River-flat Eucalypt Forest on Coastal Floodplains and 0.31 ha of Cumberland Plain Woodland for implementing asset protection zones.
- Subsequent removal of threatened fauna species seasonal nectar foraging habitat.
- Removal of small to medium sized hollows providing potential use by threatened microbats.

The potential indirect impacts of the proposal from the subject site are considered as:

- Edge effects such as weed incursions into the adjacent remnant vegetation.
- Minor changes to runoff from cut and fill, and installing hard surfaces.
- Potential for further garden escape species entering bushland areas.
- Reduced cross-site movements by small bird species such as passerines in the central open areas.
- Increased vehicle presence and potential light and noise spill-over into adjacent natural habitats.

With consideration to the relative direct and indirect impacts on all threatened species with varying potential to occur, it is considered that the proposal is unlikely to disrupt the life cycle

for any of these listed species such that a viable local population would be placed at risk of extinction. Species recorded present during survey, previously recorded nearby or with high potential to occur and requiring further discussion given potential impacts are further discussed in detail below.

Summary of threatened species recorded

Large-footed Myotis (*Myotis macropus*), East-coast Freetail-bat (*Micronomus norfolkensis*) and Greater Broad-nosed Bat (*Scoteanax rueppellii*)

The roosting/breeding/foraging microhabitat requirements varies between each of these three microbat species, however they are considered here together due to their similar potential roosting dependence in hollows, the resultant similar impact potential and subsequent similar assessment outcome.

The Large-footed Myotis inhabits rainforests and open forests containing creeks and lakes over which it feeds and roosts in tree hollows, caves, mines, under bridges, in tunnels and occasionally buildings (Richards 1995). The Large-footed Myotis predominantly forages along creeklines and over waterbodies where it takes insects and small fish from on and just below the water surface (Richards 1995). This species has a strong association with streams and permanent waterways, most frequently at low elevations and in flat or undulating country and usually in areas that are vegetated rather than cleared. They will live in most habitat types as long as it is near water (Churchill 2008).

The East-coast Freetail Bat forages above the canopy of open forests and woodlands and in clearings at forest edges, feeding on small insects (Allison, Hoyer & Law 2008). This species is thought to roost predominantly in tree hollows but also under loose bark and occasionally in houses and outbuildings (Allison, Hoyer & Law 2008). Until recent findings of a roost within mangroves, all known natural roosts had occurred within hollow spouts of large mature eucalypts. The species is often found close to dams and waterholes. The East-coast Freetail Bat species will utilize paddock trees and isolated remnant vegetation when in proximity to larger forest remnants (Allison, Hoyer & Law 2008).

The East-coast Freetail Bat is a highly mobile species, Hoy et. al (2008) suggesting that despite a female recorded 6km from its roost, this species generally forages within a few kilometres of roosts. Cleared and semi-cleared landscapes have been found to have higher activity levels than urban or forested landscapes. Riparian sites were also found to have high activity levels. This species is known for its utilisation of paddock trees in disturbed landscapes where nearby forest and woodland habitats occur (Hoy et. al 2008).

The Greater Broad-nosed Bat inhabits a variety of habitats including moist gullies in mature coastal forest, rainforest, open woodland, *Melaleuca* swamp woodland, wet and dry sclerophyll forests, cleared paddocks with remnant trees and tree lined creeks in open areas (Churchill 2008). The Greater Broad-nosed Bat predominantly forages within open forest, woodlands, along vegetated creeklines and small river systems (Hoyer and Richards 1995). This species roosts in tree hollows, cracks and fissures in trunks and dead branches, under exfoliating bark as well as the roof of old buildings (Churchill 2008, Hoyer & Richards 1995). Flight for this species is not very maneuverable and as such foraging takes places in open areas or along trails in forest environs. They hunt beetles but also moths and bugs.

These three species were recorded by over-night ultrasonic passive recording on the 5th October 2017. The Greater Broad-nosed Bat was recorded at three of the four recording stations. The Large-footed Myotis was recorded foraging over the mid-north dam as well as a 'possible' recording in the south-west of the study area. The East-coast Freetail Bat was

recorded only in the north-western corner of the study area. See Figure 3 for recorded locations.

The study area is likely utilised by the Greater Broad-nosed Bat and East-coast Freetail Bat for foraging throughout particularly along the northern fringe of the study area where small drainages combine with remnant tree patches. Both species can have a preference to forage along such drainages. The Large-footed Myotis will forage more specifically over the open water locations provided by the dams and only generally en-route between these and roosting location(s).

Use of the site by each species may also be for roosting and breeding given the presence of a number of recorded suitable hollows. This may be moreso for the Greater Broad-nosed bat given a more notable high recorded activity.

The removal of habitat within the subject site will therefore result in the alteration of known foraging habitat but more importantly potential removal of roosting and breeding habitat for all three species. The removal of a roosting and/or breeding hollows for any of these species is regarded as a potential significant impact on their respective local population.

The assessment for threatened microbats has therefore recommended the retention of hollows where possible within the development landscape. Habitat tree HT10 (T784) was observed to contain a bat roost during survey. Habitat trees HT6 (T732) and HT20 (T948) were also identified as highly suitable for microbat use. Other hollows recorded may also be suitable. Subsequent realignment of the road is therefore required.

Where a habitat trees which is not found to be utilised by a microbat is required for removal this is to be undertaken according to a strict protocol. This initially includes stag-watching or hollow inspections for presence or signs of activity. Inspections should also be undertaken for hollows close to proposed road and building locations. A recorded threatened bat species roost should be retained in-situ and the proposal amended accordingly. All hollow-bearing trees not found to be utilised at the time of survey may be periodically utilised at other times. Therefore these trees should have a careful removal process implemented as specified in Section 6.1, to ensure appropriate animal welfare outcomes for those encountered during tree removal.

Provided that the measures outlined in Section 6.1 recommendations are undertaken with respect to threatened hollow-dependent microbats it may be concluded that the proposal will not likely significantly impact on a local population of East-coast Freetail-bat, Greater Broad-nosed Bat or Large-footed Myotis.

Eastern Bentwing-bat (*Miniopterus orianae oceanensis*)

The Eastern Bentwing-bat forages above and below the canopy within open forests and woodlands, feeding on small flying insects, predominantly moths (Dwyer 1995). The Eastern Bentwing-bat is known to roost in a range of habitats including stormwater channels, under bridges, occasionally in buildings, old mines and, in particular, caves (Dwyer 1995). For this species caves are an important resource, particularly for breeding where maternity caves must have suitable temperature, humidity and physical dimensions to permit breeding (Dwyer 1995).

This species has not been identified as utilising culverts for maternity roosts. Maternity roosts rather are occupied by up to 100 000 females with only 12 maternity roosts known throughout the complete range (Hoy & Hall 2008). Roost sites in tree hollows have not been reported within the literature reviewed.

The Eastern Bentwing-bat was recorded foraging by passive monitoring ultrasonic recording stations at two locations in the north-west portions of the study area on the 5th October 2017 (see Figure 3 for locations). Only a few passes were recorded at each location at alternating times which may in fact be a single individual.

The Eastern Bentwing-bat is a highly mobile species with wing morphology designed to allow foraging forays beyond 10km from roost sites (which will include along streetlights on the fringe urban landscapes) and will undertake large migrations during the breeding season. The Eastern Bentwing-bat is therefore often recorded during overnight recording surveys.

The study area provides suitable foraging habitat throughout particularly along forest fringes, along the northern remnants and vegetated drainages. There is however no suitable breeding habitat for this species present within the study area. The protection of breeding caves where thousands of female bats congregate to have their young is the highest management issue in regard to the conservation of this species, as disturbance of maternity roosts can have large impacts on the overall population.

The roosting locations taken up away from breeding locations can be varied and do include old houses where an external opening can permit access to an internal cavity such as within ceiling or wall cavities. Therefore there is some potential for this species to utilise the old existing buildings within the subject site for roosting but these are not likely of breeding or life-cycle importance.

The proposed development will alter some foraging habitat for this species which may also improve given their preference for sometimes foraging along street lights.

Given that no important breeding habitat will be impacted and that foraging habitat will remain consistent (and is otherwise well represented in the remaining locality), this species will not be likely 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.

A Grey-headed Flying-fox was observed foraging within the north-west portion of the study area after dusk during nocturnal survey on the 5th October 2017.

The mature flowering myrtaceae trees within the study area provide seasonal foraging habitat for the Grey-headed Flying-fox. The study area does not provide any suitable roosting or subsequent breeding habitat.

As the study area does not contain any likely roosting or breeding habitat and seasonal foraging habitat in the locality will not be significantly reduced by the proposal it is concluded that there will not be any significant impact on this species. It is recommended that foraging habitat is replaced by locally native flowering myrtaceae trees within landscaping and restoration areas.

- 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 Penrith LGA.

Marsdenia viridiflora subsp. *viridiflora* endangered population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith LGAs is the only known endangered population within a 10km radius of the study area.

Cumberland Plain Woodland vegetation communities are suitable for the species to grow.

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

Therefore, it is considered that the action proposed is not likely to have an adverse effect on the life cycle of these species that constitute the endangered populations such that a viable local population of these 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:***
- i. *Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or***

Forest Red Gum / Broad-leaved Apple / Swamp Oak Forest

This is River-flat Eucalypt Forest on Coastal Floodplains under the TSC Act, which is listed as endangered.

The proposed impacts on the community include creek crossings by pathways in the west, and construction of the edge of a basin. There will be an impact along one edge by a proposed road near the north-east site corner. The estimation of impacts is 0.15 ha which represents 5% of all River-flat Eucalypt Forest on Coastal Floodplains within the site.

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

Given the small impacts on site, the lack of any fragmentation or connectivity loss, and that the EEC extends well beyond the site boundaries, it was considered that the proposal unlikely to have an adverse effect on the extent of this ecological community such that its local occurrence is likely to be placed at risk of extinction.

Grey Box / Forest Red Gum Woodland

This is Cumberland Plain Woodland under the TSC Act, which is listed as critically endangered. It has been observed as a number of fragmented remnants across the site, generally on higher elevation lands away from watercourses. The estimated extent on site is 2.35 ha. Impacts to the vegetation include the installation of roads and tracks, and application of asset protection zones for new dwellings / structures. Whilst many remnants are currently managed or canopy only vegetation, the roads, tracks or APZ's will continue to impact on the regenerative capacity of the trees, or they will impact partially on ground layer species. The impact area is estimated at 0.93 ha or 40% of all Cumberland Plain Woodland vegetation on site.

There is no connectivity from the Cumberland Plain Woodland vegetation on site, to vegetation off site. As such, the remnants on site are highly fragmented and sensitive to direct and indirect impacts.

Very little tree removal is required in the Cumberland Plain Woodland remnants, and all APZs occur in areas where the understorey is completely managed. The estimated impact of 40% there is overstated where for several patches there is almost no impact at all considering they are already APZ compliant.

The proposed land use is low impact, and future grave sites can be accommodated amongst native vegetation if required. The impacts on Cumberland Plain woodland should be avoided and minimised and residual impacts offset through combination of onsite conservation./restoration measures or offsite offsetting.

It is therefore considered that the proposed development is unlikely to have an adverse effect on the extent of this 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 proposal will not require the composition of any River-flat Eucalypt Forest on Coastal Floodplains to be altered by way of an APZ or through removal of any layers or species within the remnant. It is unlikely that the proposed development will adversely modify the composition of this community such that its local occurrence is likely to be placed at risk of extinction.

The proposal will include modification of some patches for APZs, however these are generally APZ compliant and will not require much in the way of any tree removal or mid-storey removal. The ground layer will require ongoing maintenance which will limit the regeneration potential of that area.

The proportion of any proposed vegetation modification is very limited across the site and across the extent of the community on site.

It is unlikely that the proposed development will adversely modify the composition of this community such that its 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 *Dillwynia tenuifolia*, *Grevillea juniperina* subsp. *juniperina*, *Pimelea spicata*,

Pultenaea parviflora, Cumberland Plain Woodland, River-flat Eucalypt Forest on Coastal Floodplains, Green and Golden Bell Frog, Black-necked Stork, White-bellied Sea Eagle, Square-tailed Kite, Gang-gang Cockatoo, Glossy Black-Cockatoo, Little Lorikeet, Swift Parrot, Powerful Owl, Masked Owl, Speckled Warbler, Regent Honeyeater, Black-chinned Honeyeater, Varied Sittella, Dusky Woodswallow, Scarlet Robin, Flame Robin, Diamond Firetail, Koala, Yellow-bellied Glider, Grey-headed Flying-fox, East-coast Freetail Bat, Large-eared Pied Bat, Eastern Falsistrelle, Little Bentwing-bat, Eastern Bentwing-bat, Large-footed Myotis, Greater Broad-nosed Bat and Cumberland Plain Land Snail.

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

The study area is approximately 44 ha in size which comprises has an area of 15.22ha, which comprises approximately 5.2 ha of native vegetation. The proposed development is likely to remove or modify approximately 1.08 ha of native vegetation.

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 study area is located within an existing fragmented landscape with connectivity values remaining only along the existing drainages. Refer to Section 5.5 for a review and description.

The proposal will require removal of select trees through the existing landscape. This removal will however be offset by the restoration of the riparian habitat along the two existing unnamed drainages within the study area. This restoration will ultimately improve the connective values within the study area to adjacent linear riparian habitat towards and along the Nepean River to the west as well as large consolidated remnants to the south.

River-flat Eucalypt Forest on Coastal Floodplains is connected along local watercourses and will not be subject to fragmentation or isolation. Cumberland Plain Woodland is highly fragmented with no connectivity outside of the study area. The proposal will not further fragment remnants but may reduce them in size unless restoration measures are put in place.

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

In respect to threatened fauna species recorded or with potential to occur the proposed area of impact may remove important hollows for hollow-dependent threatened microbats. Subsequent hollow retention and removal protocols area outlined in Section 6.1 to prevent these impacts. With respect to remaining threatened fauna species recorded or with potential to occur the proposal is not likely of high quality, of any breeding importance or central to the home range requirements such that behaviour or ecology of these species will be significantly altered in any way.

The proposal will not impact on threatened flora.

The proposal impacts upon just over 1 ha of native vegetation which is listed under the TSC Act as endangered or critically endangered. Nearly half of the impacts are from the application of APZ's however those areas will not likely require any tree removal; only maintenance of the ground layer of vegetation.

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

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

- Green and Golden Bell Frog (*Litoria aurea*) (DEC 2005)

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

- Koala (*Phascolarctos cinereus*) (DEC 2008)
- Large Forest Owls ((Powerful Owl (*Ninox strenua*), Sooty Owl (*Tyto tenebricosa*) and Masked Owl (*Tyto novaehollandiae*)) (DEC 2006)
- *Pimelea spicata* (DEC 2004)
- Yellow-bellied Glider (*Petaurus australis*) (NPWS 2003)
- Cumberland Plain Recovery Plan (DECC 2010)

The proponent has considered the placement of structures, paths and roads against the location of remnant native vegetation and thus the overall impact is considered small.

It is 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 melanoccephala</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
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>)			✓

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
Invasion of the Yellow Crazy Ant (<i>Anoplolepis gracilipes</i>)			✓
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.

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 amount of native vegetation clearing across the site for the proposal is quite low and often limited to ongoing management rather than full removal. It is recommended that future landscaping utilised species that occur in Cumberland Plain Woodland outside of flood prone areas, and River-flat Eucalypt Forest species close to existing watercourses.

Competition and grazing by the feral European rabbit

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

Infection of native plants by Phytophthora cinnamomi

The proposal may temporarily increase the risk of fungal infection on site as it may be spread via vehicular movement and relocation of soil and vegetation. Consequently standard *Phytophthora cinnamomi* protocol applies to the cleaning of all plant, equipment, hand tools and work boots prior to delivery onsite to ensure that there is no loose soil or vegetation material caught under or on the equipment and within the tread of vehicle tyres. 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.

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.

Loss of hollow-bearing trees

The proposal may require the removal of hollow-bearing trees and as would be a class of development recognised as a threatening process. The hollow-bearing tree to be removed may be suitable for use by hollow-dependent threatened species with considered potential to occur including the recorded East-coast Freetail Bat, Large-footed Myotis and Greater Broad-nosed Bat. These species utilise hollows for roosting and breeding and impacts on such habitat features may be significant to the long-term viability of local populations.

The other hollow-dependent threatened fauna with considered potential to occur are not considered likely to utilise the hollows present due to suitability of habitat (Powerful Owl, Masked owl and Gang-gang Cockatoo) or low/unlikely potential to occur (Little Lorikeet or Yellow-bellied Glider).

The assessment for threatened microbats has recommended the retention of hollows where possible within the development landscape. Where habitat trees are required for removal this is to be undertaken according to a strict protocol to reduce the potential impact on the identified threatened microbats.

The relocation of quality hollows and the replacement of hollows with nest boxes recommended to supplement the loss of natural hollow locations.

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

The proposed development is very likely to promote the use of garden plants. Many exotic garden plants can become invasive if poorly managed or if propagules are dumped or left to invade other areas. It is recommended that a) native species, preferably locally occurring are used in preference to exotic and ornamental species, and b) a weed control program is undertaken to reduce the incidence of spread on non-native species.

Removal of dead wood and dead trees

The proposal will likely require the removal of deadwood and / or dead trees along the proposed road route and as such would be a class of development recognised as a threatening process. The golf course is currently a well-managed landscape where dead limbs have been previously cut from trees so such limbs are not in high representation by

comparison to naturally occurring trees of the same species. There is also less completion of trees particularly along the edges of fairways.

There are however notable patches of recently dead trees which may be attributed to the presence of Bell Miners in these locations but possibly also due to over management of herbicides.

Threatened fauna species with potential habitat within the subject site and likely dependent on dead wood or dead trees include Varied Sittella, Dusky Woodswallow, Green and Golden Bell Frog, Scarlet Robin, Flame Robin, Cumberland Plain Land Snail and Speckled Warbler. 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.